1. General Description

A: SPECIFICATION

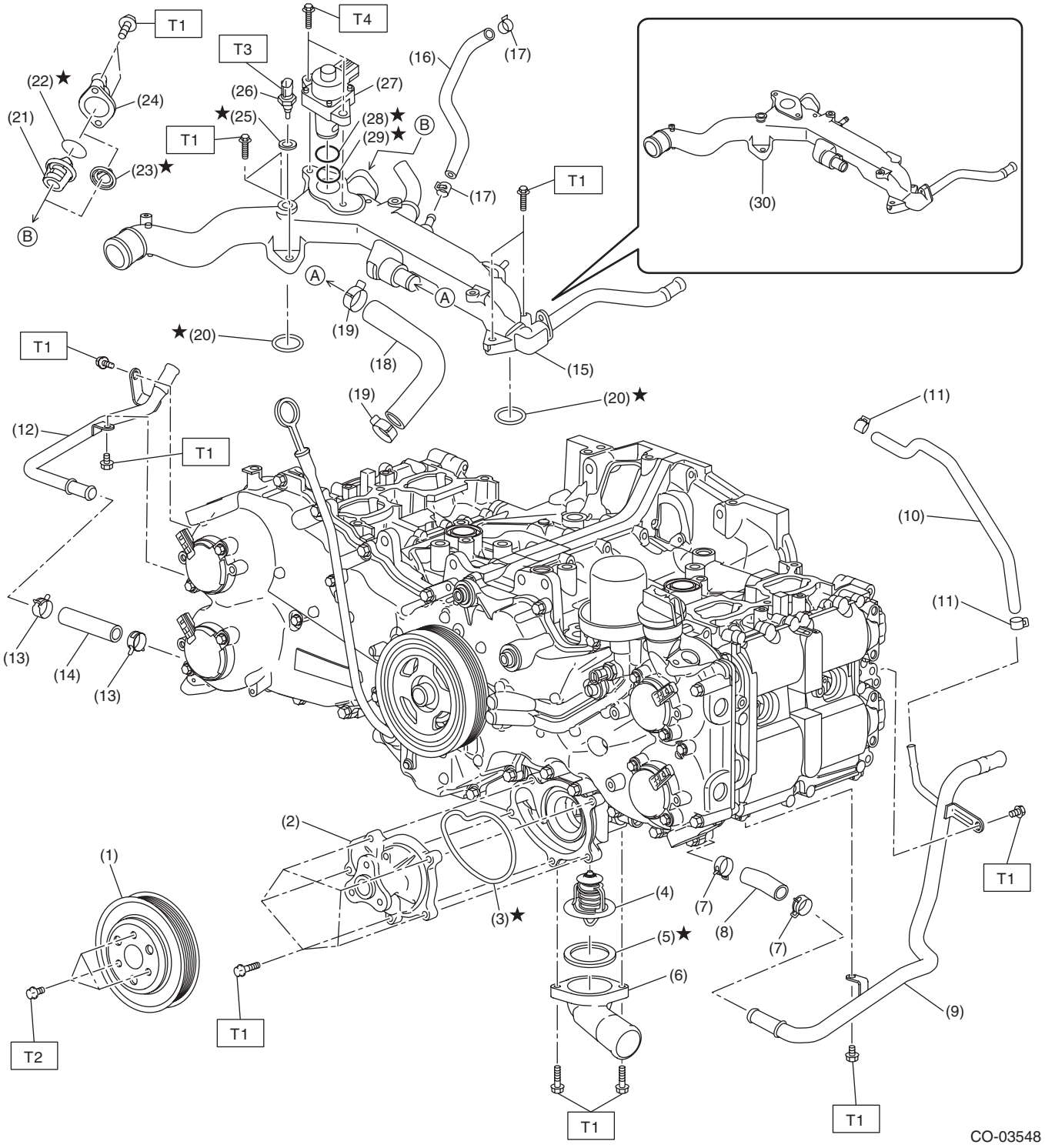
Cooling system					Electric fan + Forced engine coolant circulation system
Total engine coolant capacity L (US qt, Imp qt)		Gasoline engine model	CVT model		Approx. 8.4 (8.9, 7.4)
			MT model		Approx. 8.0 (8.5, 7.0)
		HEV model			Approx. 8.2 (8.7, 7.2)
Water pump	Type				Centrifugal impeller type
	Discharge performance	Discharge rate L (US gal, Imp gal)/min			230 (60.8, 50.6)
		Pump speed — Discharge pressure			6,600 r/min — 211.0 kPa (22 mAq)
		Engine coolant temperature			80°C (176°F)
	Impeller diameter mm (in)				60 (2.36)
	Number of impeller vanes				7
	Pump pulley diameter mm (in)	Gasoline engine model			130 (5.12)
		HEV model			143 (5.63)
Thermostat	Type				Wax pellet type
	Starting temperature to open	Engine side	Gasoline engine model		90 — 94°C (194 — 201°F)
			HEV model		87 — 91°C (189 — 196°F)
		CVTF cooler (with warmer feature) side (CVT model)			48 — 52°C (118 — 126°F)
	Fully opens	Engine side	Gasoline engine model		100°C (212°F)
			HEV model		98°C (208°F)
		CVTF cooler (with warmer feature) side (CVT model)			63°C (145°F)
	Valve lift mm (in)	Engine side			8.0 (0.315) or more
		CVTF cooler (with warmer feature) side (CVT model)			6.0 (0.236) or more
	Valve opening size mm (in)	Engine side			32 (1.26)
		CVTF cooler (with warmer feature) side (CVT model)			22 (0.87)
Radiator fan	Motor input	Main fan W			120
		Sub fan W			120
	Fan diameter / Blade	Main fan			318.5 mm (12.54 in)/9
		Sub fan			318.5 mm (12.54 in)/11
Radiator	Type				Down flow, pressure type
	Core dimensions	Width × Height × Thickness mm (in)			687.4 × 340 × 16 (27.06 × 13.39 × 0.63)
	Pressure range in which cap valve is open kPa (kg/cm^2, psi)		Positive pressure side	Standard	93 — 123 (0.95 — 1.25, 14 — 18)
				Limit	83 (0.85, 12)
			Negative pressure side	Standard	–1.0 to –4.9 or less (–0.01 — –0.05, –0.1 — –0.7)
	Fins				Corrugated fin type
Reservoir tank	Capacity L (US qt, Imp qt)				0.45 (0.48, 0.40)

	Recommended materials	Item number	Alternative
Coolant	SUBARU SUPER COOLANT (concentrated type)	—	—
	SUBARU SUPER COOLANT (diluted type)	K0670Y0001	
Water for dilution	Distilled water	—	Soft water or tap water
Cooling system protective agent	Cooling system conditioner	SOA345001	—

B: COMPONENT

1. WATER PUMP

- Gasoline engine model

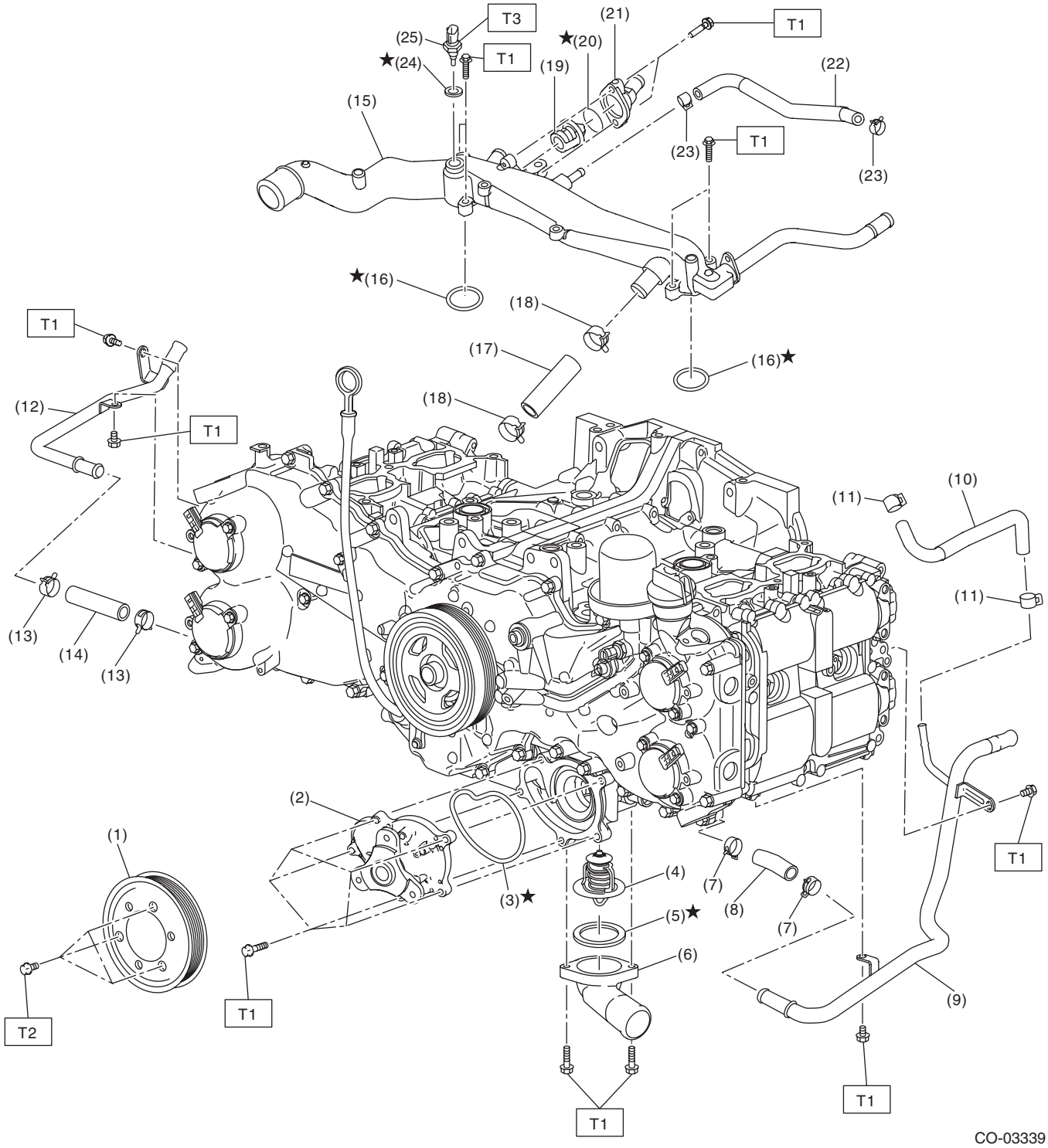


(1) Water pump pulley
(2) Water pump ASSY
(3) Gasket
(4) Thermostat (engine side)
(5) Gasket (engine side)
(6) Thermostat cover (engine side)
(7) Clip
(8) Water pipe hose LH
(9) Water pipe LH
(10) Preheater hose
(11) Clip
(12) Water pipe RH (CVT model)
(13) Clip (CVT model)
(14) Water pipe hose RH (CVT model)
(15) Water pipe ASSY (CVT model)
(16) Preheater hose A
(17) Clip
(18) Preheater hose B
(19) Clip
(20) O-ring
(21) Thermostat (CVTF cooler (with warmer feature) side)
(22) Gasket (CVTF cooler (with warmer feature) side)
(23) Gasket (MT model)
(24) Thermostat cover (CVTF cooler (with warmer feature) side)
(25) Gasket
(26) Engine coolant temperature sensor
(27) EGR control valve
(28) O-ring
(29) Gasket
(30) Water pipe ASSY (MT model)

Tightening torque: N·m (kgf-m, ft-lb)

T1: 6.4 (0.7, 4.7)
T2: 14 (1.4, 10.3)
T3: 18 (1.8, 13.3)
T4: 22 (2.2, 16.2)

- HEV model

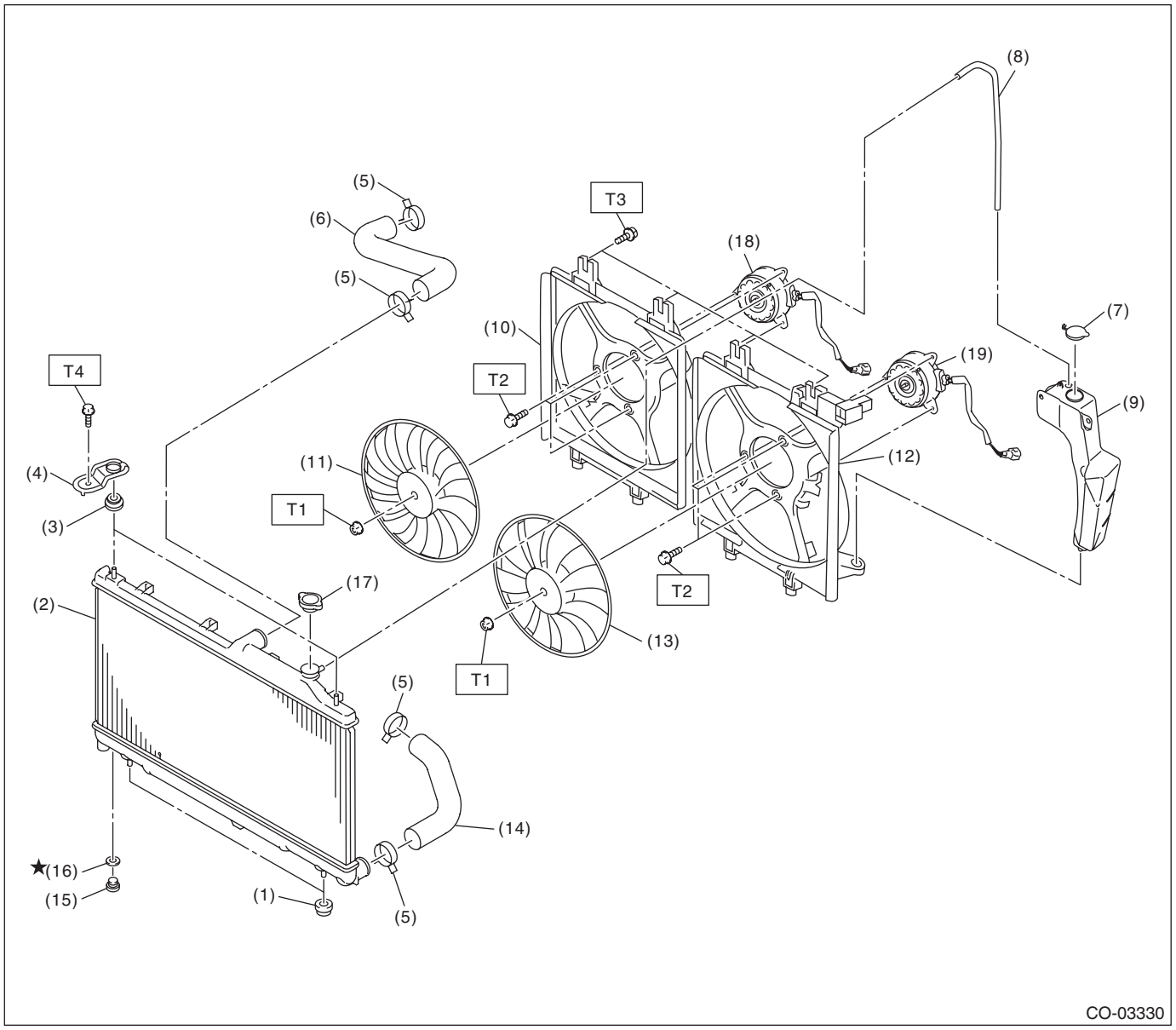

T3
(25)
T1
★(24)
(19)
★(20)
(21)
T1
(22)
(15)
(23)
T1
(23)
★(16)
(18)
T1
(17)
(16)★
(18)
(12)
T1
(10)
(11)
(11)
(13)
(14)
(13)
(2)
(1)
(4)
(7)
(8)
(7)
T1
(3)★
(5)★
(6)
(9)
T2
T1
T1
T1
CO-03339

(1) Water pump pulley
(2) Water pump ASSY
(3) Gasket
(4) Thermostat (engine side)
(5) Gasket (engine side)
(6) Thermostat cover (engine side)
(7) Clip
(8) Water pipe hose LH
(9) Water pipe LH
(10) Preheater hose
(11) Clip
(12) Water pipe RH
(13) Clip
(14) Water pipe hose RH
(15) Water pipe ASSY
(16) O-ring
(17) Preheater hose B
(18) Clip
(19) Thermostat (CVTF cooler (with warmer feature) side)
(20) Gasket (CVTF cooler (with warmer feature) side)
(21) Thermostat cover (CVTF cooler (with warmer feature) side)
(22) Preheater hose A
(23) Clip
(24) Gasket
(25) Engine coolant temperature sensor

Tightening torque: N·m (kgf-m, ft-lb)

T1: 6.4 (0.7, 4.7)
T2: 14 (1.4, 10.3)
T3: 18 (1.8, 13.3)

2. RADIATOR & RADIATOR FAN



(1) Radiator lower cushion
(2) Radiator
(3) Radiator upper cushion
(4) Radiator upper bracket
(5) Clip
(6) Radiator inlet hose
(7) Engine coolant reservoir tank cap
(8) Over flow hose
(9) Engine coolant reservoir tank
(10) Radiator sub fan shroud
(11) Radiator sub fan
(12) Radiator main fan shroud
(13) Radiator main fan
(14) Radiator outlet hose
(15) Radiator drain plug
(16) O-ring
(17) Radiator cap
(18) Sub fan motor
(19) Main fan motor

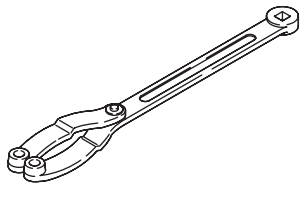
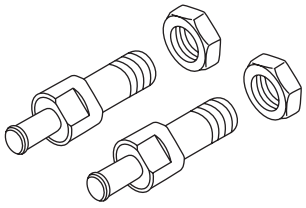
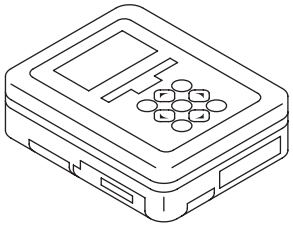
Tightening torque: N·m (kgf-m, ft-lb)
T1: 3.4 (0.3, 2.5)
T2: 4.41 (0.45, 3.25)
T3: 7.5 (0.8, 5.5)
T4: 12 (1.2, 8.9)

C: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a work cap, and protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Prepare a container and cloth to prevent scattering of engine coolant when performing work where engine coolant can be spilled. If the oil spills, wipe it off immediately to prevent from penetrating into floor or flowing out for environmental protection.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.
- Follow all government and local regulations concerning disposal of refuse when disposing engine coolant.

D: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18355AA000	18355AA000	PULLEY WRENCH	• Used for removing and installing water pump pulley. • Used with PULLEY WRENCH PIN SET (18334AA030).
 ST18334AA030	18334AA030	PULLEY WRENCH PIN SET	• Used for removing and installing water pump pulley. • Used together with PULLEY WRENCH (18355AA000).
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for setting of each function and trouble-shooting for electrical system. NOTE: For detailed operation procedures of Subaru Select Monitor III, refer to “PC application help for Subaru Select Monitor”.

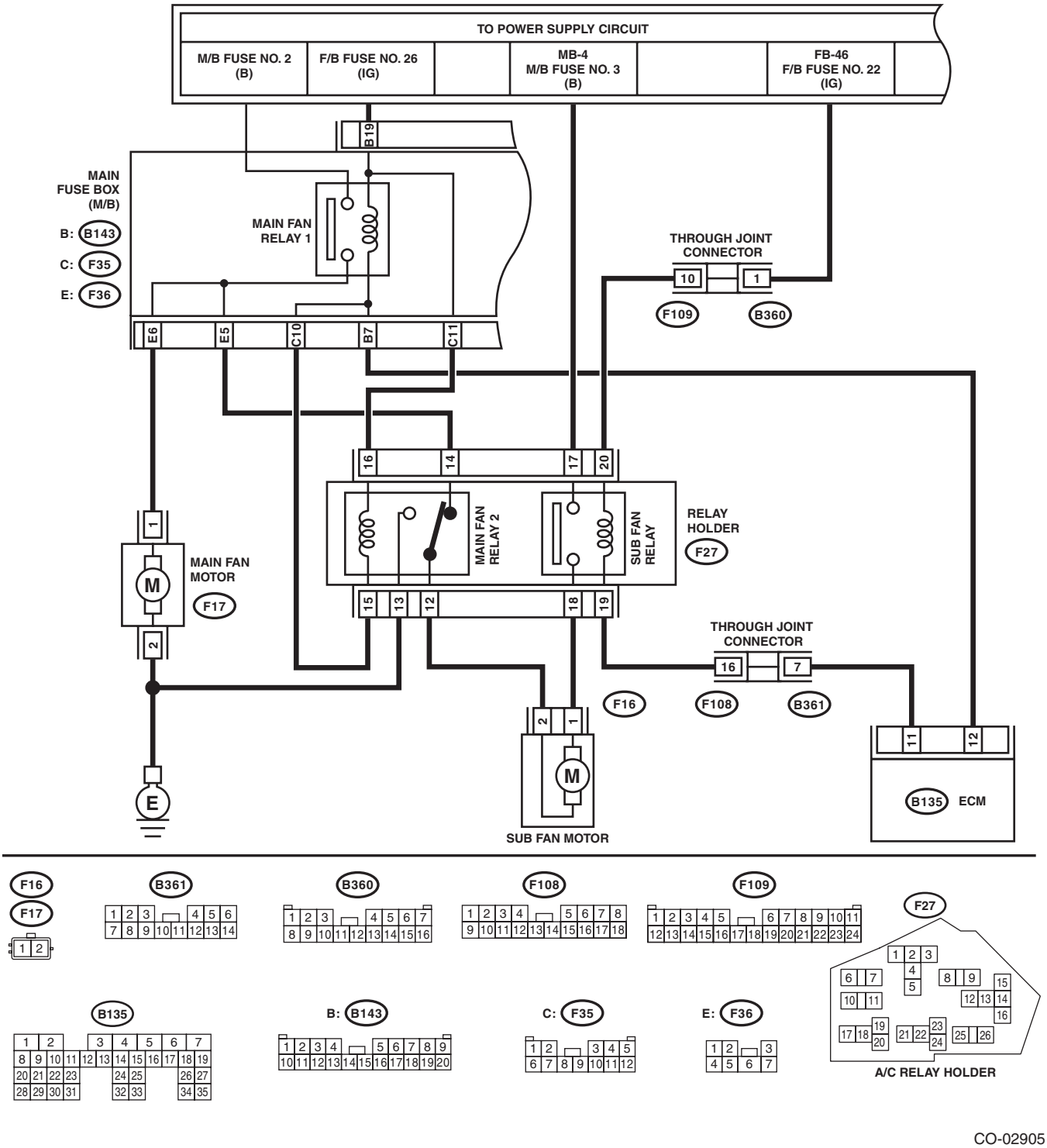
2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance and voltage.
Radiator cap tester	Used for checking radiator and radiator cap.

2. Radiator Fan System

A: WIRING DIAGRAM

Radiator fan system <Ref. to WI(w/o HEV)-183, WIRING DIAGRAM, Radiator Fan System.> <Ref. to WI(HEV)-185, WIRING DIAGRAM, Radiator Fan System.>



CO-02905

B: INSPECTION

OPERATING CONDITION:

Vehicle speed	A/C compressor load	Engine coolant temperature		
		Increase: 98°C (208°F) or less Decrease: 96°C (205°F) or less	Increase: 99 — 101°C (210 — 214°F) Decrease: 97 — 98°C (207 — 208°F)	Increase: 102°C (216°F) or more Decrease: 99°C (210°F) or more
		Radiator fan operation	Radiator fan operation	Radiator fan operation
During acceleration: 19 km/h (12 MPH) or less During deceleration: 10 km/h (6 MPH) or less	OFF	OFF	Low-Speed	High-Speed
	Low	Low-Speed	Low-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed
During acceleration: 20 — 69 km/h (12 — 43 MPH) During deceleration: 11 — 64 km/h (7 — 40 MPH)	OFF	OFF	Low-Speed	High-Speed
	Low	High-Speed	High-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed
During acceleration: 70 — 134 km/h (43 — 83 MPH) During deceleration: 65 — 129 km/h (40 — 80 MPH)	OFF	OFF	Low-Speed	High-Speed
	Low	OFF	Low-Speed	High-Speed
	High	Low-Speed	High-Speed	High-Speed
During acceleration: 135 km/h (84 MPH) or more During deceleration: 130 km/h (81 MPH) or more	OFF	OFF	OFF	High-Speed
	Low	OFF	Low-Speed	High-Speed
	High	OFF	Low-Speed	High-Speed

DIAGNOSIS:

Radiator main fan and radiator sub fan do not rotate under the above operating conditions.

	Step	Check	Yes	No
1	**CHECK OPERATION OF RADIATOR FAN.** 1) Install the delivery (test) mode fuse. 2) Turn the ignition switch to ON. 3) Perform the compulsory operation check for the radiator fan relay using Subaru Select Monitor. NOTE: • When performing the compulsory operation check for the radiator fan relay using the Subaru Select Monitor, the radiator main fan and radiator sub fan will repeat low speed revolution → high speed revolution → OFF in this order. • Subaru Select Monitor For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.	Do the radiator main fans and radiator sub fans rotate at low speed?	Go to step **2**.	Go to step **3**.
2	**CHECK OPERATION OF RADIATOR FAN.** 1) Install the delivery (test) mode fuse. 2) Turn the ignition switch to ON. 3) Perform the compulsory operation check for the radiator fan relay using Subaru Select Monitor. NOTE: • When performing the compulsory operation check for the radiator fan relay using the Subaru Select Monitor, the radiator main fan and radiator sub fan will repeat low speed revolution → high speed revolution → OFF in this order. • Subaru Select Monitor For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.	Do the radiator main fans and radiator sub fans rotate at high speed?	Radiator main fan system is normal.	Go to step **27**.

	Step	Check	Yes	No
3	**CHECK POWER SUPPLY TO SUB FAN RELAY.** 1) Turn the ignition switch to OFF. 2) Remove the sub fan relay from the relay holder. 3) Measure the voltage between the sub fan relay terminal and chassis ground. ***Connector & terminal*** ***(F27) No. 17 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **4**.	Go to step **5**.
4	**CHECK POWER SUPPLY TO SUB FAN RELAY.** 1) Turn the ignition switch to ON. 2) Measure the voltage between the sub fan relay terminal and chassis ground. ***Connector & terminal*** ***(F27) No. 20 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **7**.	Go to step **6**.
5	**CHECK FUSE.** 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 3. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Repair the power supply line.
6	**CHECK FUSE.** 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 22. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Repair the power supply line.
7	**CHECK SUB FAN RELAY.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between sub fan relay terminals. ***Terminals*** ***No. 17 — No. 18:***	Is the resistance 1 MΩ or more?	Go to step **8**.	Replace the sub fan relay. <Ref. to AC-35, Relay and Fuse.>
8	**CHECK SUB FAN RELAY.** 1) Connect the battery to terminals No. 20 and No. 19 of the sub fan relay. 2) Measure the resistance between sub fan relay terminals. ***Terminals*** ***No. 17 — No. 18:***	Is the resistance less than 1 Ω?	Go to step **9**.	Replace the sub fan relay. <Ref. to AC-35, Relay and Fuse.>
9	**CHECK HARNESS BETWEEN SUB FAN RELAY TERMINAL AND SUB FAN MOTOR CONNECTOR.** 1) Disconnect the connector from the sub fan motor. 2) Measure the resistance of harness between the sub fan relay terminal and sub fan motor connector. ***Connector & terminal*** ***(F16) No. 1 — (F27) No. 18:***	Is the resistance less than 1 Ω?	Go to step **10**.	Repair the open circuit of harness between sub fan relay terminal and sub fan motor connector.
10	**CHECK HARNESS BETWEEN SUB FAN MOTOR CONNECTOR AND MAIN FAN RELAY 2 CONNECTOR.** 1) Remove main fan relay 2 from the relay holder. 2) Measure the resistance of harness between sub fan motor connector and main fan relay 2 connector. ***Connector & terminal*** ***(F16) No. 2 — (F27) No. 12:***	Is the resistance less than 1 Ω?	Go to step **11**.	Repair the open circuit of the harness between sub fan motor connector and main fan relay 2 connector.

	Step	Check	Yes	No
11	**CHECK FOR POOR CONTACT.** Check poor contact of sub fan motor connector.	Is there poor contact of the sub fan motor connector?	Repair the poor contact of sub fan motor connector.	Go to step **12**.
12	**CHECK SUB FAN MOTOR.** Connect the battery positive (+) terminal to terminal No. 1 of the sub fan motor, and the ground (–) terminal to terminal No. 2.	Does the radiator sub fan rotate?	Go to step **13**.	Replace the sub fan motor. <Ref. to CO(H4DO(w/o HEV))-93, Radiator Sub Fan and Fan Motor.>
13	**CHECK MAIN FAN RELAY 2.** Measure the resistance of main fan relay 2. ***Terminals*** ***No. 14 — No. 12:***	Is the resistance less than 1 Ω?	Go to step **14**.	Replace the main fan relay 2. <Ref. to AC-35, Relay and Fuse.>
14	**CHECK HARNESS BETWEEN MAIN FAN RELAY 2 AND MAIN FAN MOTOR CONNECTOR.** 1) Disconnect the connector from the main fan motor. 2) Measure the resistance of the harness between main fan relay 2 terminal and main fan motor connector. ***Connector & terminal*** ***(F17) No. 1 — (F27) No. 14:***	Is the resistance less than 1 Ω?	Go to step **15**.	Repair the open circuit of the harness between main fan relay 2 terminal and main fan motor connector.
15	**CHECK GROUND CIRCUIT OF MAIN FAN MOTOR.** Measure the resistance between main fan motor connector and chassis ground. ***Connector & terminal*** ***(F17) No. 2 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **16**.	Repair the open circuit of the harness between main fan motor connector and chassis ground.
16	**CHECK FOR POOR CONTACT.** Check poor contact of main fan motor connector.	Is there poor contact of the main fan motor connector?	Repair the poor contact of main fan motor connector.	Go to step **17**.
17	**CHECK MAIN FAN MOTOR.** Connect the battery positive (+) terminal to terminal No. 1 of the main fan motor, and the ground (–) terminal to terminal No. 2.	Does the radiator main fan rotate?	Go to step **18**.	Replace the main fan motor. <Ref. to CO(H4DO(w/o HEV))-89, Radiator Main Fan and Fan Motor.>
18	**CHECK HARNESS BETWEEN SUB FAN RELAY AND ECM.** 1) Disconnect the connector from ECM. 2) Measure the resistance between the sub fan relay terminal and ECM connector. ***Connector & terminal*** ***(B135) No. 11 — (F27) No. 19:***	Is the resistance less than 1 Ω?	Go to step **19**.	Repair the open circuit of harness between sub fan relay terminal and ECM.
19	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM connector.	Is there poor contact of ECM connector?	Repair the poor contact of ECM connector.	Check the DTC. Repair the trouble cause. <Ref. to EN(H4DO w/o HEV)(diag)-49, Read Diagnostic Trouble Code (DTC).> <Ref. to EN(H4DO HEV)(diag)-51, Read Diagnostic Trouble Code (DTC).>

	Step	Check	Yes	No
20	**CHECK MAIN FAN RELAY 1.** 1) Turn the ignition switch to OFF. 2) Remove main fan relay 1 from the main fuse box. 3) Measure the resistance between terminals of main fan relay 1 switch.	Is the resistance 1 MΩ or more?	Go to step **21**.	Replace the main fan relay 1. <Ref. to AC-35, Relay and Fuse.>
21	**CHECK MAIN FAN RELAY 1.** 1) Connect the main fan relay 1 coil side terminal to the battery. 2) Measure the resistance between terminals of main fan relay 1 switch.	Is the resistance less than 1 Ω?	Go to step **22**.	Replace the main fan relay 1. <Ref. to AC-35, Relay and Fuse.>
22	**CHECK HARNESS BETWEEN MAIN FAN RELAY 1 AND MAIN FAN MOTOR CONNECTOR.** 1) Disconnect the connector from the main fan motor. 2) Measure the resistance of the harness between main fan relay 1 terminal and main fan motor connector. ***Connector & terminal*** ***(F17) No. 1 — (F36) No. 6:***	Is the resistance less than 1 Ω?	Go to step **23**.	Repair the open circuit of the harness between main fan relay 1 terminal and main fan motor connector.
23	**CHECK HARNESS BETWEEN MAIN FAN RELAY 1 AND ECM.** 1) Disconnect the connector from ECM. 2) Measure the resistance between main fan relay 1 terminal and ECM connector. ***Connector & terminal*** ***(B135) No. 12 — (B143) No. 7:***	Is the resistance less than 1 Ω?	Go to step **24**.	Repair the open circuit of the harness between main fan relay 1 terminal and ECM.
24	**CHECK HARNESS BETWEEN MAIN FAN RELAY 2 AND ECM.** Measure the resistance between main fan relay 2 terminal and ECM connector. ***Connector & terminal*** ***(B135) No. 12 — (F27) No. 15:***	Is the resistance less than 1 Ω?	Go to step **25**.	Repair the open circuit of the harness between main fan relay 2 terminal and ECM.
25	**CHECK FUSE.** 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 2 and No. 26. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Go to step **26**.
26	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM connector.	Is there poor contact of ECM connector?	Repair the poor contact of ECM connector.	Repair the power supply circuit to the main fuse box.
27	**CHECK OPERATION OF RADIATOR FAN.** If the both fans do not rotate at high speed in the condition of step 2, check whether the radiator sub fan is rotating.	Does the radiator sub fan rotate?	Go to step **20**.	Go to step **28**.
28	**CHECK GROUND CIRCUIT OF MAIN FAN RELAY 2.** 1) Remove the main fan relay 2 from A/C relay holder. 2) Measure the resistance between main fan relay 2 terminal and chassis ground. ***Connector & terminal*** ***(F27) No. 13 — Chassis ground:***	Is the resistance less than 1 Ω?	Go to step **29**.	Repair the open circuit of harness between main fan relay 2 and chassis ground.

	Step	Check	Yes	No
29	**CHECK POWER SUPPLY TO MAIN FAN RELAY 2.** 1) Turn the ignition switch to ON. 2) Measure the voltage between main fan relay 2 terminal and chassis ground. ***Connector & terminal*** ***(F27) No. 16 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **30**.	Repair the power supply line.
30	**CHECK MAIN FAN RELAY 2.** 1) Turn the ignition switch to OFF. 2) Remove the main fan relay 2. 3) Measure the resistance of main fan relay 2. ***Terminals*** ***(F27) No. 12 — (F27) No. 13:***	Is the resistance 1 MΩ or more?	Go to step **31**.	Replace the main fan relay 2. <Ref. to AC-35, Relay and Fuse.>
31	**CHECK MAIN FAN RELAY 2.** 1) Connect the battery to terminals No. 16 and No. 15 of the main fan relay 2. 2) Measure the resistance of main fan relay 2. ***Terminals*** ***(F27) No. 12 — (F27) No. 13:***	Is the resistance less than 1 Ω?	Go to step **23**.	Replace the main fan relay 2. <Ref. to AC-35, Relay and Fuse.>

3. Engine Coolant

A: INSPECTION

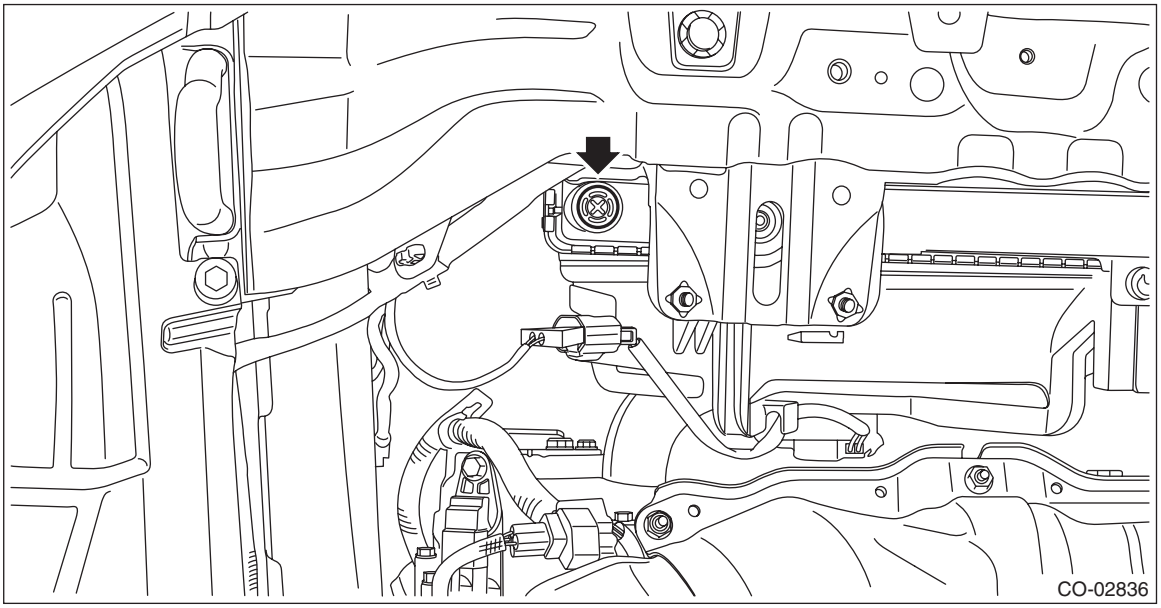
NOTE:
When adding the engine coolant, always use SUBARU Super Coolant.
1) Park the vehicle on a level surface.
2) Turn the ignition switch to OFF.
3) Check the engine coolant amount, and if the coolant level is low, check for the coolant leakage, and then add the engine coolant.
   (1) Make sure the engine coolant level in the reservoir tank is between “FULL” and “LOW” with the engine in a cold condition.
   (2) Open the radiator cap and make sure that the radiator is filled with the engine coolant up to its filler neck position.

B: REPLACEMENT

1. DRAINING OF ENGINE COOLANT

1) Turn the ignition switch to OFF.
2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-32, REMOVAL, Front Under Cover.>
4) Remove the drain plug to drain engine coolant into container.

NOTE:
Remove the radiator cap so that engine coolant will drain faster.



5) Install the drain plug.

NOTE:
Use new O-rings.
6) Install the under cover. <Ref. to EI-32, INSTALLATION, Front Under Cover.>

2. FILLING OF ENGINE COOLANT

CAUTION:
For CVT models, set the select lever to “P” or “N” range (for MT models, the shift lever in neutral) during work, and do not shift the lever.
1) Pour cooling system conditioner through the filler neck.

Cooling system protective agent:
Refer to “SPECIFICATION” for cooling system protective agent. <Ref. to CO(H4DO(w/o HEV))-2, SPECIFICATION, General Description.>

2) Pour engine coolant into the radiator up to the filler neck position.

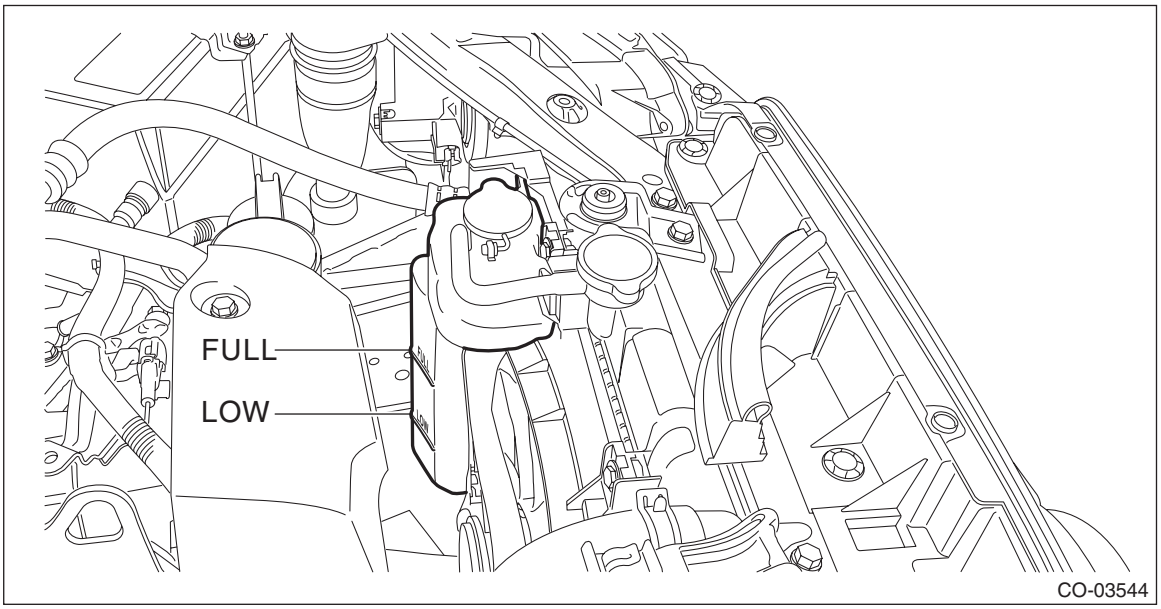
Recommended engine coolant:
Refer to "SPECIFICATION" for recommended engine coolant. <Ref. to CO(H4DO(w/o HEV))-2, SPECIFICATION, General Description.>

Engine coolant level:
Refer to "SPECIFICATION" for engine coolant level. <Ref. to CO(H4DO(w/o HEV))-2, SPECIFICATION, General Description.>

Engine coolant concentration:
Refer to "ADJUSTMENT" for the recommended engine coolant concentration. <Ref. to CO(H4DO(w/o HEV))-18, ADJUSTMENT, Engine Coolant.>

NOTE:
The SUBARU Super Coolant contains anti-freeze and anti-rust agents, and is especially made for Subaru engines with an aluminum cylinder block. Be sure to use SUBARU Super Coolant, since other coolant may cause corrosion.

3) Fill engine coolant into the reservoir tank up to "FULL" level.



4) Close the radiator cap and start the engine. Race 5 to 6 times at 3,000 r/min or less, then stop the engine. (Complete this operation within 40 seconds.)
5) Wait for one minute after the engine stops (ignition OFF), and open the radiator cap. If the engine coolant level drops, add engine coolant into radiator up to the filler neck position.
6) Perform the procedures 4) and 5) again.
7) Attach the radiator cap and reservoir tank cap properly.
8) Start the engine and operate the heater at maximum hot position and the blower speed setting to "LO".
9) Run the engine at 3,000 r/min or less until radiator fan starts and stops.

NOTE:
Be careful with the engine coolant temperature to prevent overheating.

10) Stop the engine (ignition OFF) and wait until the engine coolant temperature lowers to 30°C (86°F) or less.
11) Open the radiator cap. If the engine coolant level drops, add engine coolant into the radiator up to the filler neck position and the reservoir tank to "FULL" level.
12) Attach the radiator cap and reservoir tank cap properly.
13) Set the heater setting to maximum hot position and the blower speed setting to "LO" and start the engine. Perform racing at 3,000 r/min or less. If the flowing sound is heard from heater core at this time, perform the procedures from 9) again.

C: ADJUSTMENT

1. PROCEDURE TO ADJUST THE SUBARU SUPER COOLANT CONCENTRATION

CAUTION:
Use the SUBARU Super Coolant with a 50 — 60% concentration in order to obtain maximum anti-freeze and anti-rust performance.
To adjust the concentration of SUBARU Super Coolant according to temperature, find the proper SUBARU Super Coolant concentration in the table, and add dilution water to the SUBARU Super Coolant (concentrated type) until it reaches the proper dilution.

Relationship of SUBARU Super Coolant concentration and freezing temperature			
SUBARU Super Coolant concentration	50%	55%	60%
Freezing temperature	–36°C (–33°F)	–41°C (–42°F)	–50°C (–58°F)

Engine coolant and diluting water:
Refer to "SPECIFICATION" for recommended engine coolant and diluting water. <Ref. to CO(H4DO(w/o HEV))-2, SPECIFICATION, General Description.>

4. Water Pump

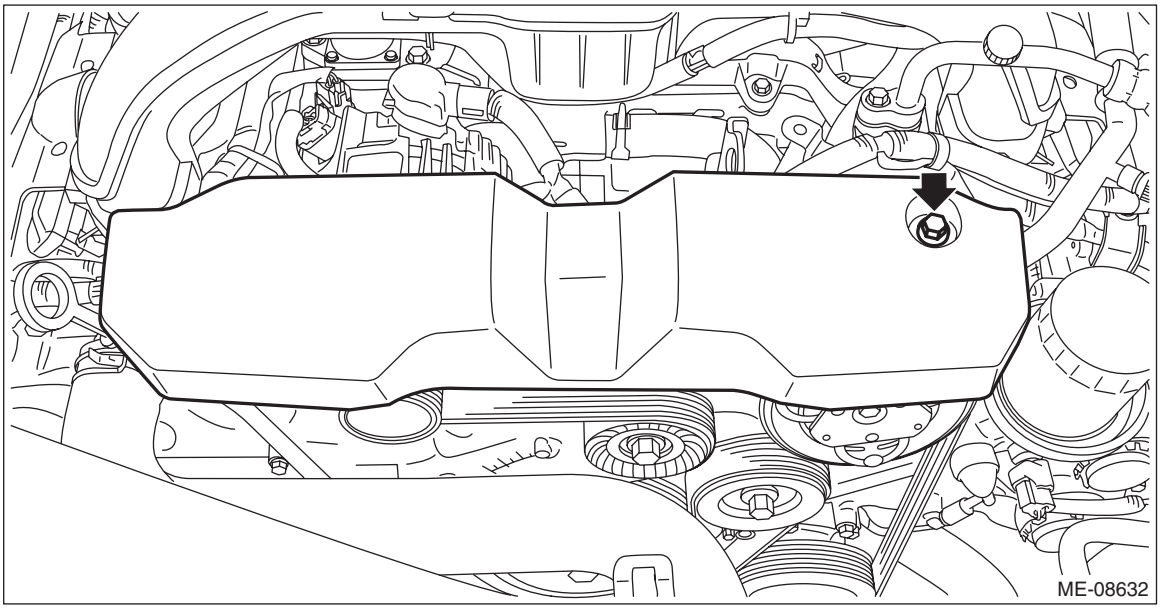
A: REMOVAL

1. WATER PUMP PULLEY

1) Disconnect the ground cable from battery. <Ref. to NT-5, BATTERY, NOTE, Note.>

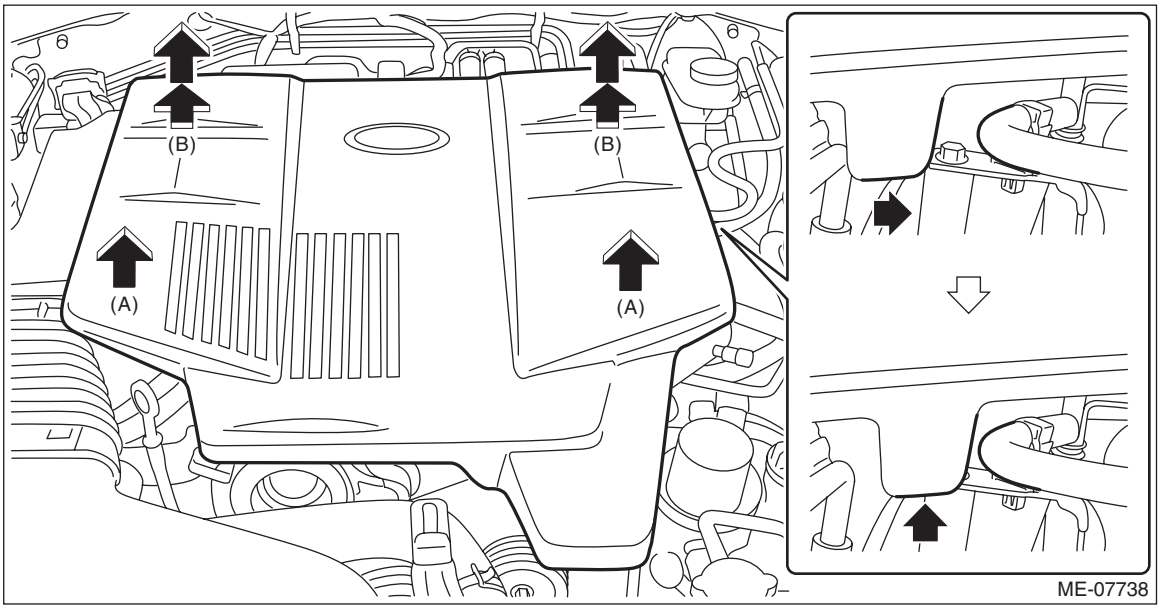
NOTE:
For the 12 volt engine restart battery of HEV model, disconnect the ground terminal from 12V engine restart battery sensor.

2) Remove the V-belt covers. (Gasoline engine model)



3) Remove the collector cover. (HEV model)
   (1) Carefully pull up the front of collector cover at two positions (A).
   (2) Carefully pull up the rear of collector cover at two positions (B) while moving it backward.

NOTE:
Be careful not to contact the fuel delivery tube when moving the collector cover rearward.



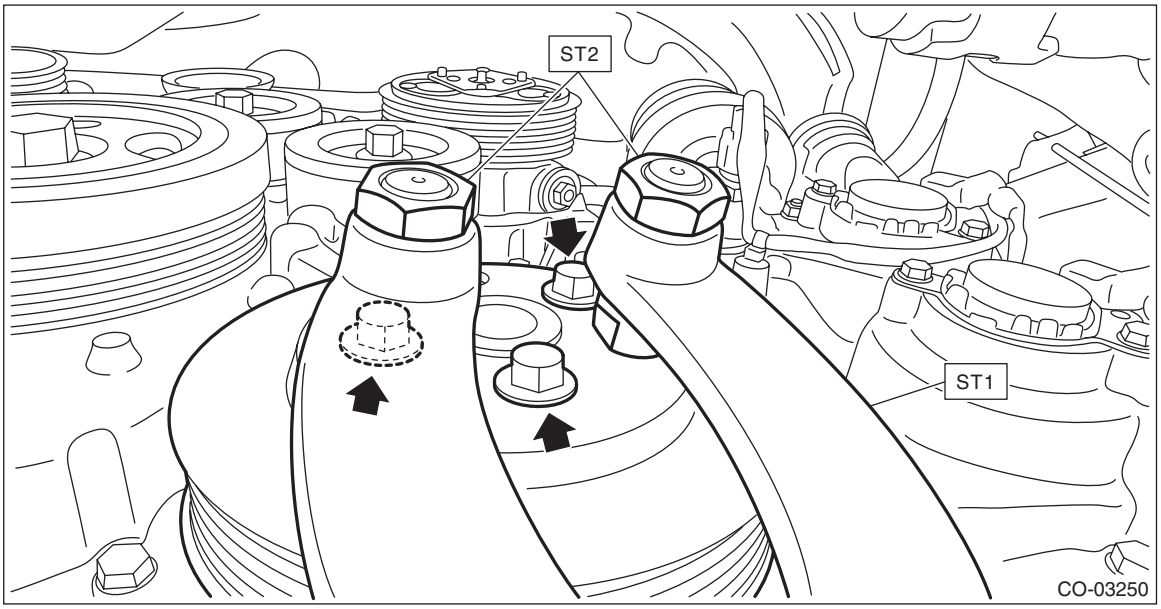
4) Remove the V-belts. (Gasoline engine model) <Ref. to ME(H4DO(w/o HEV))-122, GASOLINE ENGINE MODEL, REMOVAL, V-belt.>

5) Loosen the V-belt, and remove the V-belt from the water pump pulley. (HEV model) <Ref. to ME(H4DO(w/o HEV))-124, HEV MODEL, REMOVAL, V-belt.>

NOTE:
It is not necessary to remove the V-belt tensioner assembly and the V-belt from ISG.

6) Remove the radiator main fan & fan motor assembly. <Ref. to CO(H4DO(w/o HEV))-89, REMOVAL, Radiator Main Fan and Fan Motor.>
7) Lift up the vehicle.
8) Remove the under cover. <Ref. to EI-32, REMOVAL, Front Under Cover.>
9) Remove the water pump pulley using the ST.

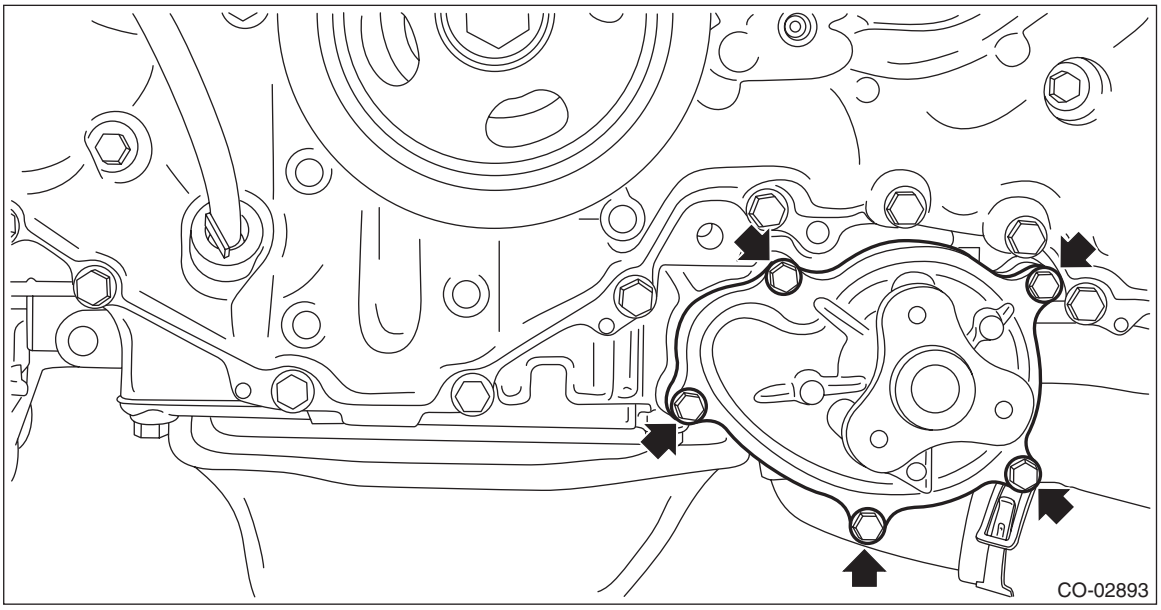
ST1 18355AA000 PULLEY WRENCH
ST2 18334AA030 PULLEY WRENCH PIN SET



2. WATER PUMP

1) Drain engine coolant. <Ref. to CO(H4DO(w/o HEV))-16, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
2) Remove the water pump pulley. <Ref. to CO(H4DO(w/o HEV))-19, WATER PUMP PULLEY, REMOVAL, Water Pump.>
3) Remove the front exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-6, REMOVAL, Front Exhaust Pipe.>

4) Remove the water pump from the oil pan upper.

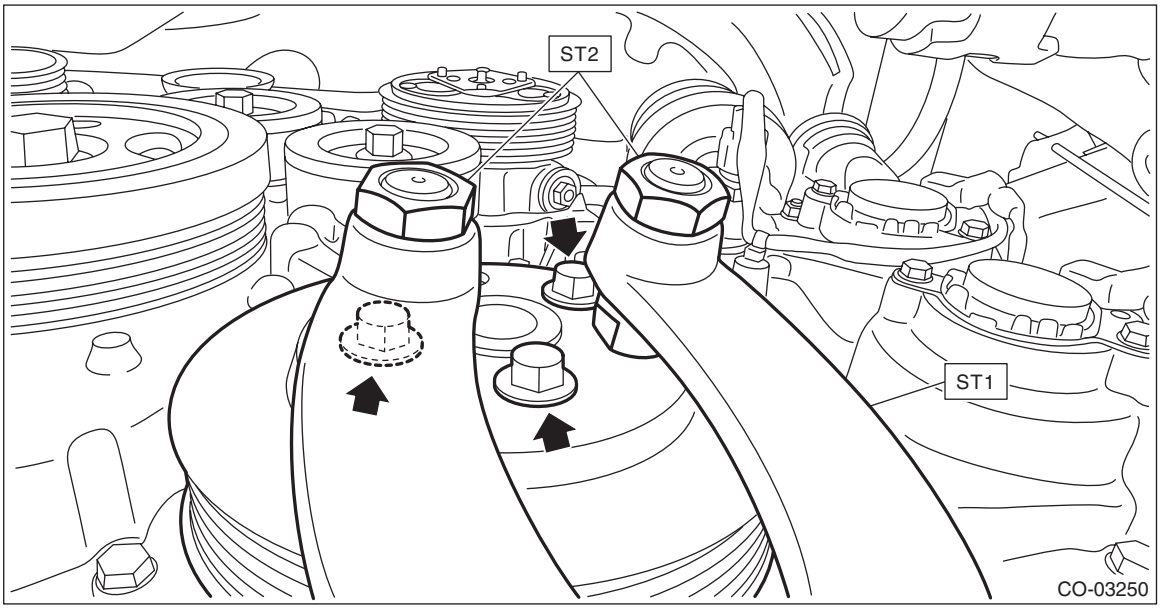


B: INSTALLATION

1. WATER PUMP PULLEY

1) Using the ST, install the water pump pulley.
ST1 18355AA000 PULLEY WRENCH
ST2 18334AA030 PULLEY WRENCH PIN SET

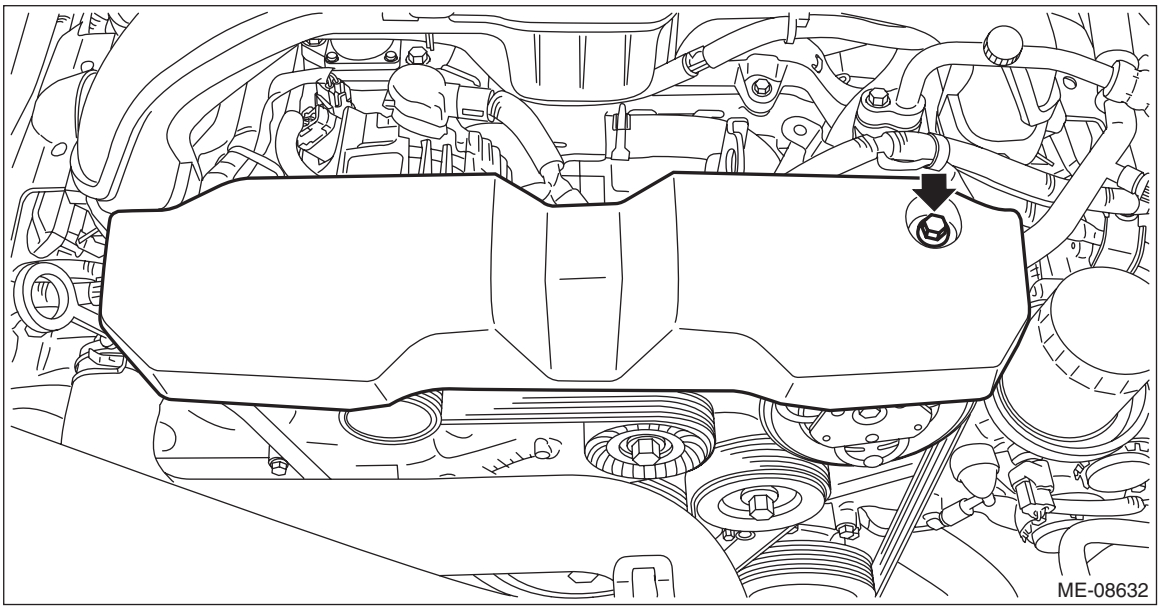
Tightening torque:
14 N·m (1.4 kgf-m, 10.3 ft-lb)



2) Install the under cover. <Ref. to EI-32, INSTALLATION, Front Under Cover.>
3) Lower the vehicle.
4) Install the radiator main fan & fan motor assembly. <Ref. to CO(H4DO(w/o HEV))-90, INSTALLATION, Radiator Main Fan and Fan Motor.>
5) Install the V-belts. <Ref. to ME(H4DO(w/o HEV))-130, INSTALLATION, V-belt.>

6) Install the V-belt cover. (Gasoline engine model)

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



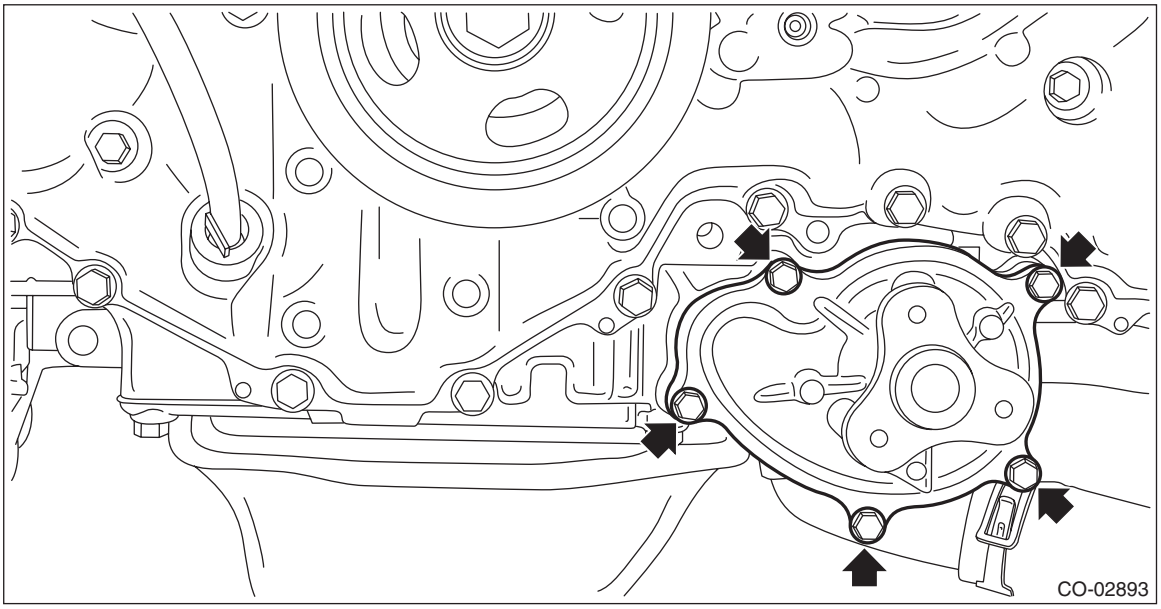
7) Install the collector cover. (HEV model)
8) Connect the battery ground terminal. <Ref. to NT-5, BATTERY, NOTE, Note.>

2. WATER PUMP

1) Install the water pump to oil pan upper.

NOTE:
Use a new gasket.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



2) Install the front exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-8, INSTALLATION, Front Exhaust Pipe.>
3) Install the water pump pulley. <Ref. to CO(H4DO(w/o HEV))-21, WATER PUMP PULLEY, INSTALLATION, Water Pump.>
4) Fill engine coolant. <Ref. to CO(H4DO(w/o HEV))-16, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

C: INSPECTION

1) Check the water pump bearing for smooth rotation.
2) Check the water pump pulley for abnormalities.
3) Make sure the impeller is not abnormally deformed or damaged.

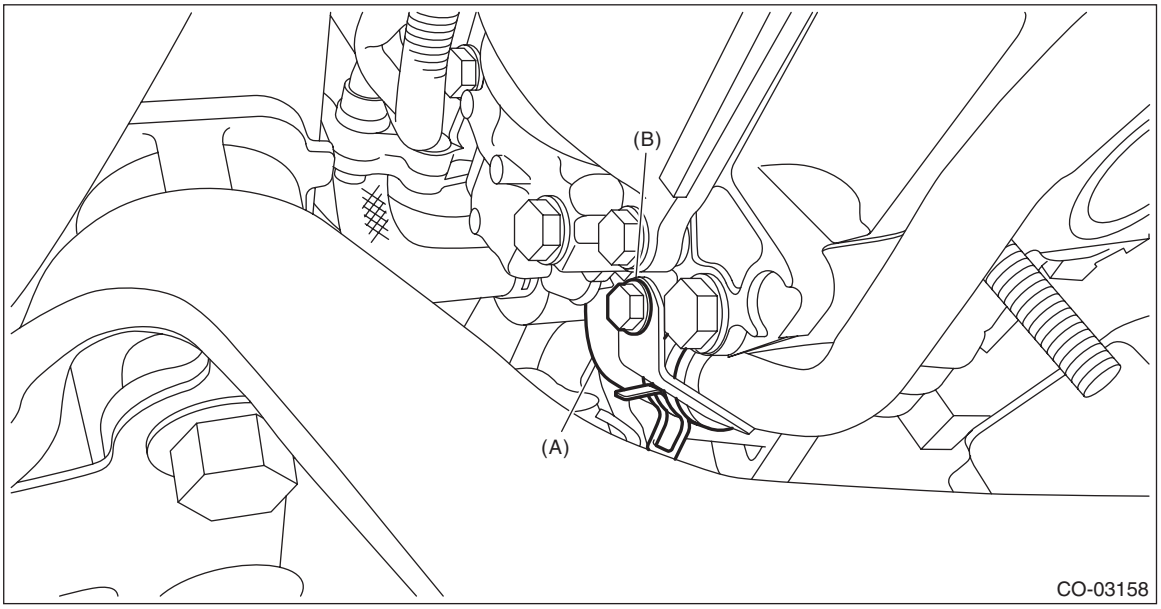
5. Water Pipe Assembly

A: REMOVAL

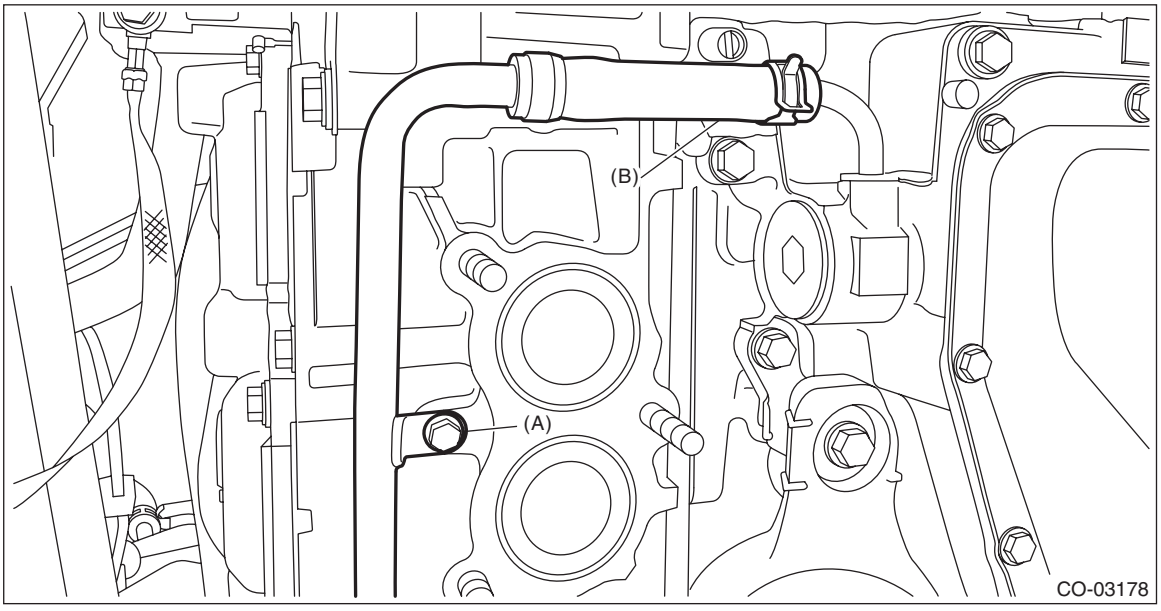
1. WATER PIPE ASSEMBLY RH

NOTE:
Water pipe assembly RH is installed to CVT model.
1) Disconnect the ground cable from battery. <Ref. to NT-5, BATTERY, NOTE, Note.>

NOTE:
For the 12 volt engine restart battery of HEV model, disconnect the ground terminal from 12V engine restart battery sensor.
2) Drain engine coolant. <Ref. to CO(H4DO(w/o HEV))-16, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
3) Remove the front exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-6, REMOVAL, Front Exhaust Pipe.>
4) Disconnect the water hose (A) from the water pipe assembly RH, and remove the bolt (B) securing the water pipe assembly RH to the cam carrier RH.



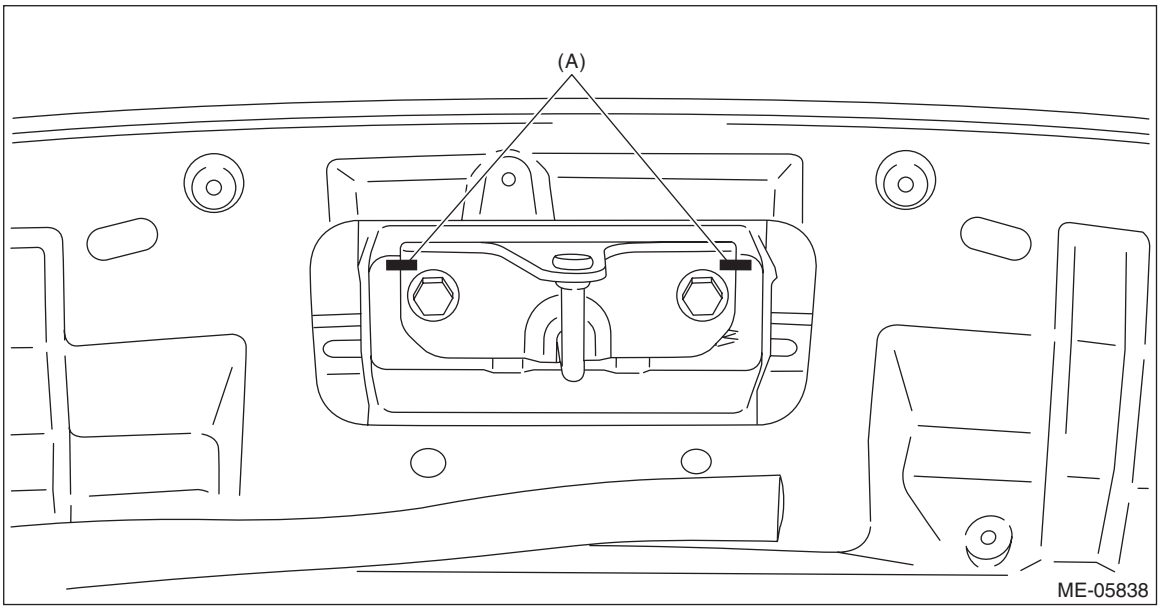
5) Remove the bolt (A) which secures the water pipe assembly RH to the cylinder head RH.
6) Disconnect the water pipe hose RH (B) from oil pan upper, and remove the water pipe assembly RH.



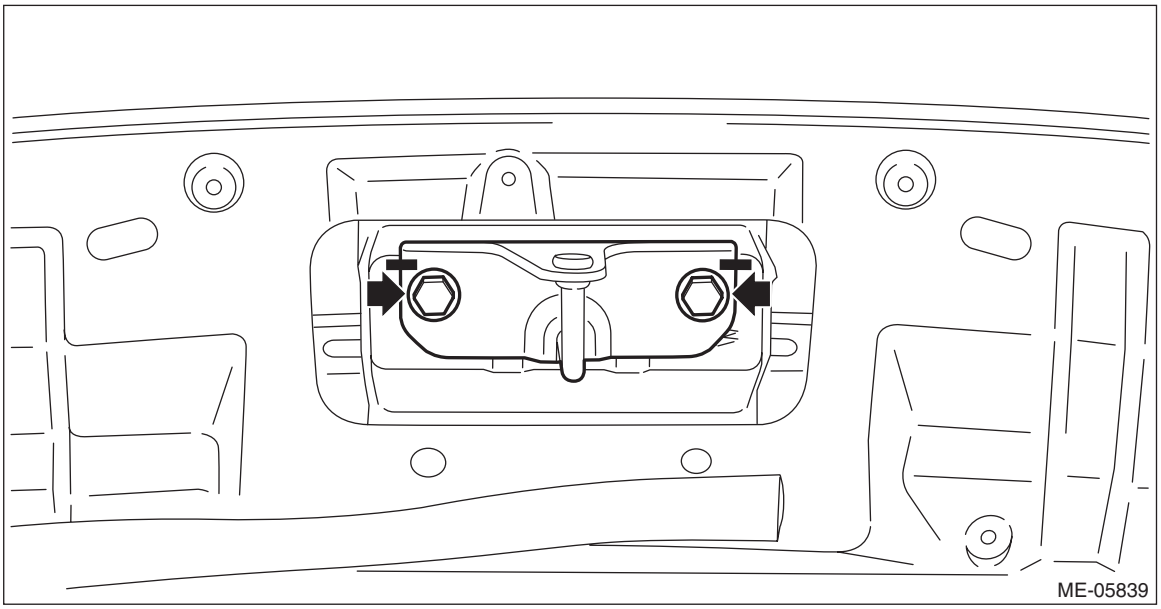
2. WATER PIPE ASSEMBLY LH

• Gasoline engine model

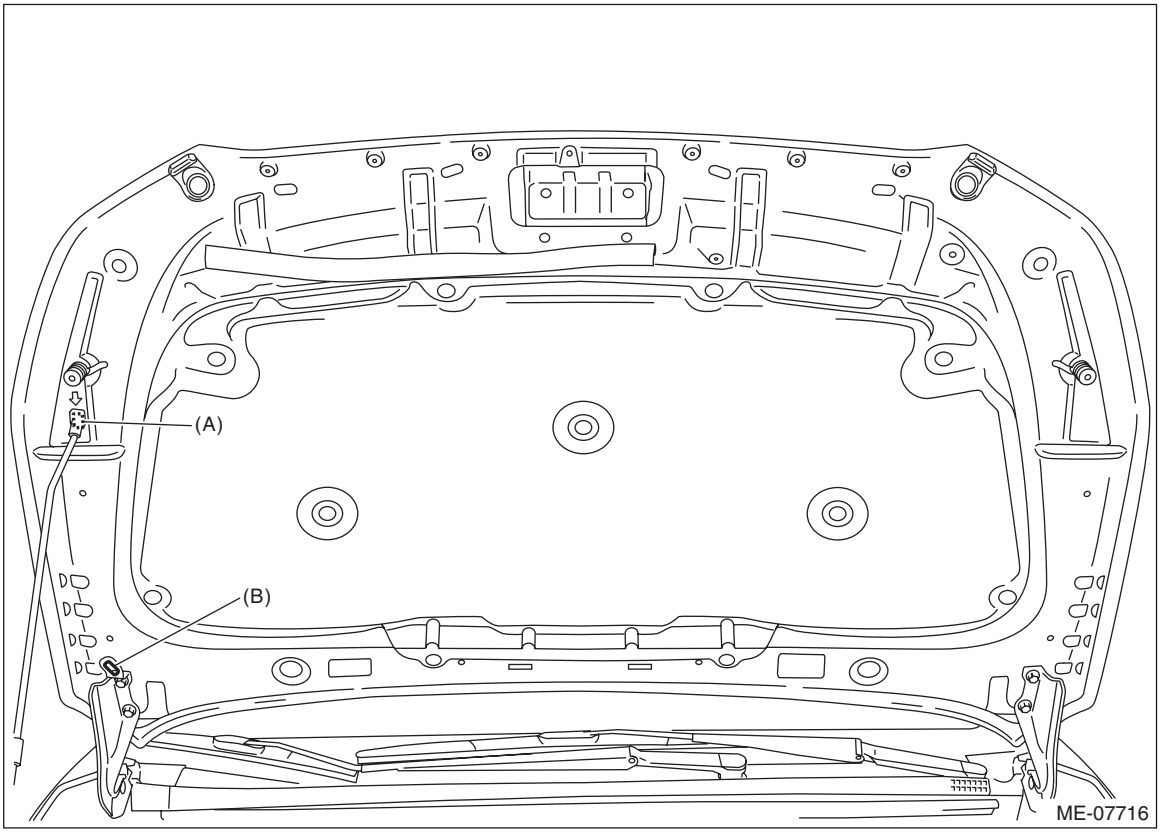
1) Open the front hood, and make alignment marks (A) on both the front hood and the front hood striker by using a marker pen.



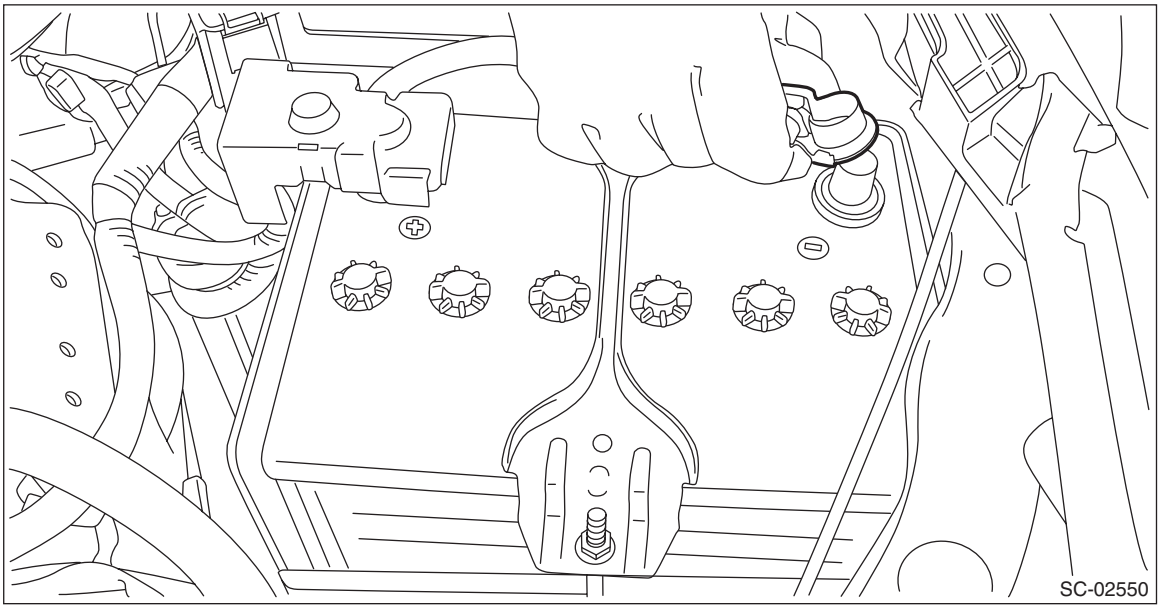
2) Remove the front hood striker from the front hood.



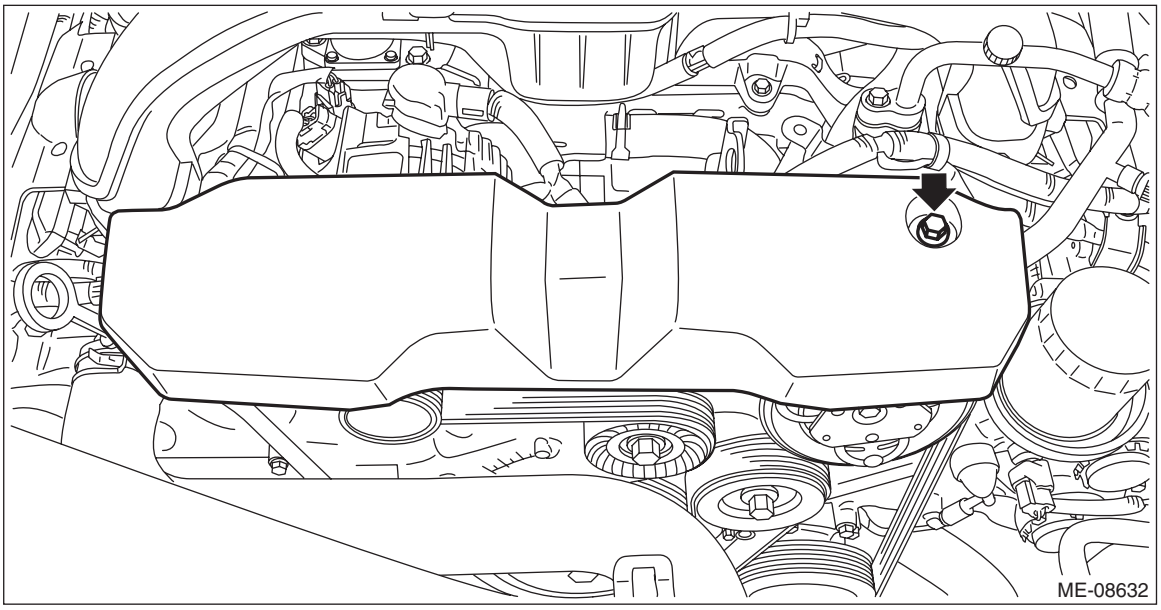
3) Change the front hood stay position from (A) to (B), and completely open the front hood.



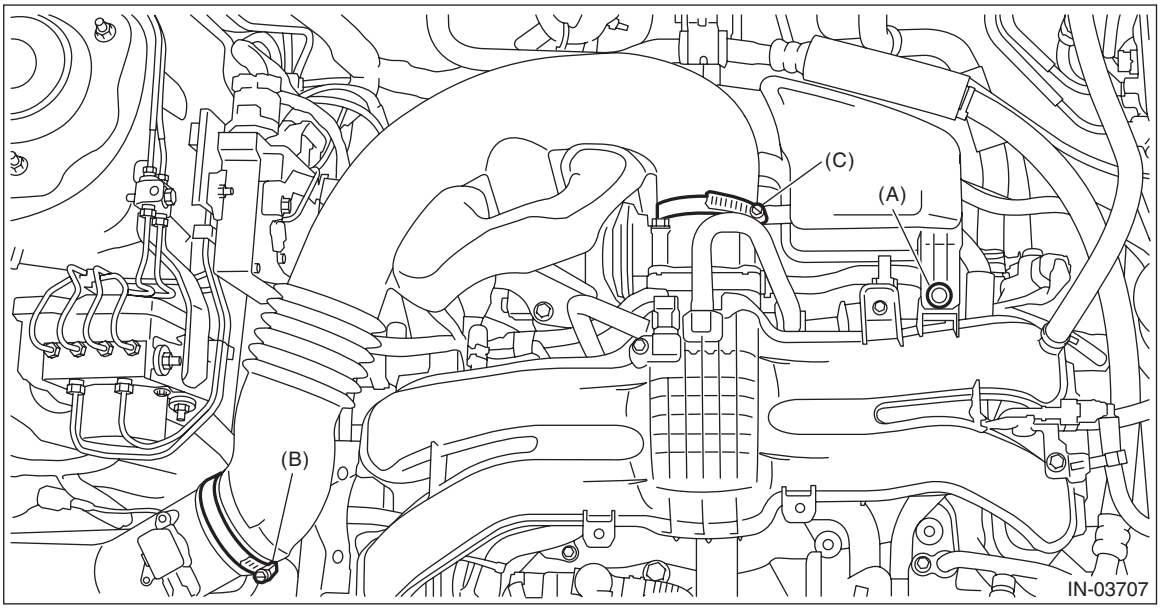
4) Disconnect the ground cable from battery.



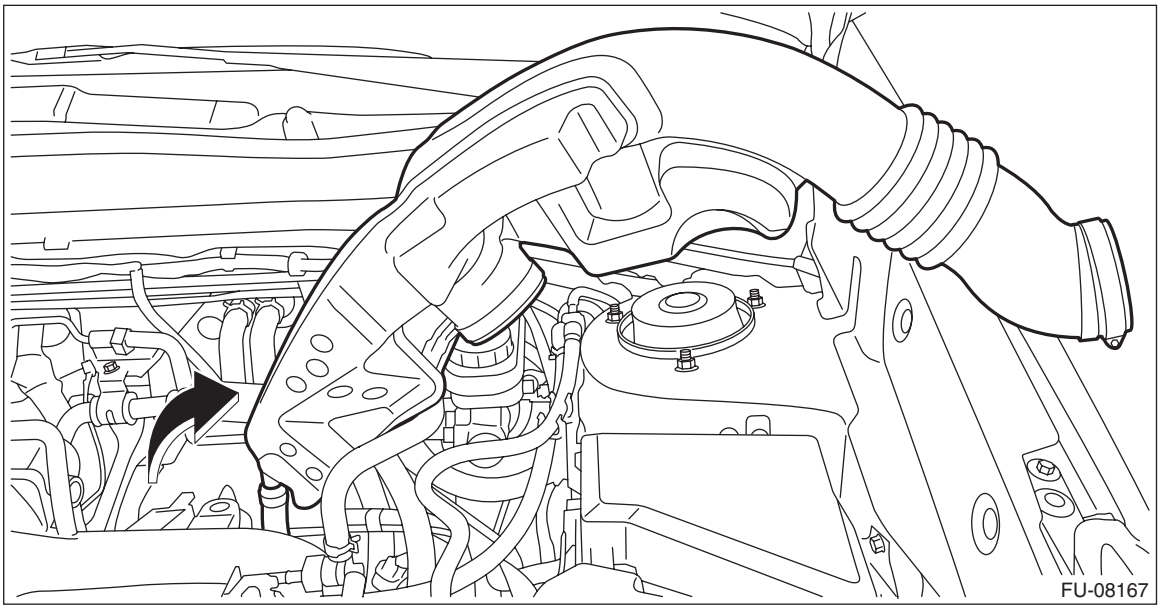
5) Remove the V-belt covers.



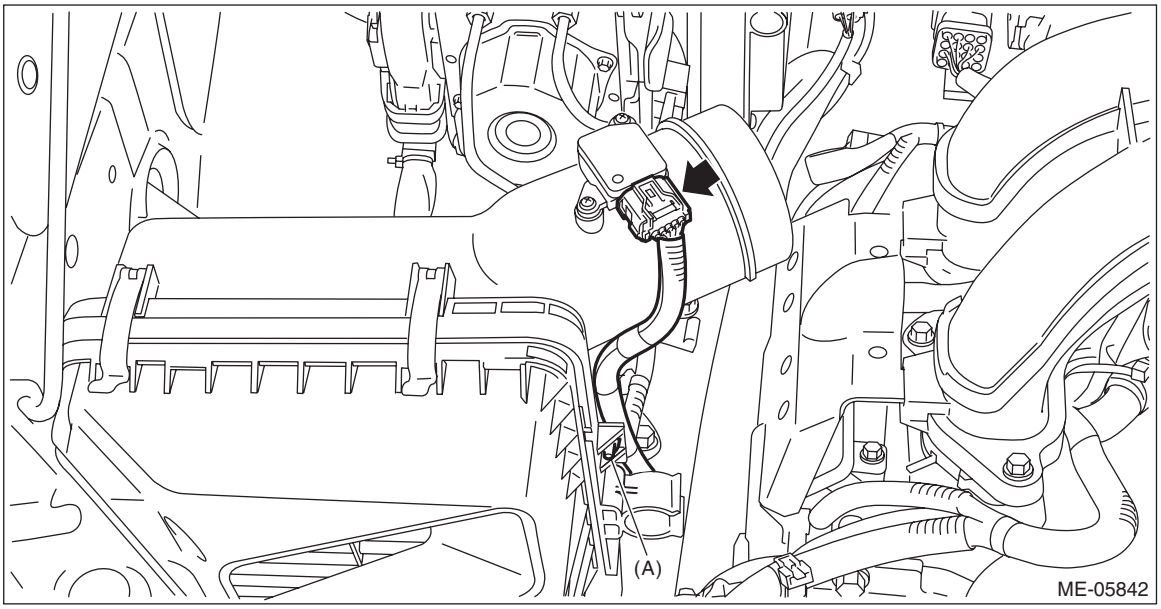
6) Remove the air intake duct. <Ref. to IN(H4DO(w/o HEV))-13, REMOVAL, Air Intake Duct.>
7) Remove the clip (A) from the air intake boot.
8) Loosen the clamp (B) securing the air cleaner case (rear) to the air intake boot.
9) Loosen the clamp (C) which secures the throttle body to the air intake boot.



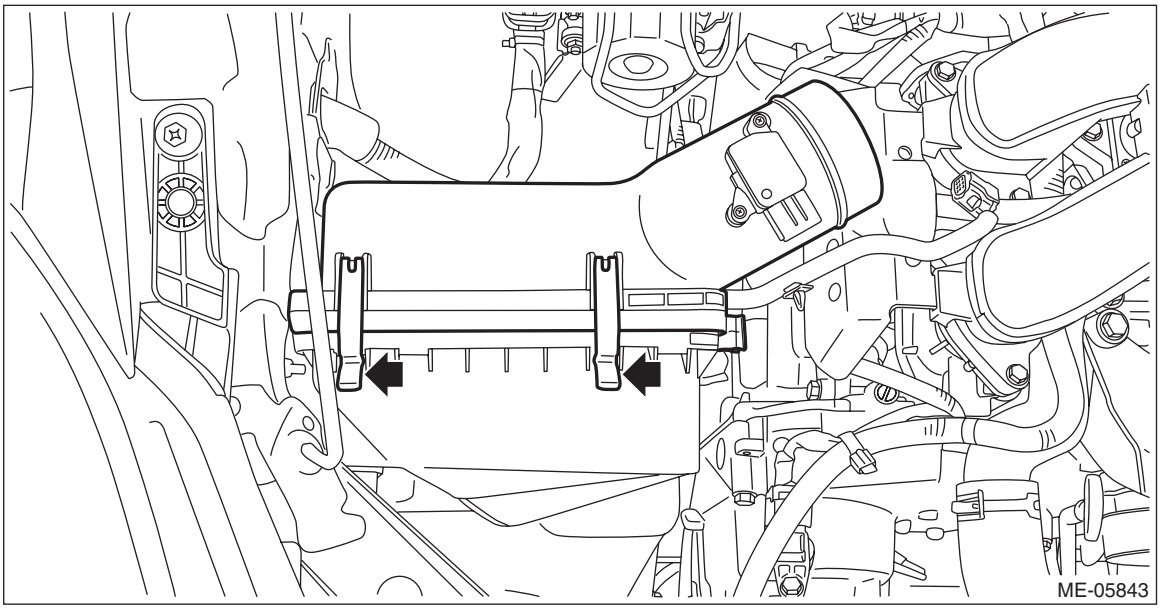
10) Remove the air intake boot from the throttle body, and move it to the left side wheel apron.



11) Disconnect the connector from the mass air flow and intake air temperature sensor, and remove the clip (A) which holds the mass air flow and intake air temperature sensor harness.

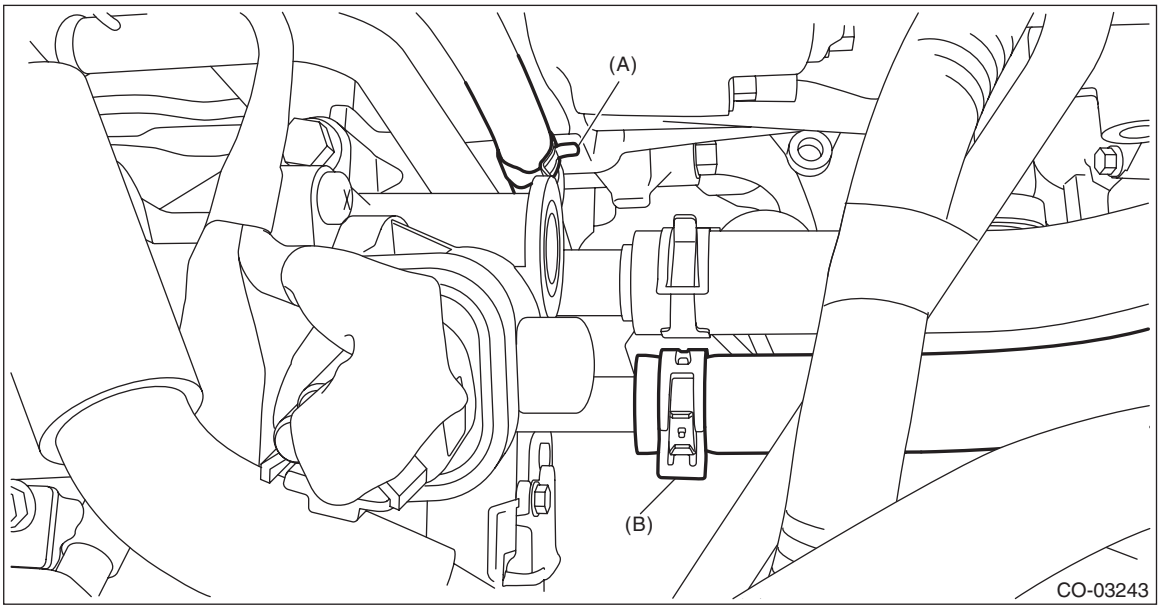


12) Remove the air cleaner case (rear).

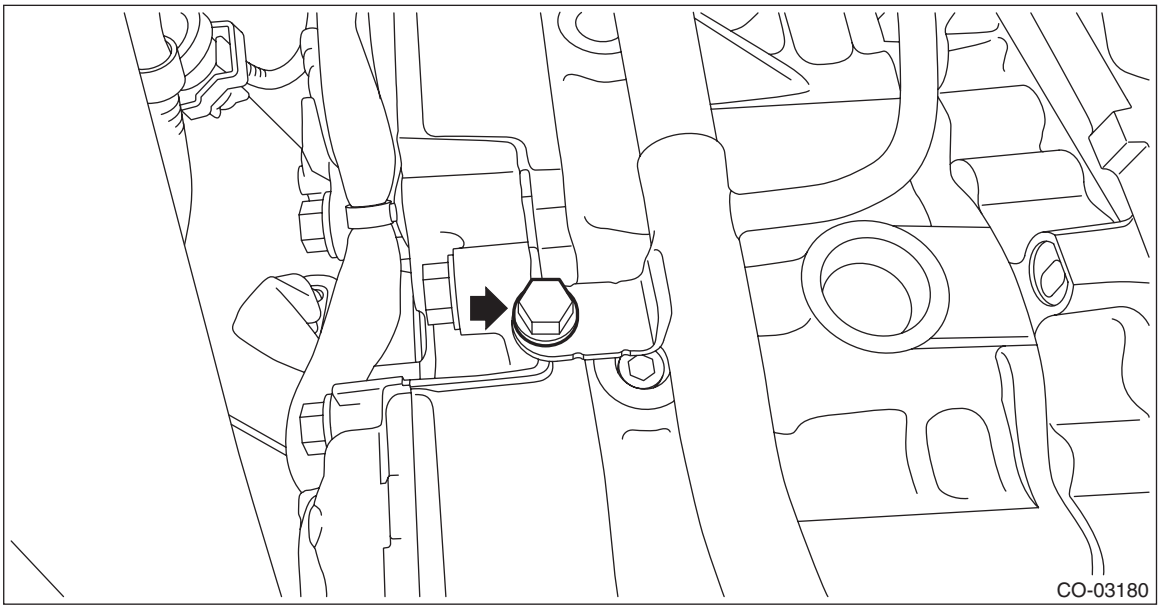


13) Drain engine coolant. <Ref. to CO(H4DO(w/o HEV))-16, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

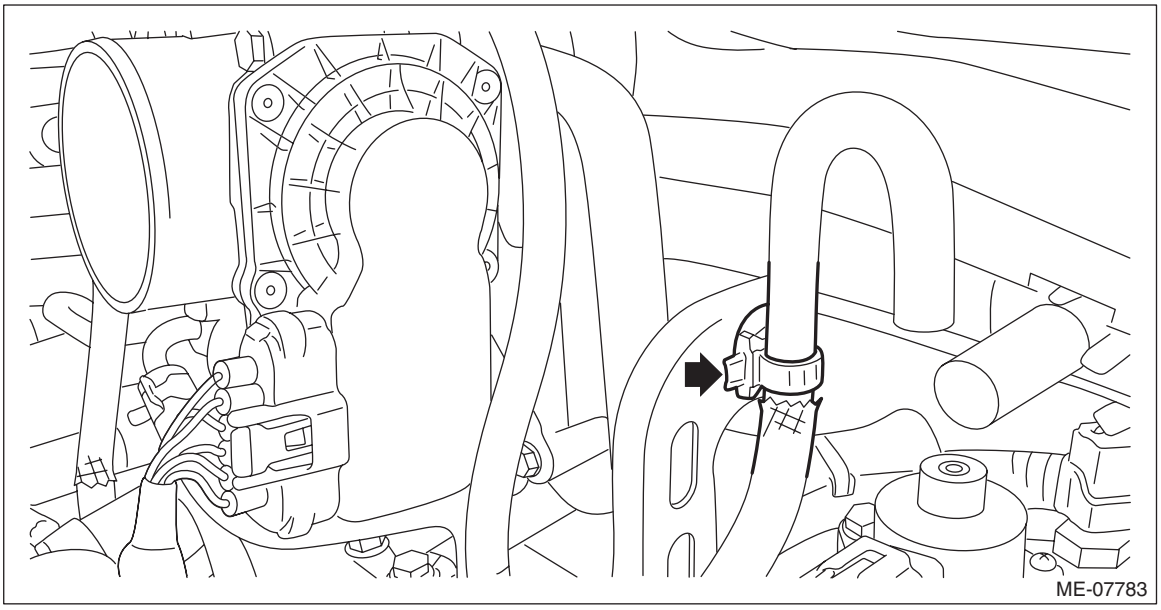
14) Disconnect the preheater hose (A) and the heater outlet hose (B) from the water pipe assembly LH.



15) Remove the bolt which holds the water pipe assembly LH from the cylinder head LH.

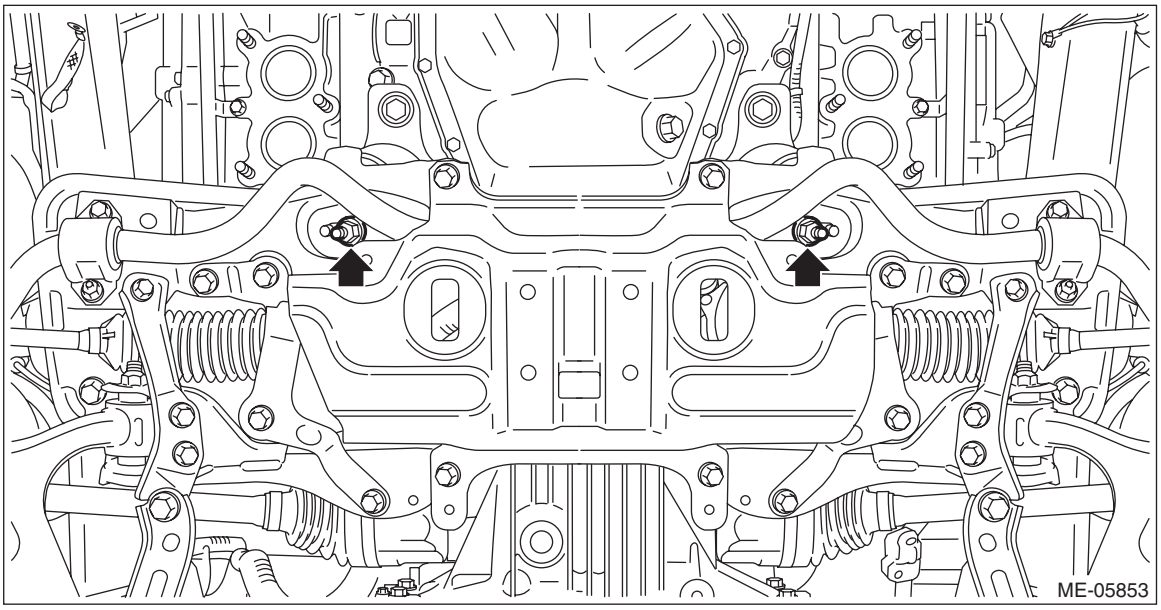


16) Remove the clip holding the air breather hose to the engine rear hanger. (MT model)

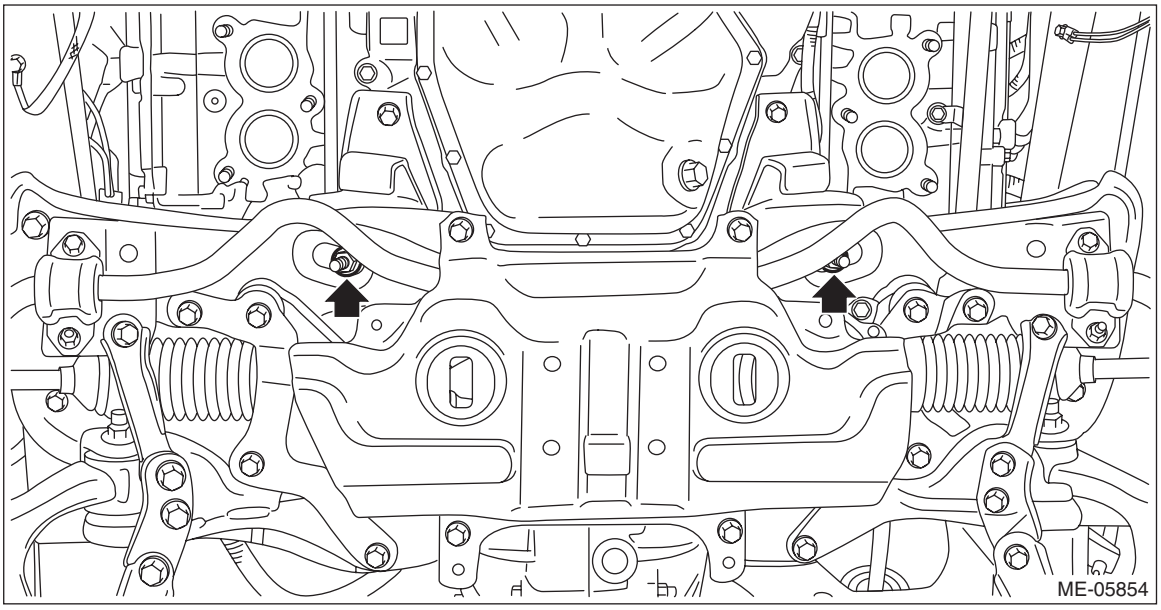


17) Lift up the vehicle.
18) Remove the front exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-6, REMOVAL, Front Exhaust Pipe.>

19) Remove the nuts which secure the engine mounting to the front crossmember. (CVT model)

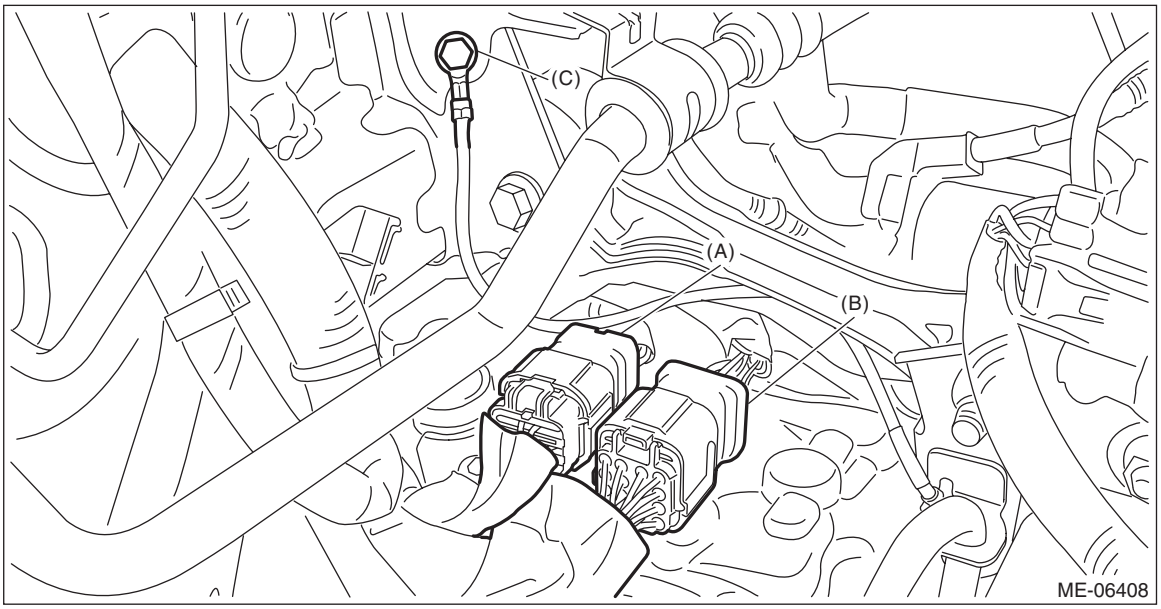


20) Remove the nuts which secure the engine mounting to the front crossmember. (MT model)

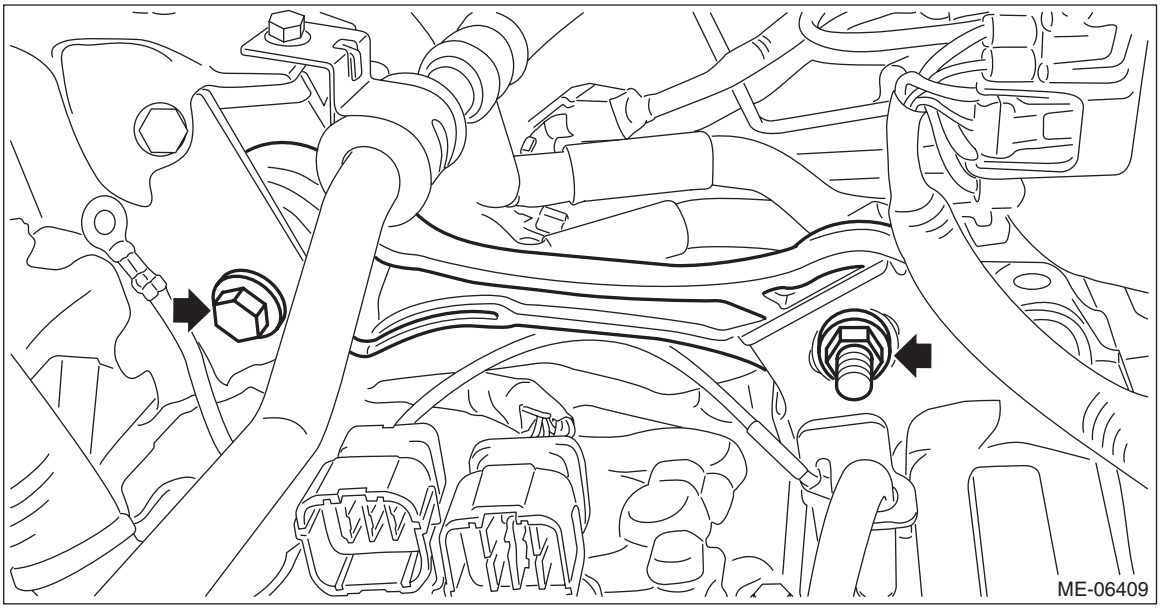


21) Lower the vehicle.

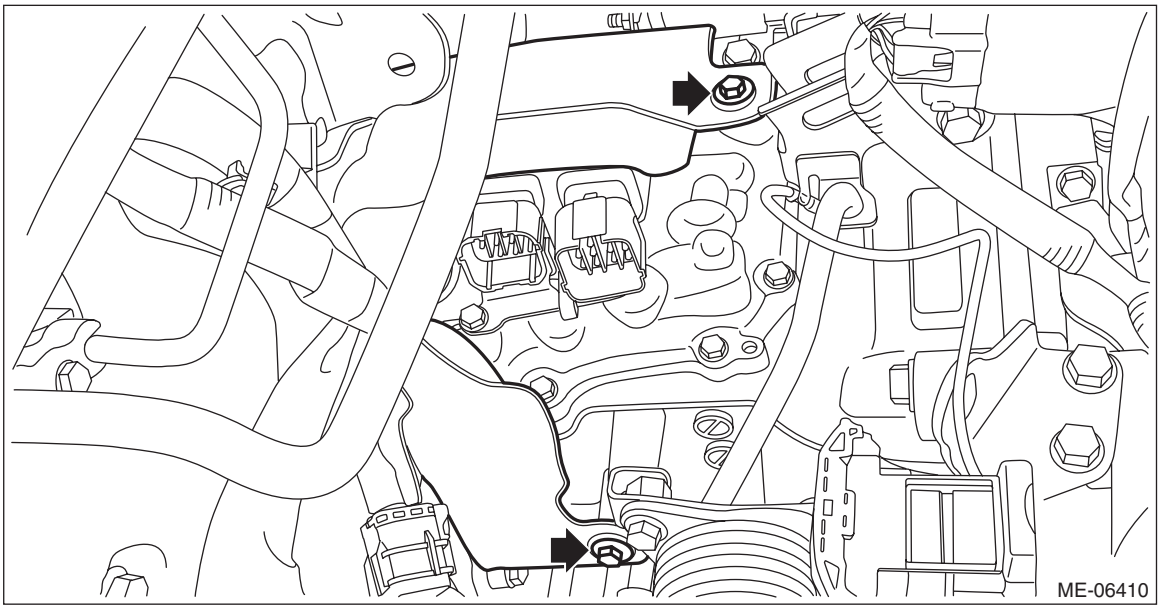
22) Disconnect the bulkhead harness connector from the transmission harness connector (A) and the inhibitor harness connector (B), and disconnect the transmission radio ground terminal (C) from the vehicle body. (CVT model)



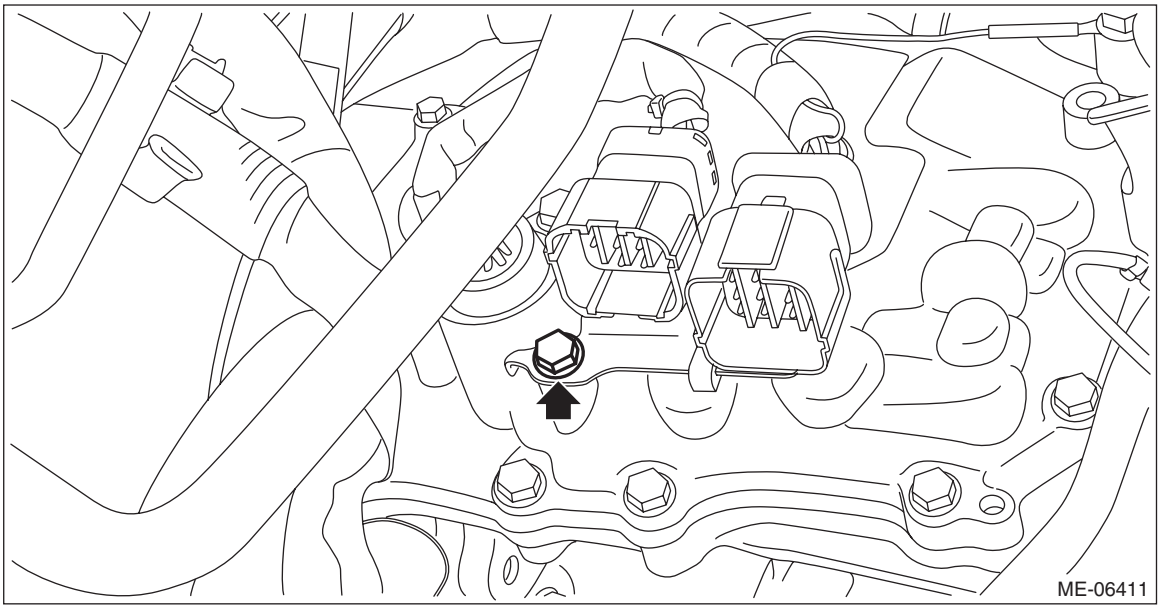
23) Remove the pitching stopper.



24) Remove the transmission case cover. (CVT model)

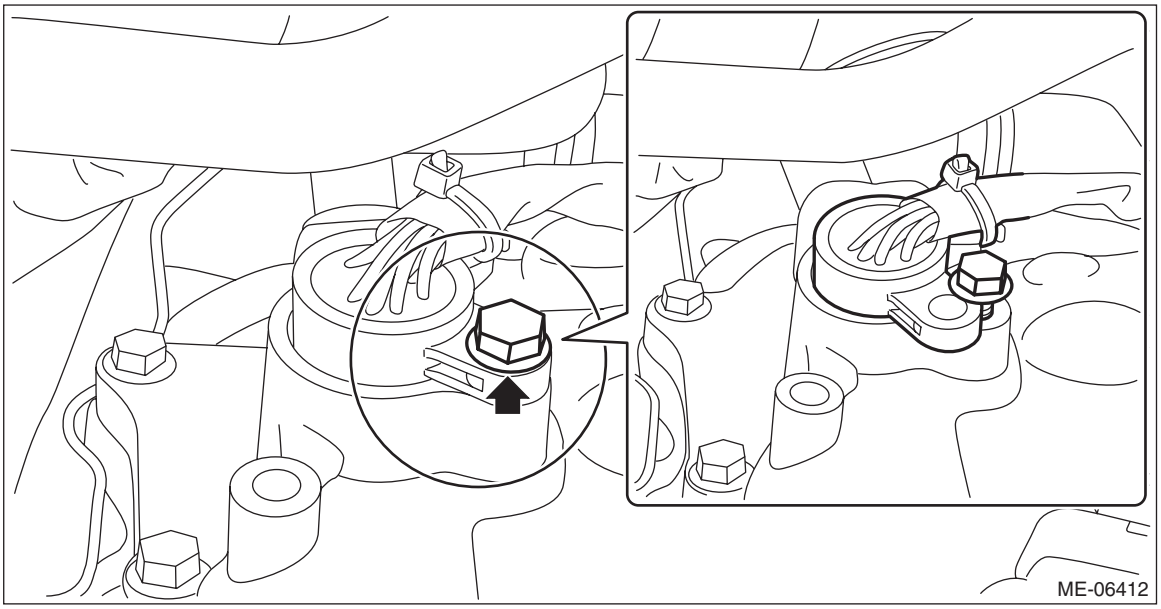


25) Remove the bolt which holds the transmission harness stay. (CVT model)



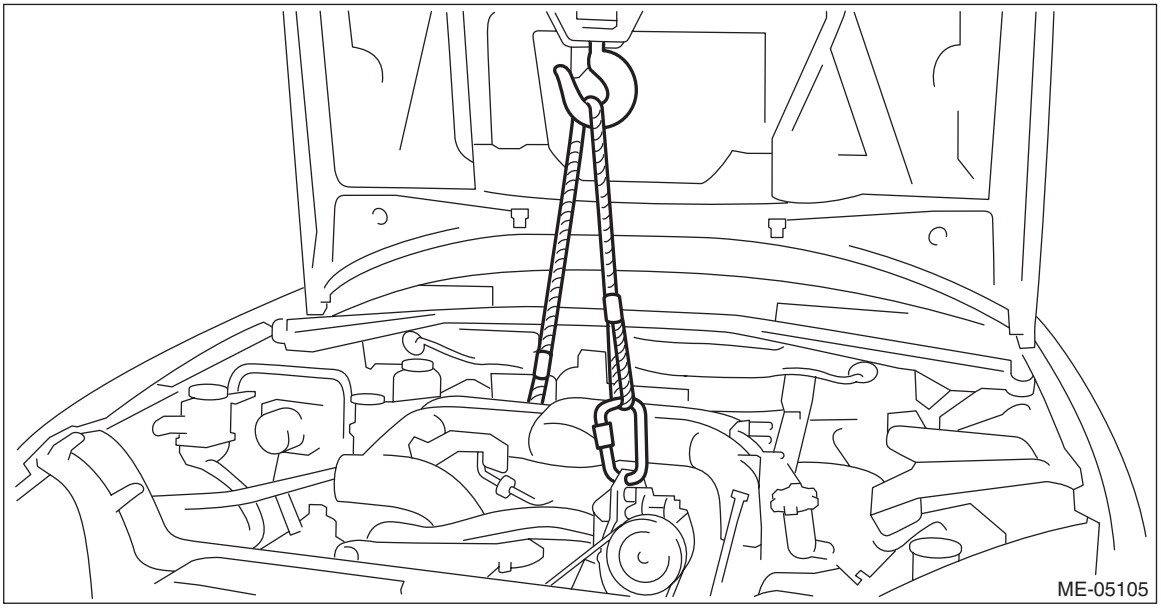
26) Remove the bolt which holds the transmission harness to the control valve body, and turn the transmission harness clockwise till the bolt hole can be seen as shown in the figure, and tighten the bolt to temporary lock the harness. (CVT model)

NOTE:
This procedure is required to prevent the transmission harness from touching the vehicle body during engine lift-up.



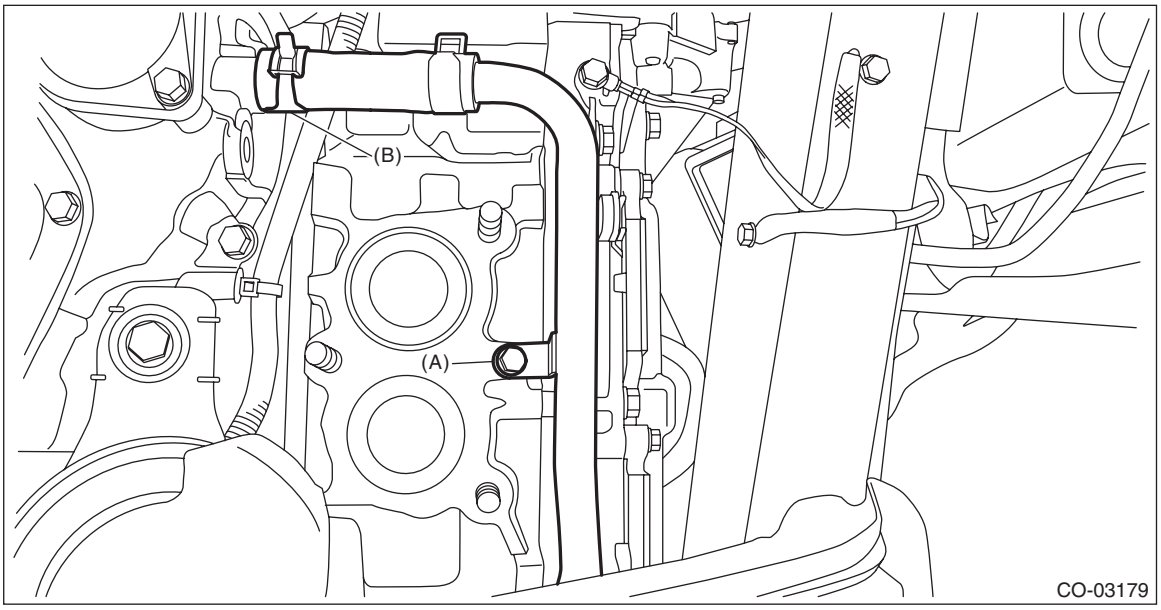
27) Lift up the engine with a lifting device and wire ropes.

CAUTION:
When lifting up the engine, pay attention to the clearance of each part and be careful not to lift the engine too much, in order to prevent damaging the vehicle.



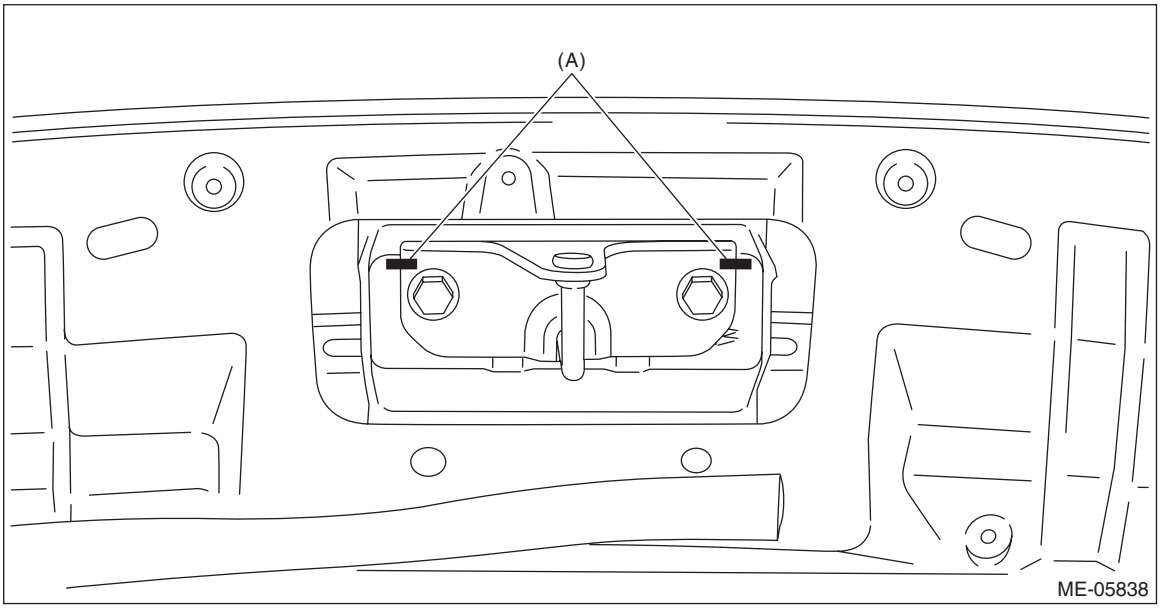
28) Remove the bolt (A) which secures the water pipe assembly LH to the cylinder head LH.

29) Disconnect the water pipe hose LH (B) from oil pan upper, and remove the water pipe assembly LH.

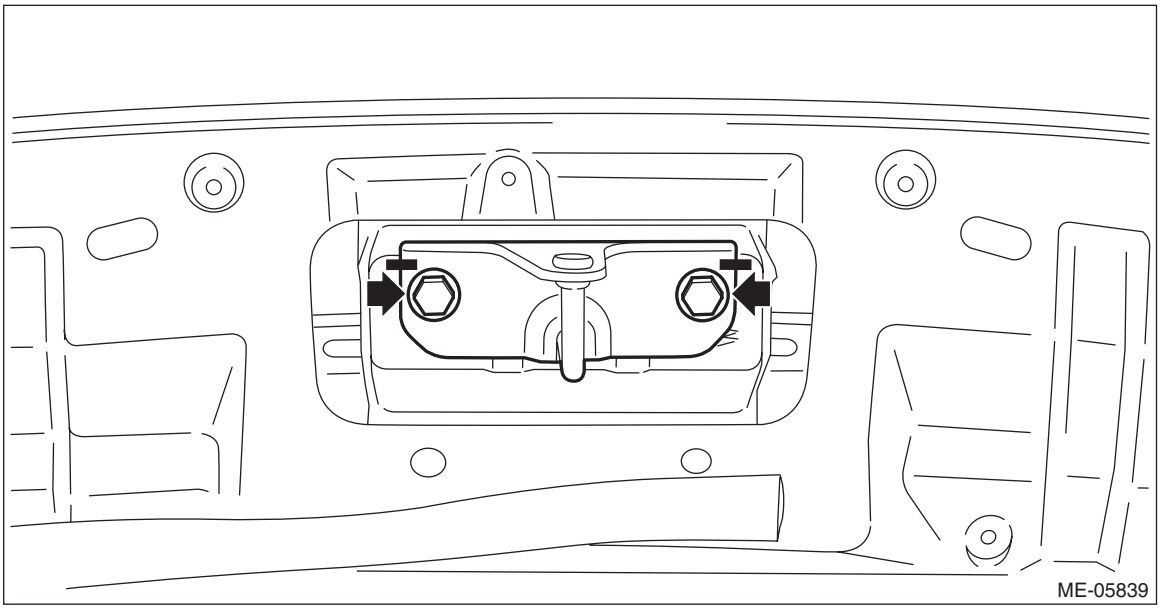


- **HEV model**

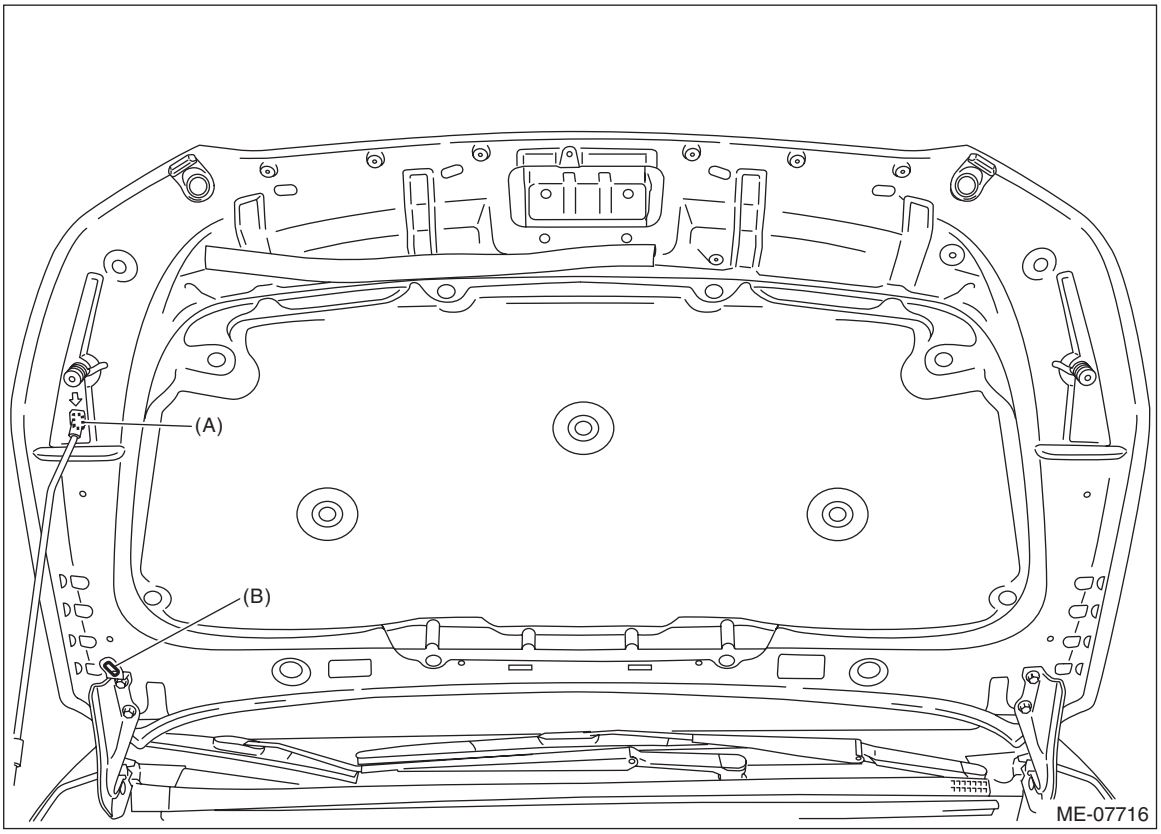
1) Turn the ignition switch to OFF.
2) Open the front hood, and make alignment marks (A) on both the front hood and the front hood striker by using a marker pen.



3) Remove the front hood striker from the front hood.



4) Change the front hood stay position from (A) to (B), and completely open the front hood.

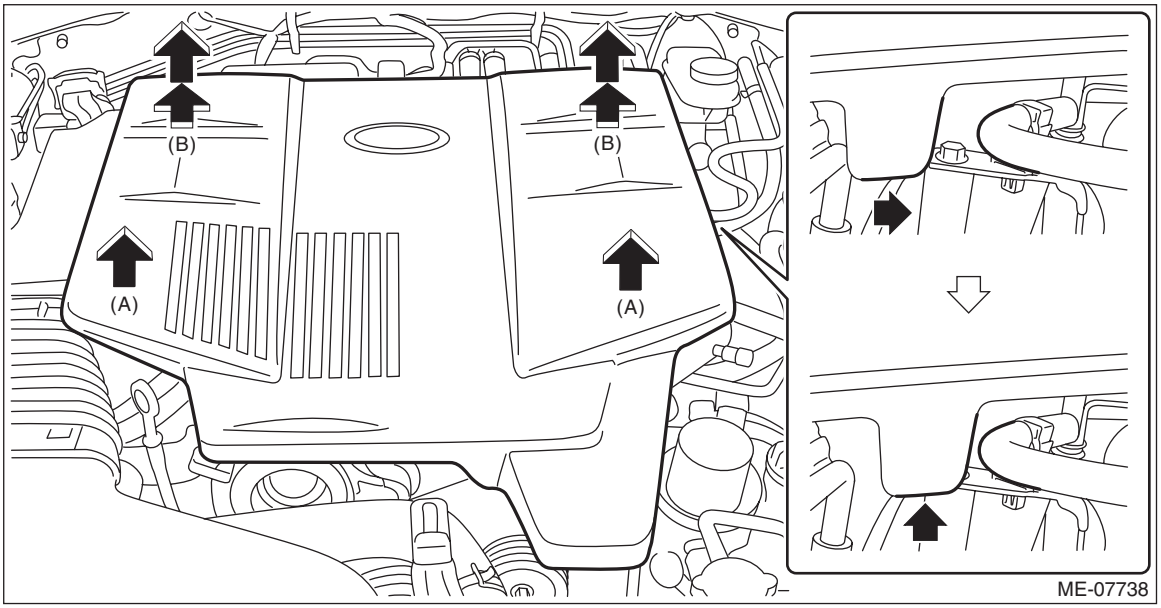


5) Disconnect the ground cable from battery. <Ref. to NT-5, BATTERY, NOTE, Note.>

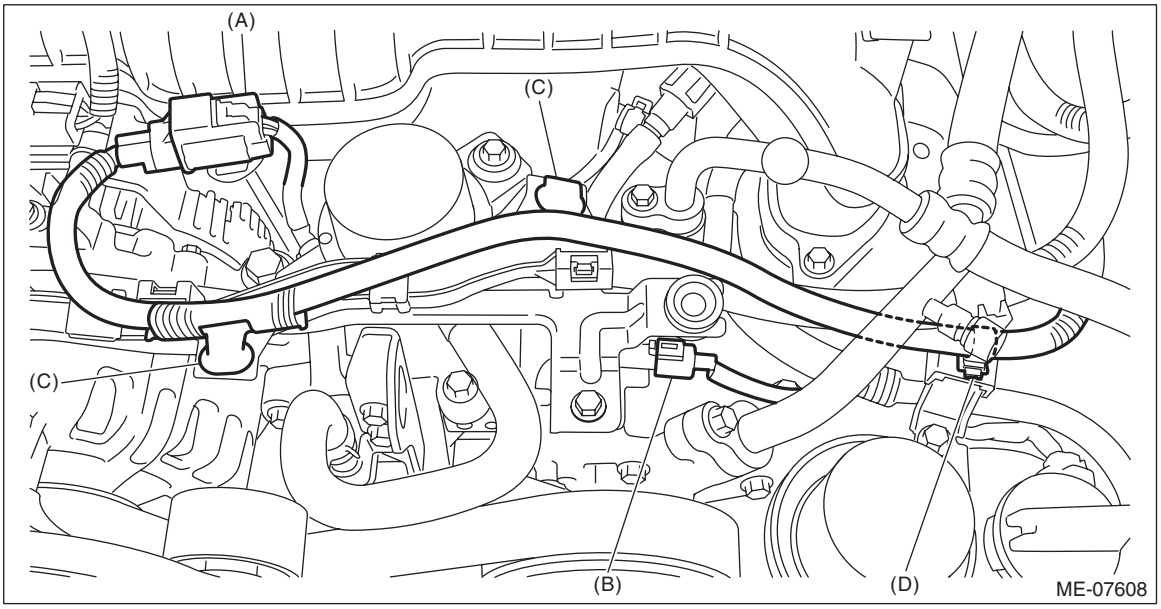
NOTE:
For the 12 volt engine restart battery, disconnect the ground terminal from 12V engine restart battery sensor.

6) Remove the collector cover.
(1) Carefully pull up the front of collector cover at two positions (A).
(2) Carefully pull up the rear of collector cover at two positions (B) while moving it backward.

NOTE:
Be careful not to contact the fuel delivery tube when moving the collector cover rearward.

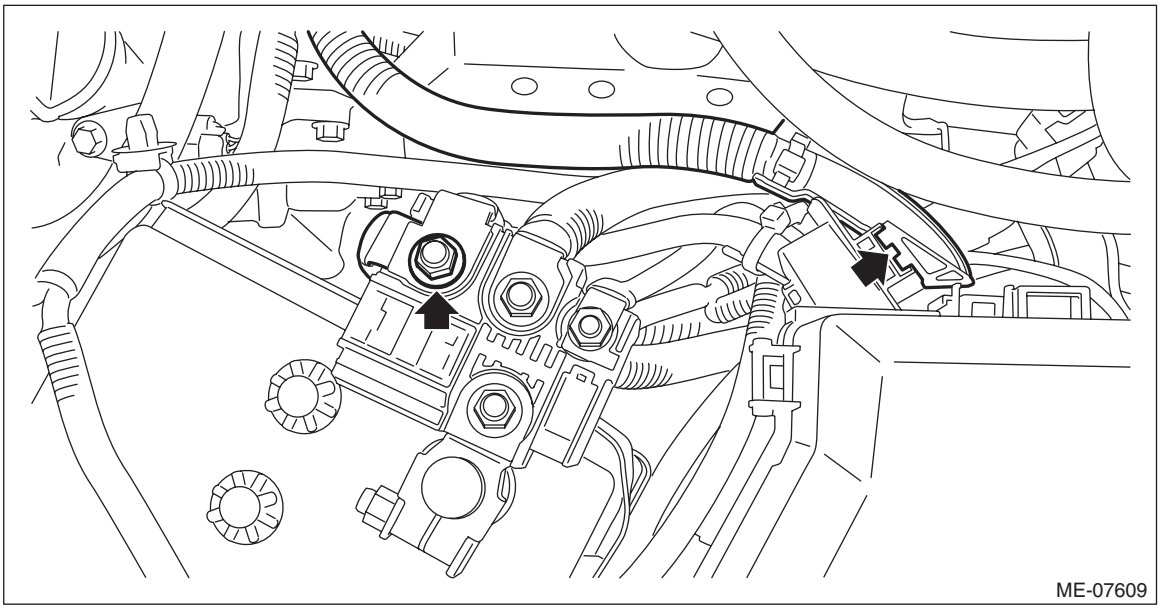


7) Remove the air intake duct. <Ref. to IN(H4DO(HEV))-15, REMOVAL, Air Intake Duct.>
8) Remove the air cleaner case. <Ref. to IN(H4DO(HEV))-6, REMOVAL, Air Cleaner Case.>
9) Drain engine coolant. <Ref. to CO(H4DO(w/o HEV))-16, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
10) Disconnect the connector (A) from the brake vacuum pump, and disconnect the connector (B) from the A/C compressor.
11) Remove the clip (C) and the clip (D) securing the harness to the battery cable assembly, and move the harness to the left side wheel apron.

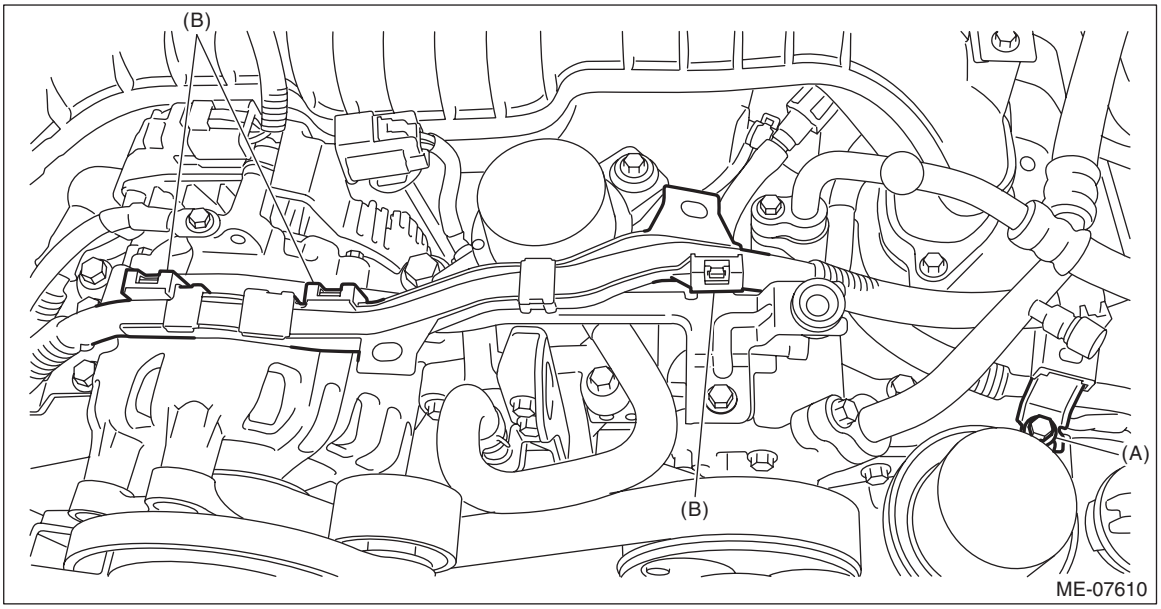


12) Remove the terminal boot from the positive terminal of the 12 volt auxiliary battery.

13) Remove the nuts fastening the battery cable assembly to the slow blow fuse (12 volt auxiliary battery), and remove the battery cable assembly from the main fuse box.

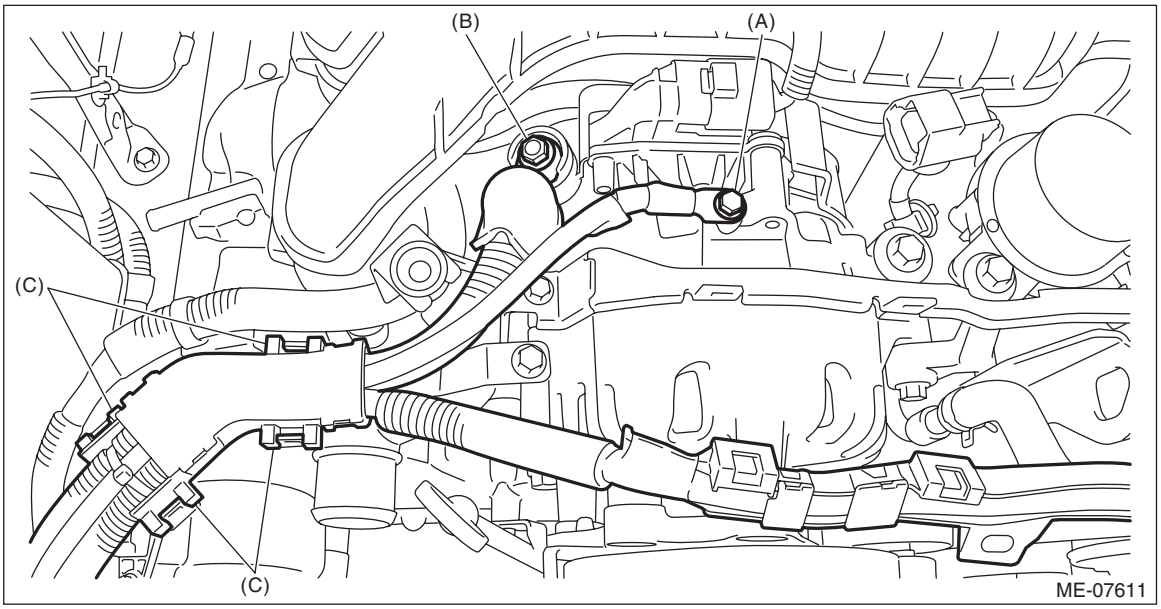


14) Remove the bolt (A) securing the battery cable stay to the chain cover, and remove the clip (B) securing the battery cable assembly to the collector cover bracket.

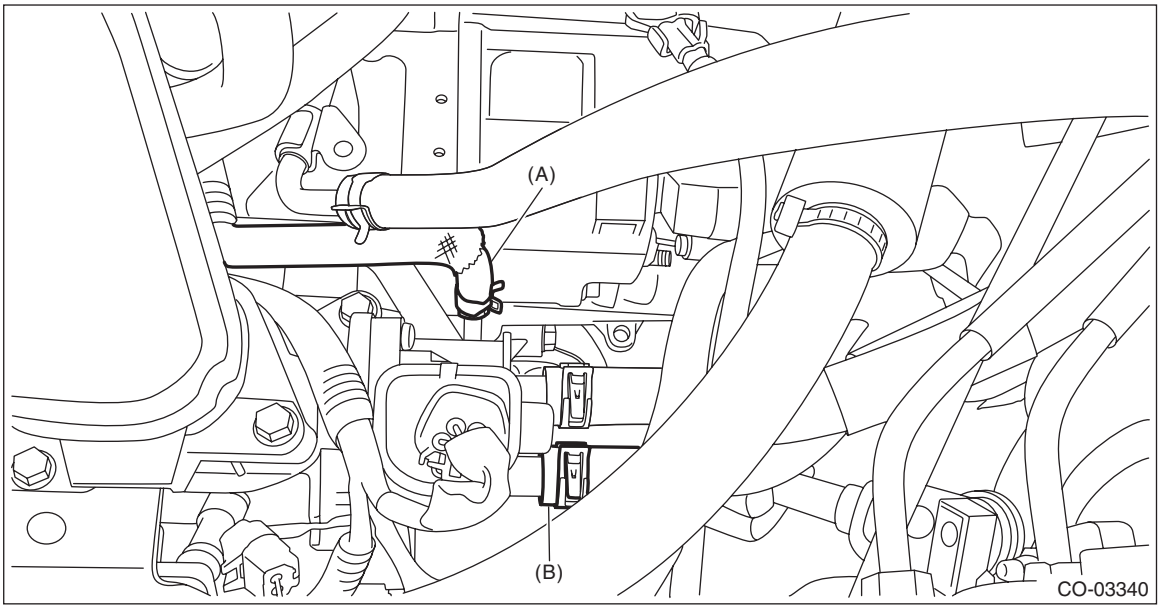


15) Disconnect the terminal (A) and the terminal (B) from ISG.

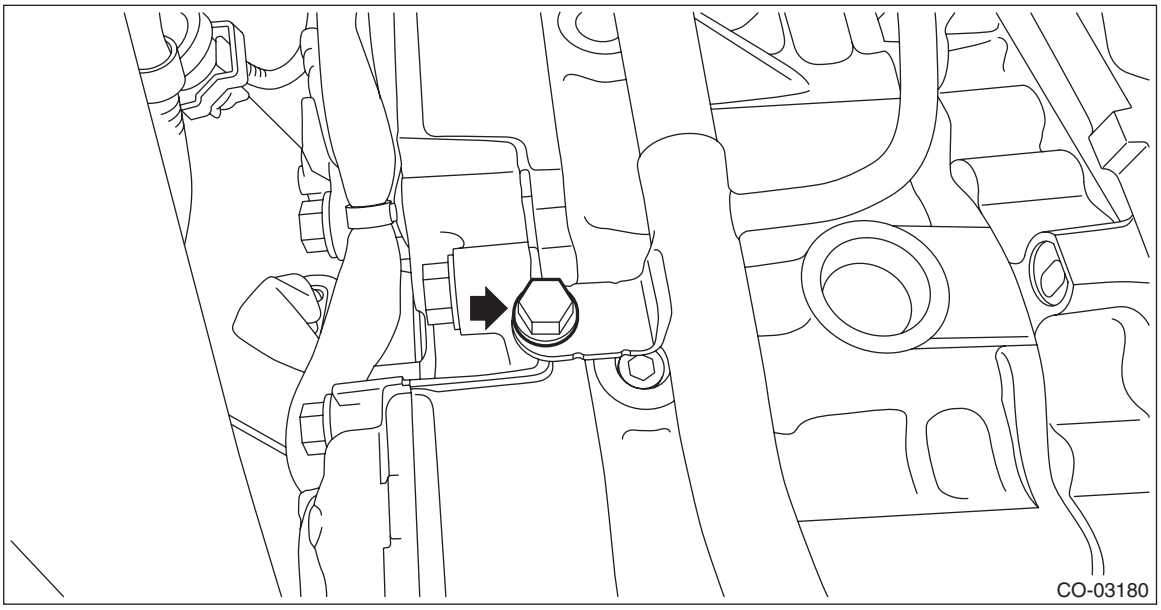
16) Remove the clip (C) securing the battery cable assembly to the battery cable bracket No. 1, and move the battery cable assembly to the right side wheel apron.



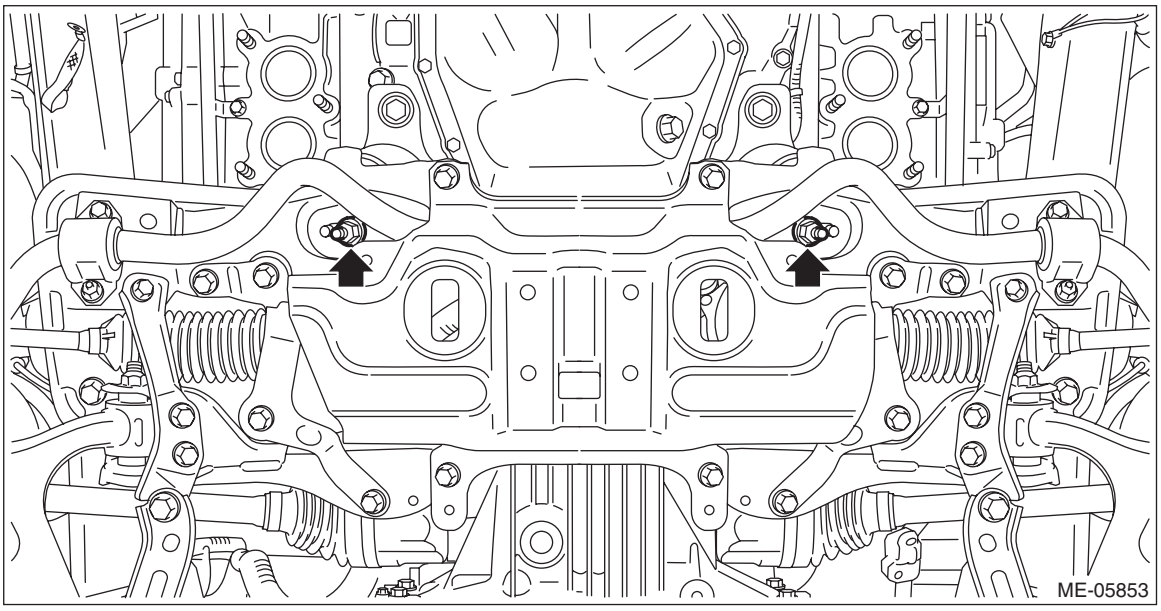
17) Disconnect the preheater hose (A) and the heater outlet hose (B) from the water pipe assembly LH.



18) Remove the bolt which holds the water pipe assembly LH from the cylinder head LH.

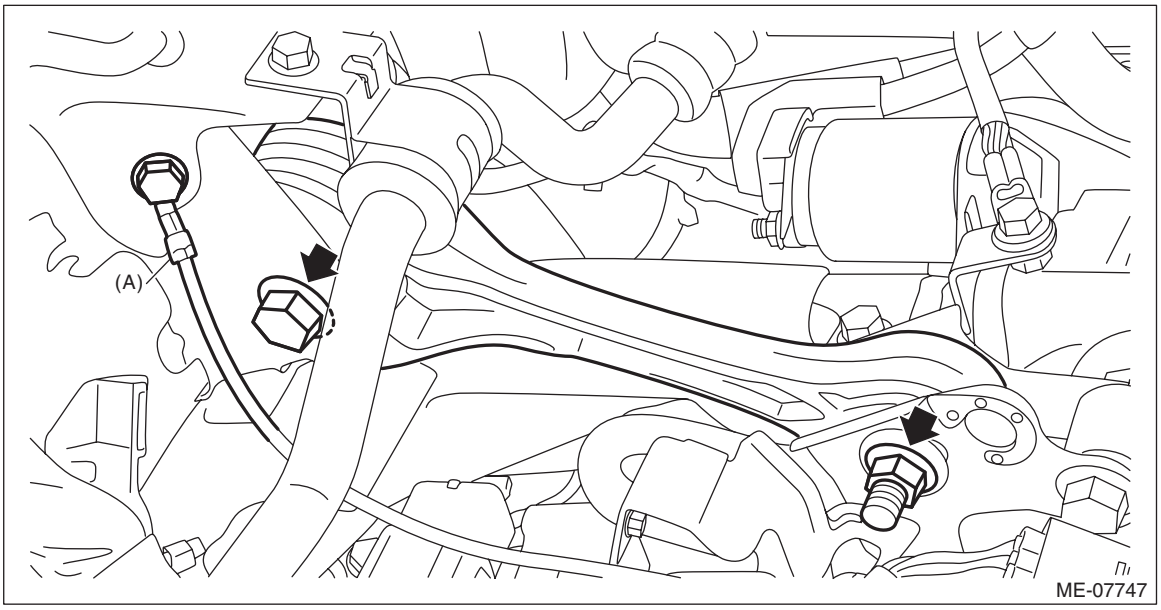


19) Lift up the vehicle.
20) Remove the front exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-6, REMOVAL, Front Exhaust Pipe.>
21) Remove the nuts which secure the engine mounting to the front crossmember.

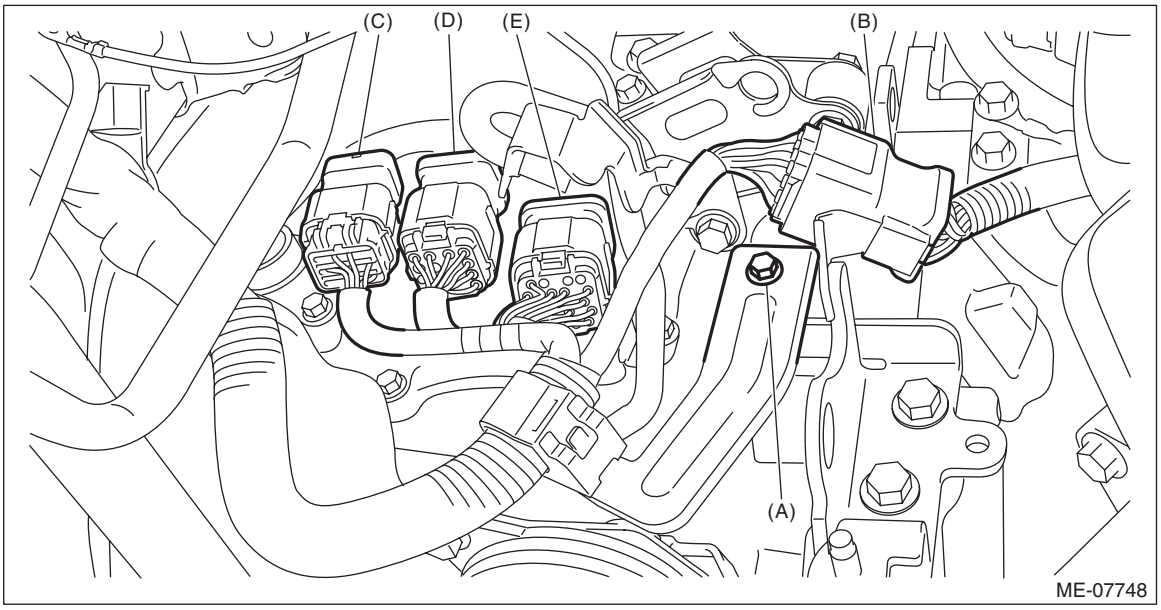


22) Lower the vehicle.

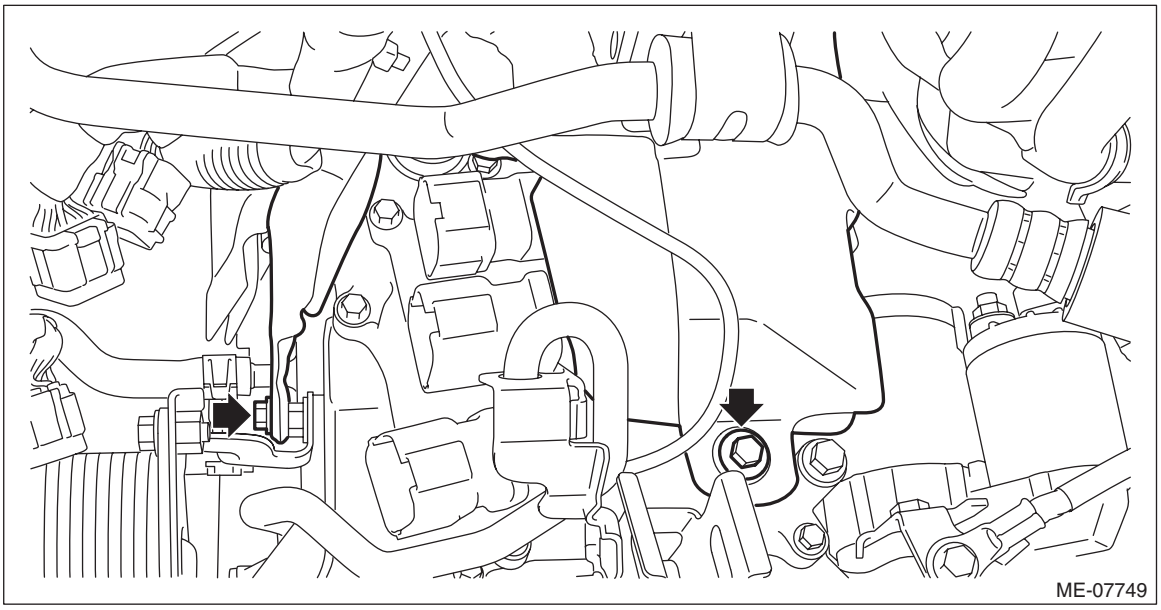
23) Disconnect the transmission radio ground terminal (A) from the vehicle, and remove the pitching stopper.



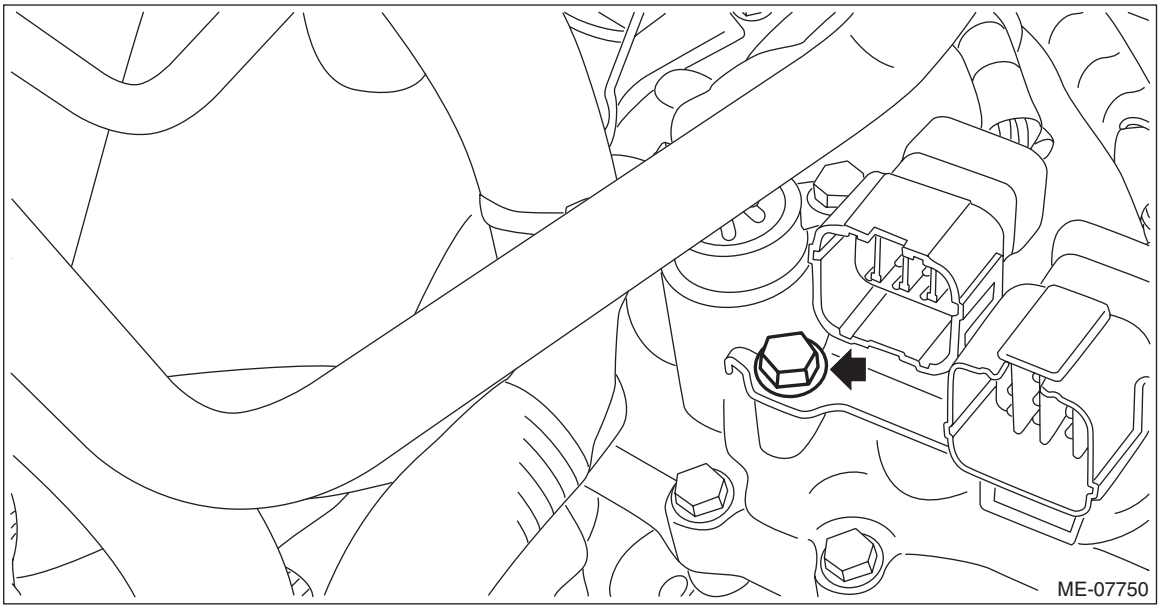
24) Remove the bolt (A) securing the bulkhead harness connector bracket, and disconnect the bulkhead harness connector from the engine harness connector (brown) (B).
25) Disconnect the bulkhead harness connector from the transmission harness connector (C), inhibitor harness connector (D) and drive motor harness connector (E).



26) Remove the transmission case cover.

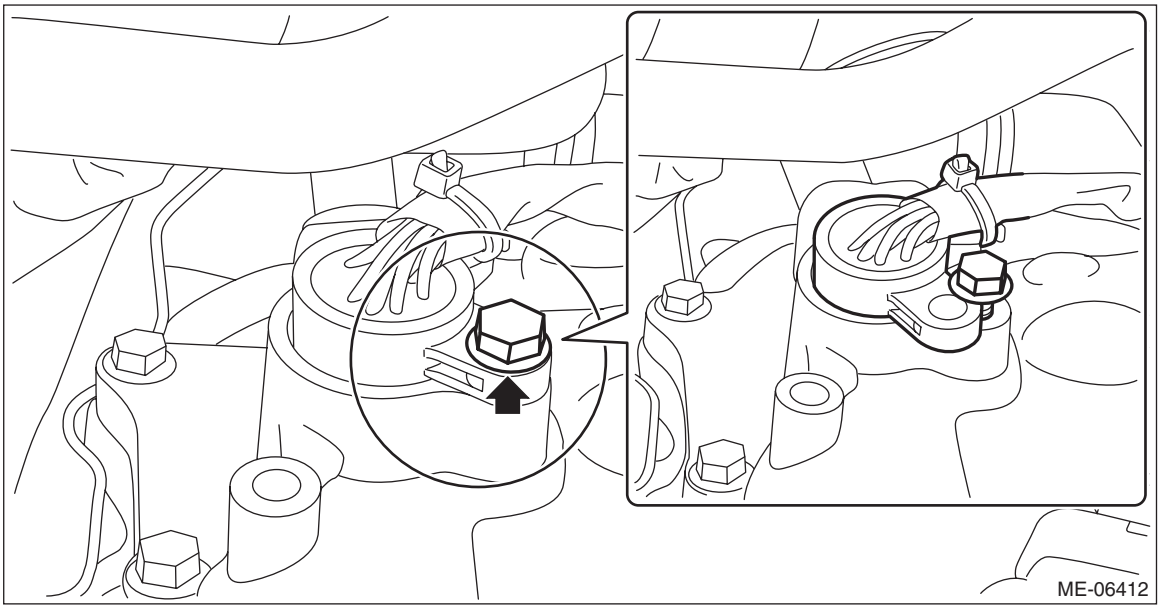


27) Remove the bolt which holds the transmission harness stay.



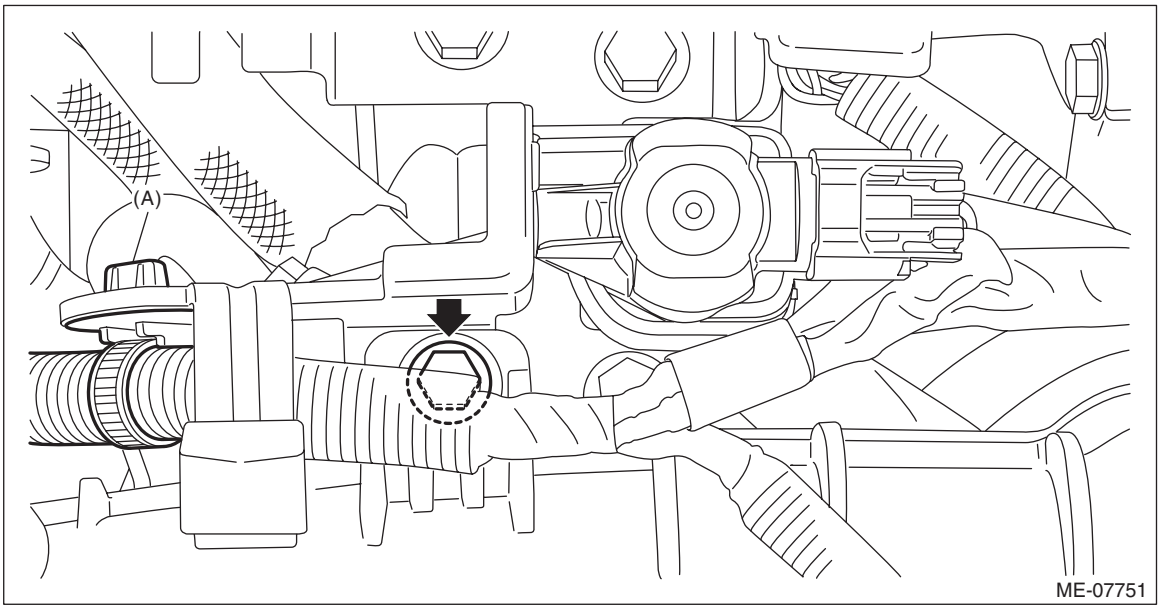
28) Remove the bolt which holds the transmission harness to the control valve body, and turn the transmission harness clockwise till the bolt hole can be seen as shown in the figure, and tighten the bolt to temporary lock the harness.

NOTE:
This procedure is required to prevent the transmission harness from touching the vehicle body during engine lift-up.

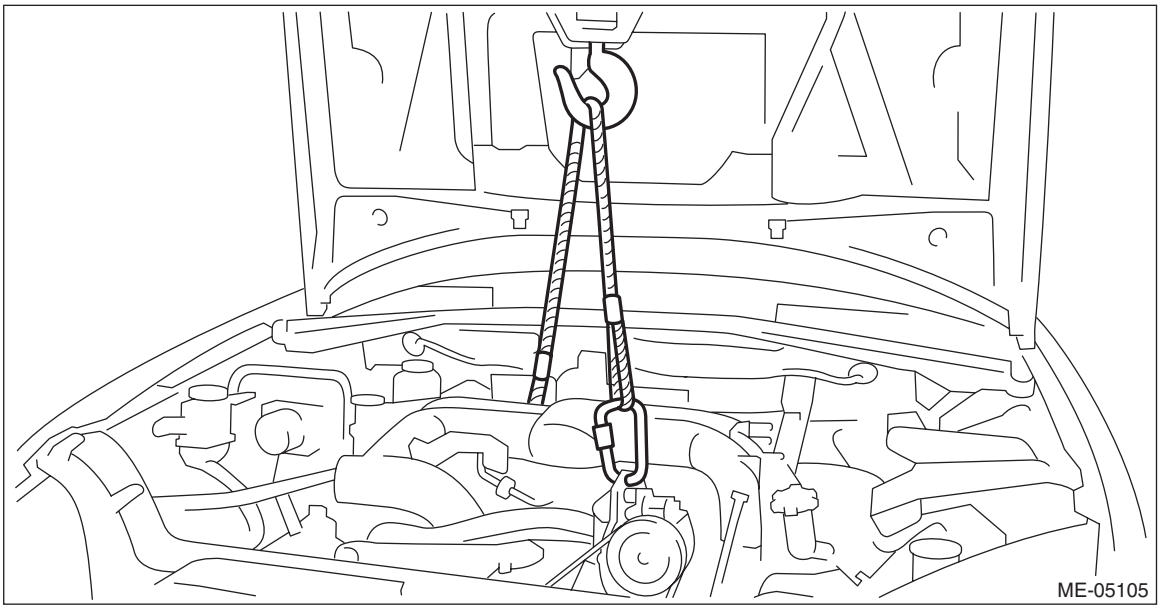


29) Remove the clip (A) securing the engine harness to the purge control solenoid valve bracket, and disconnect the bolt securing the purge control solenoid valve bracket to the intake manifold.

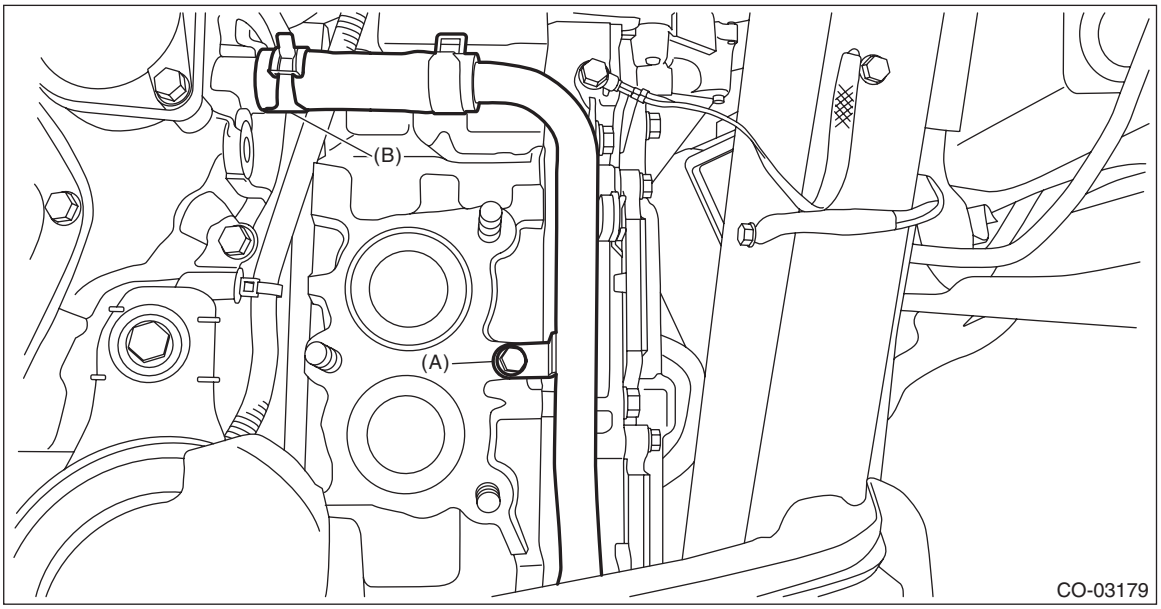
NOTE:
This operation is required to prevent the wire rope from contacting the purge control solenoid valve while lifting the engine.



30) Lift up the engine with a lifting device and wire ropes.



31) Remove the bolt (A) which secures the water pipe assembly LH to the cylinder head LH.
32) Disconnect the water pipe hose LH (B) from oil pan upper, and remove the water pipe assembly LH.

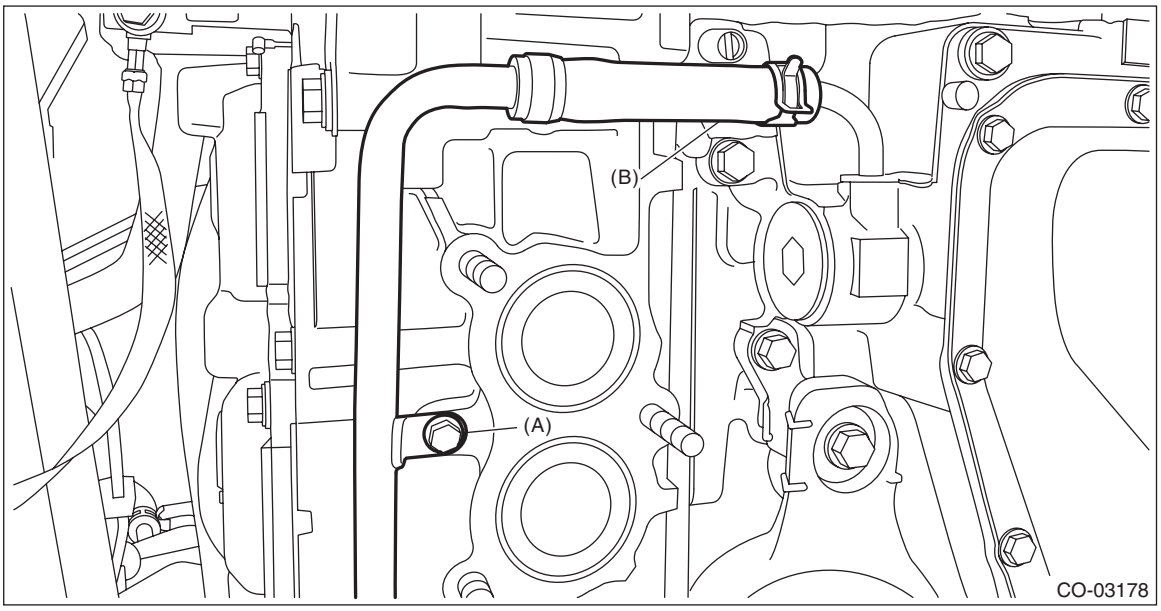


B: INSTALLATION

1. WATER PIPE ASSEMBLY RH

1) Set the water pipe assembly RH on the engine, and connect the water pipe hose RH (B) to the oil pan upper.
2) Secure the water pipe assembly RH to the cylinder head RH with bolt (A).

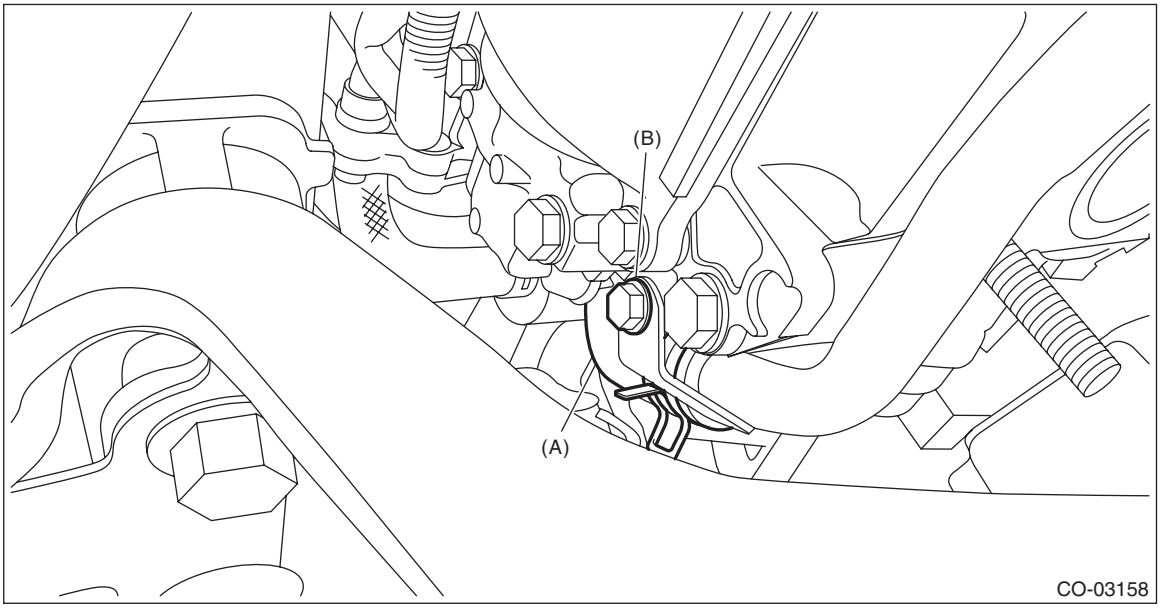
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



3) Install the bolt (B) which secures the water pipe assembly RH to the cam carrier RH.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

4) Connect the water hose (A) to the water pipe assembly RH.



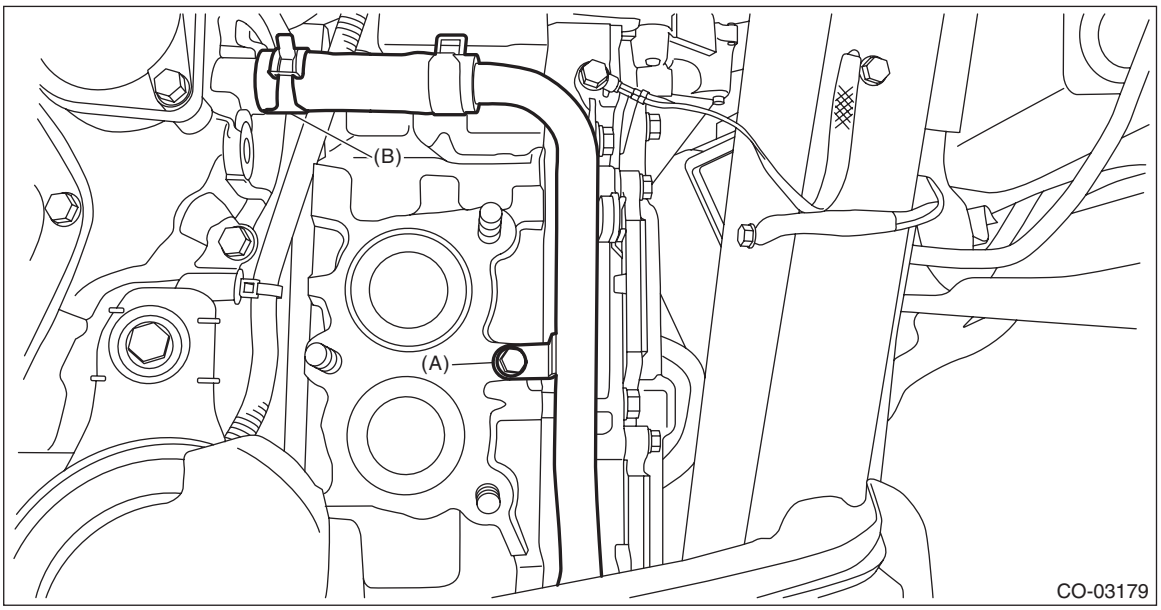
5) Install the front exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-8, INSTALLATION, Front Exhaust Pipe.>
6) Connect the battery ground terminal. <Ref. to NT-5, BATTERY, NOTE, Note.>
7) Fill engine coolant. <Ref. to CO(H4DO(w/o HEV))-16, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

2. WATER PIPE ASSEMBLY LH

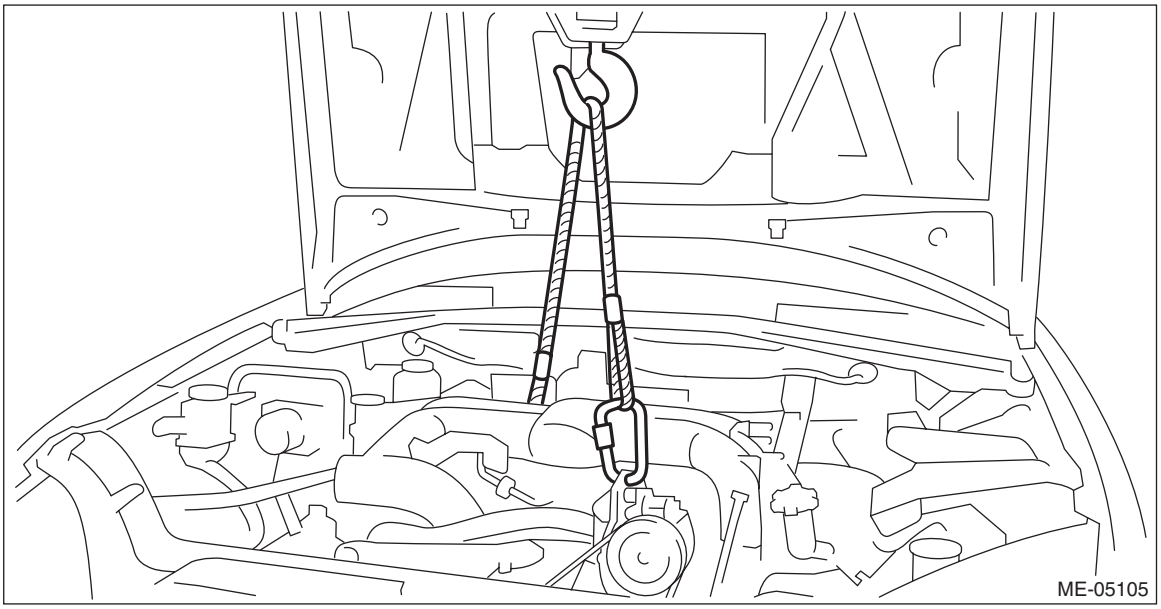
• Gasoline engine model

1) Set the water pipe assembly LH on the engine, and connect the water pipe hose LH (B) to the oil pan upper.
2) Secure the water pipe assembly LH to the cylinder head LH with bolt (A).

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

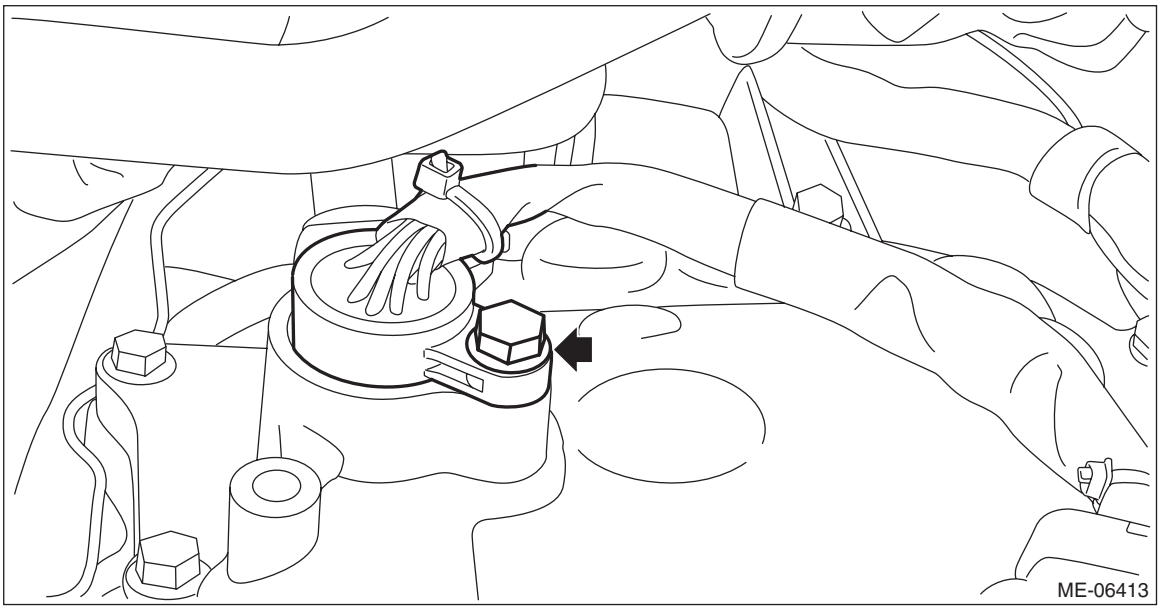


3) Lower the engine and remove the lifting device and wire ropes.



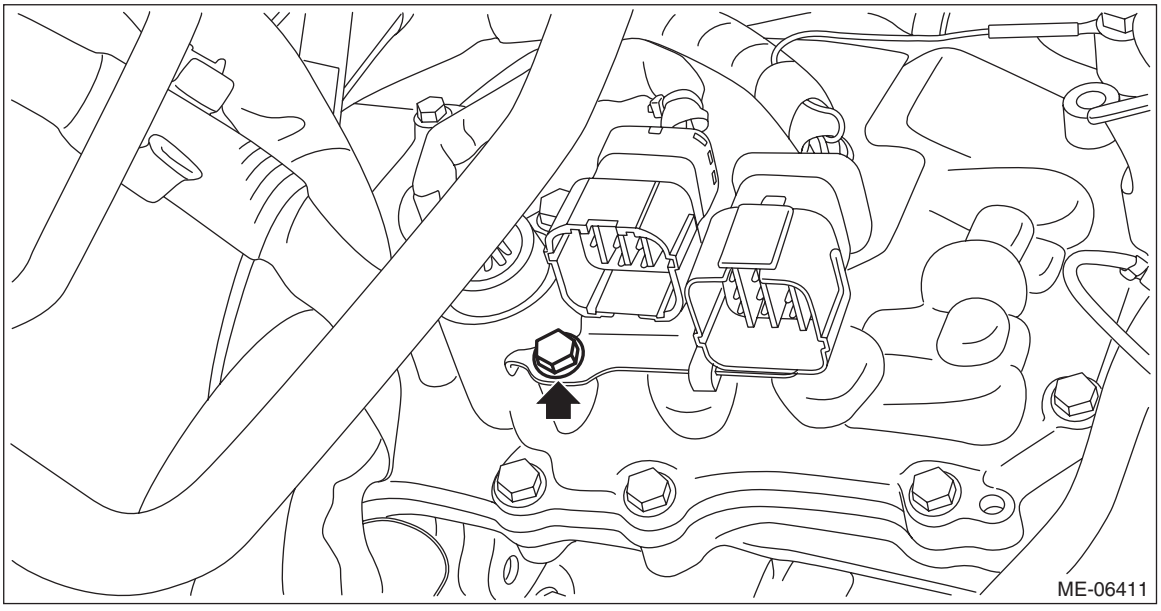
4) Remove the bolt and turn the transmission harness counterclockwise to install the transmission harness to the control valve body. (CVT model)

Tightening torque:
7 N·m (0.7 kgf-m, 5.2 ft-lb)



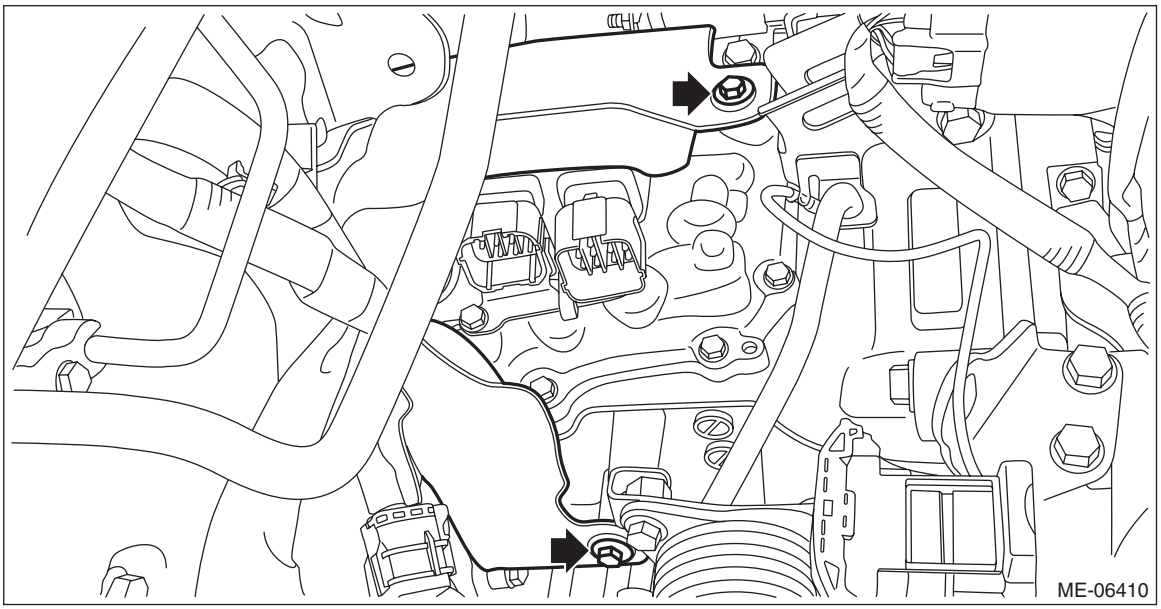
5) Install the bolt which holds the transmission harness stay. (CVT model)

Tightening torque:
7 N·m (0.7 kgf-m, 5.2 ft-lb)



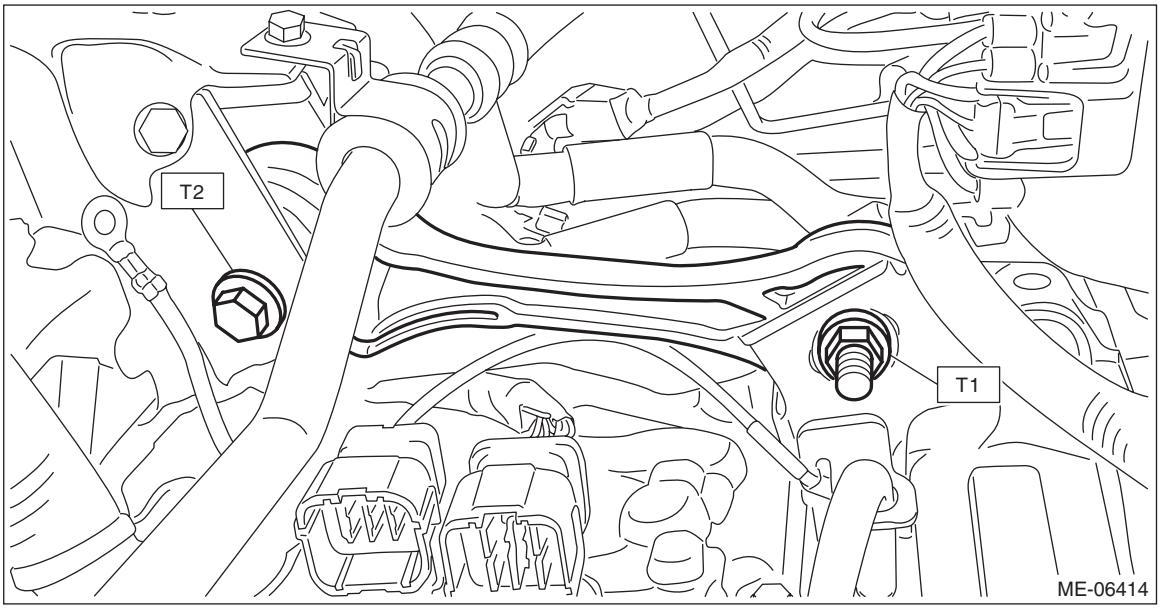
6) Install the transmission case cover. (CVT model)

Tightening torque:
8 N·m (0.8 kgf-m, 5.9 ft-lb)



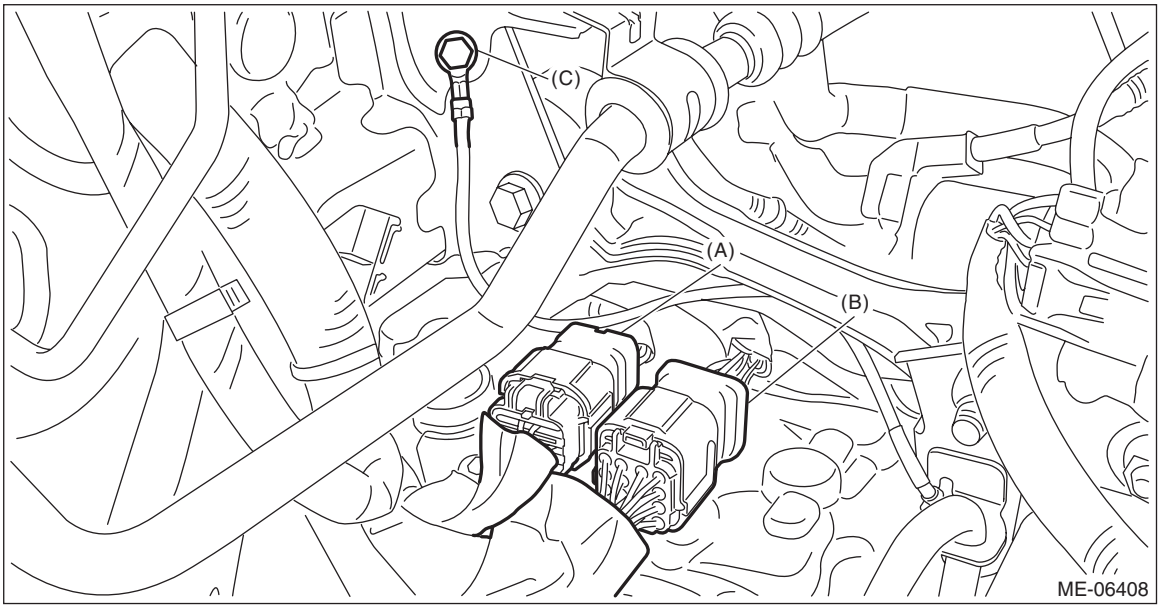
7) Install the pitching stopper.

Tightening torque:
T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)
T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)



8) Connect the transmission radio ground terminal (C) to the vehicle body, and connect the bulkhead harness connector to the transmission harness connector (A) and the inhibitor harness connector (B). (CVT model)

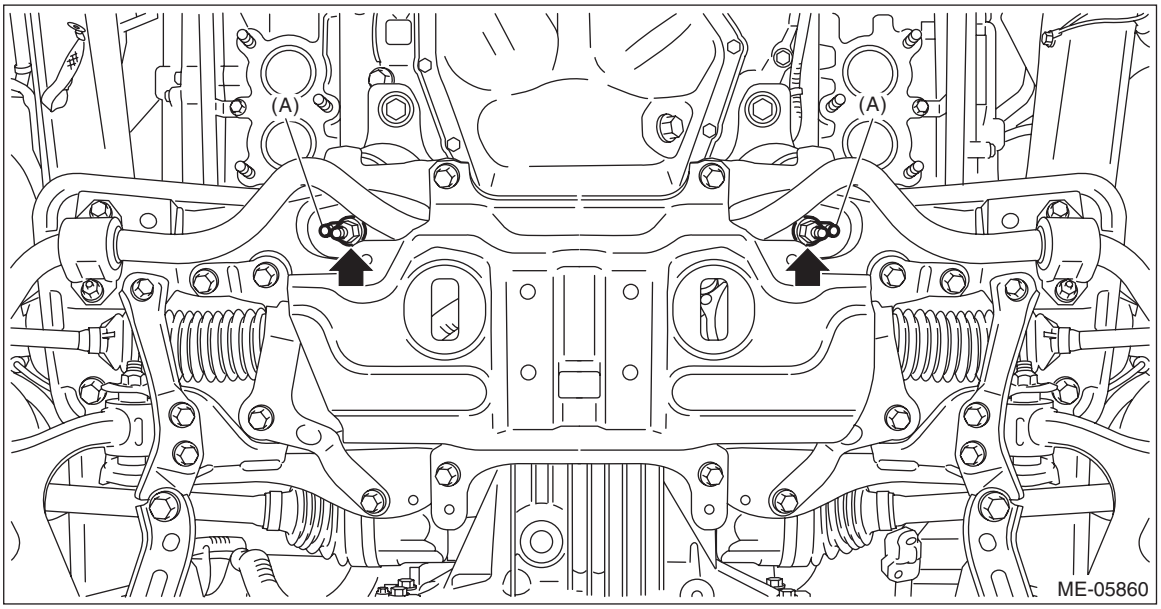
Tightening torque:
13 N·m (1.3 kgf-m, 9.6 ft-lb)



9) Lift up the vehicle.
10) Install the nuts which hold the engine mounting to the crossmember. (CVT model)

NOTE:
- Make sure that locators (A) of the engine mounting are securely inserted.
- Use a new nut.

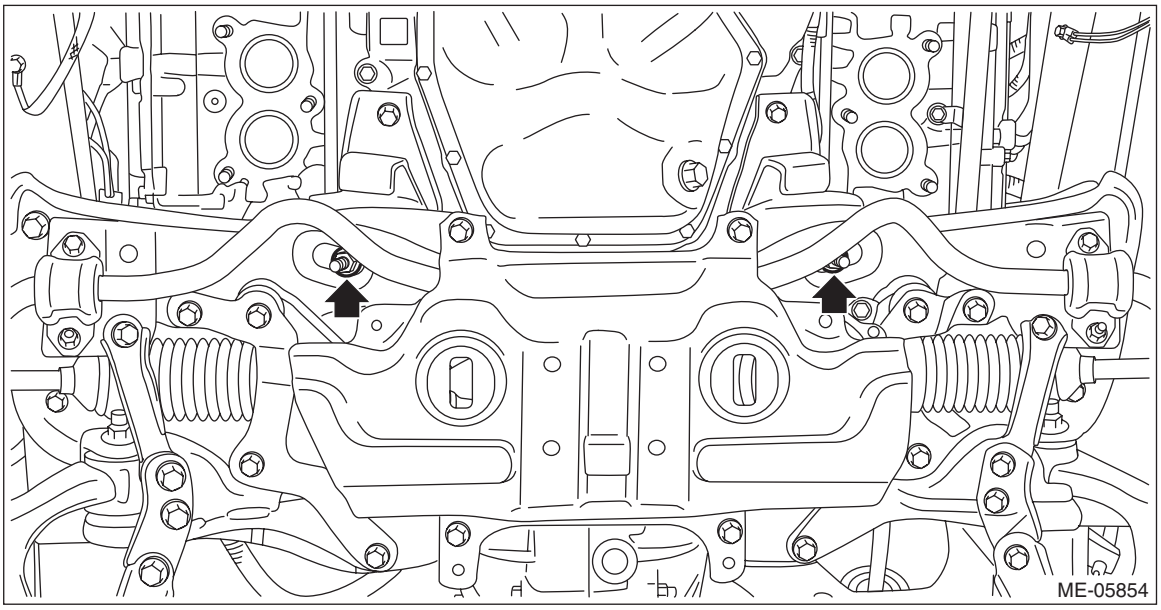
Tightening torque:
60 N·m (6.1 kgf-m, 44.3 ft-lb)



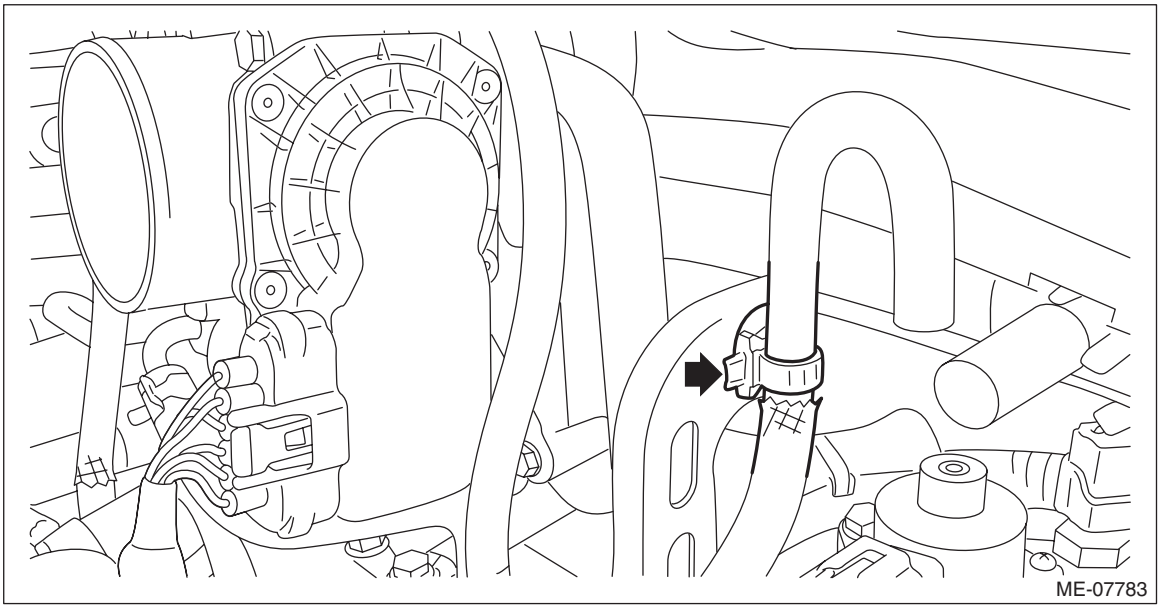
11) Install the nuts which hold the engine mounting to the crossmember. (MT model)

NOTE:
Use a new nut.

Tightening torque:
60 N·m (6.1 kgf-m, 44.3 ft-lb)

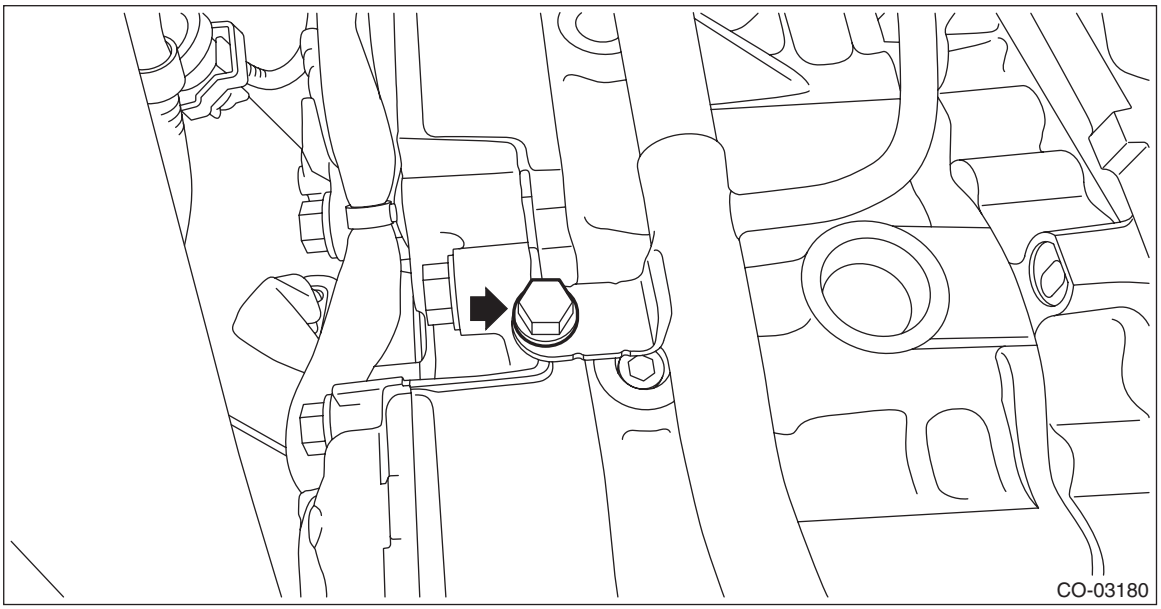


12) Install the front exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-6, REMOVAL, Front Exhaust Pipe.>
13) Lower the vehicle.
14) Secure the air breather hose to the engine rear hanger using clip. (MT model)

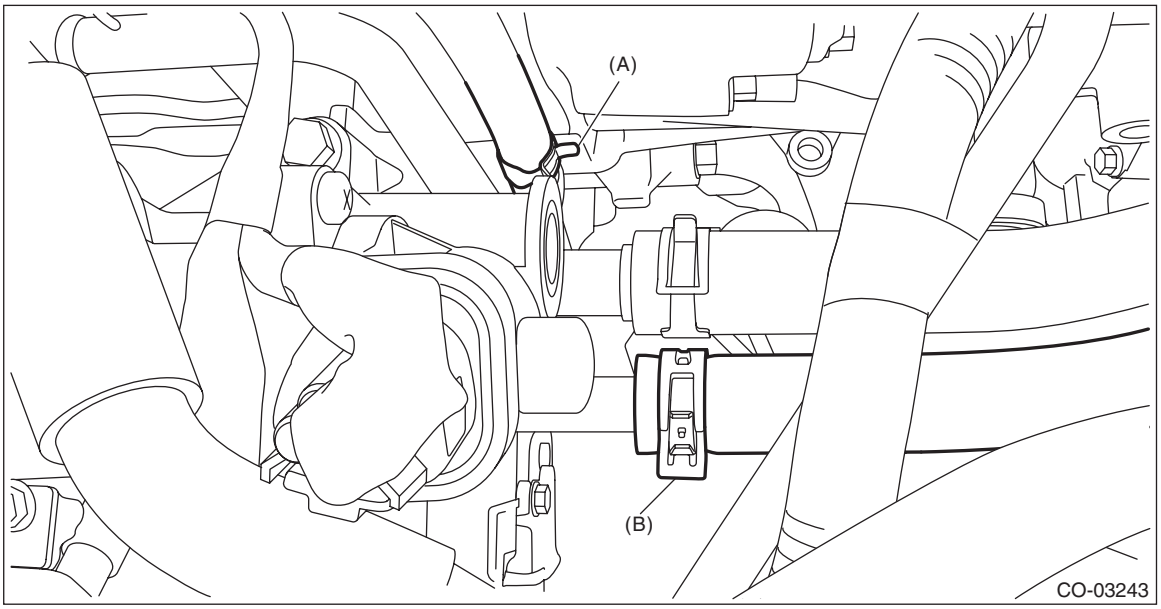


15) Install the bolt which secures the water pipe assembly LH to the cylinder head LH.

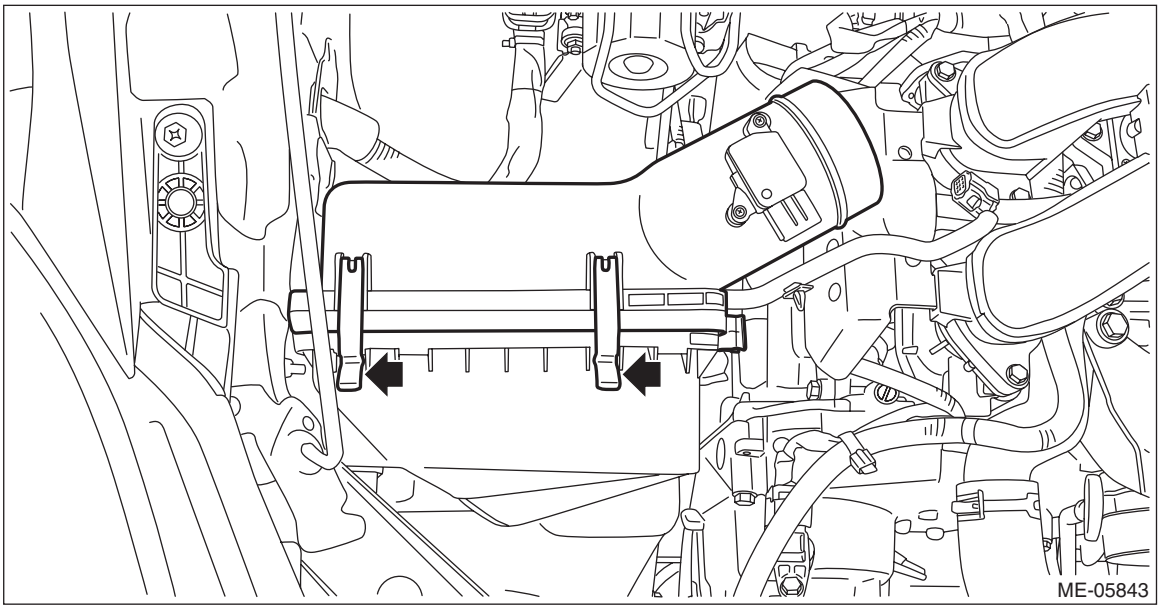
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



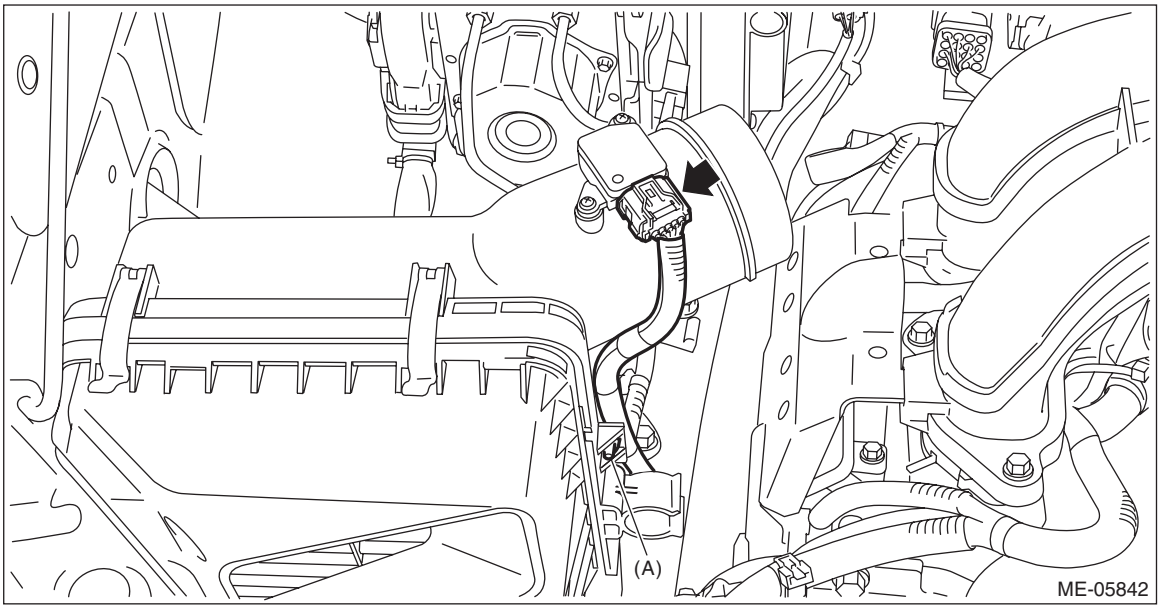
16) Connect the preheater hose (A) and the heater outlet hose (B) to the water pipe assembly LH.



17) Install the air intake case (rear).



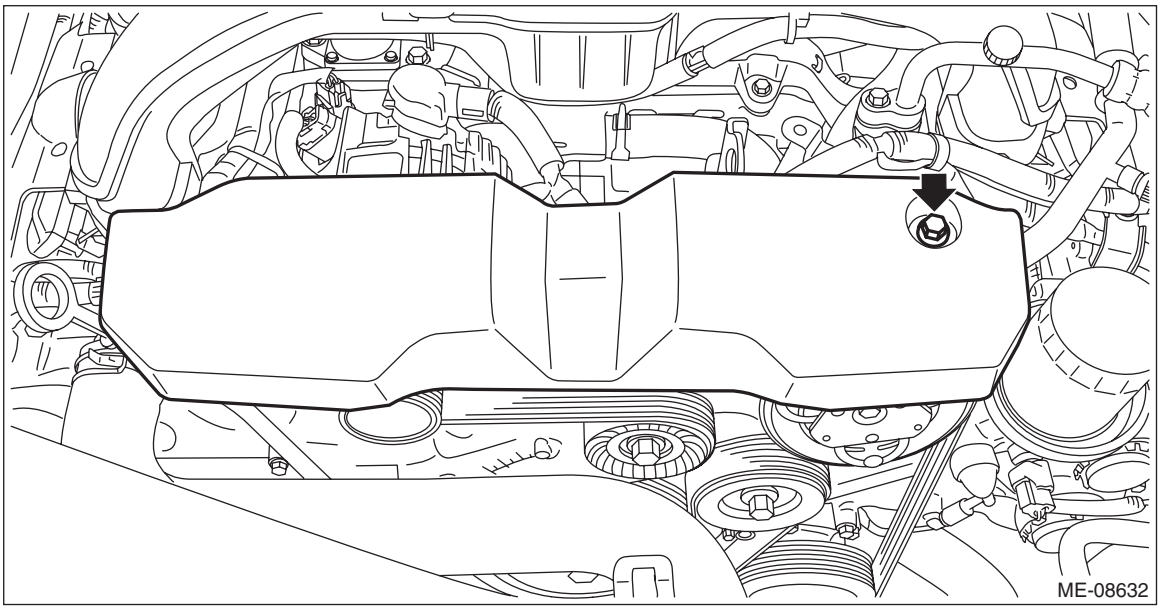
18) Install the clip (A) which secures the air flow and intake air temperature sensor harness, and connect the connector to the air flow and intake air temperature sensor.



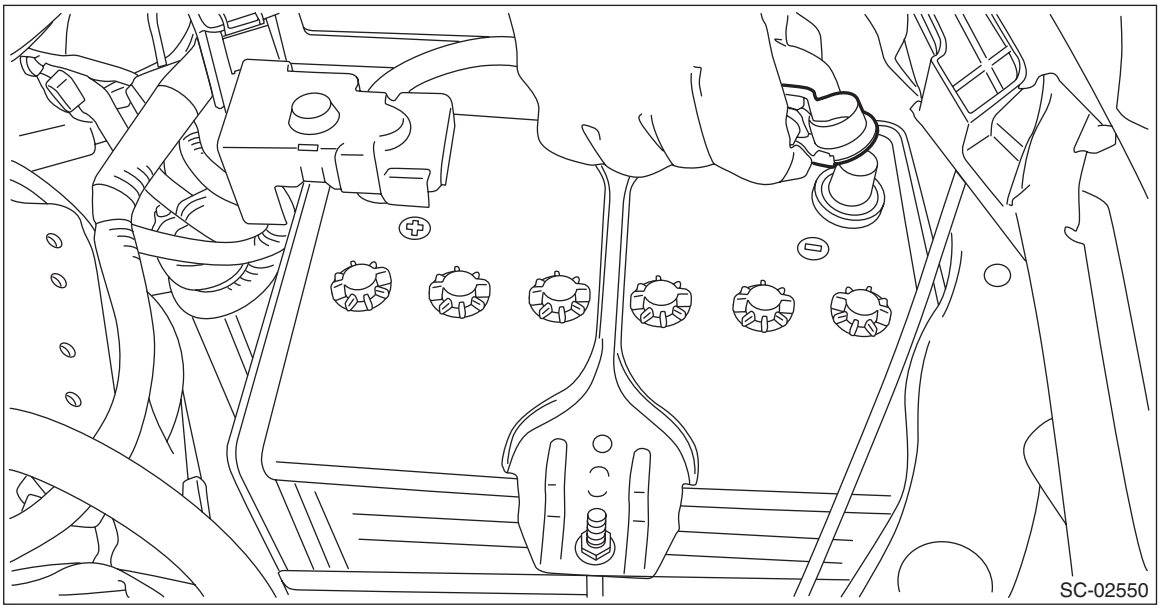
19) Install the air intake boot. <Ref. to IN(H4DO(w/o HEV))-12, INSTALLATION, Air Intake Boot.>
20) Install the air intake duct. <Ref. to IN(H4DO(w/o HEV))-13, INSTALLATION, Air Intake Duct.>

21) Install the V-belt cover.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

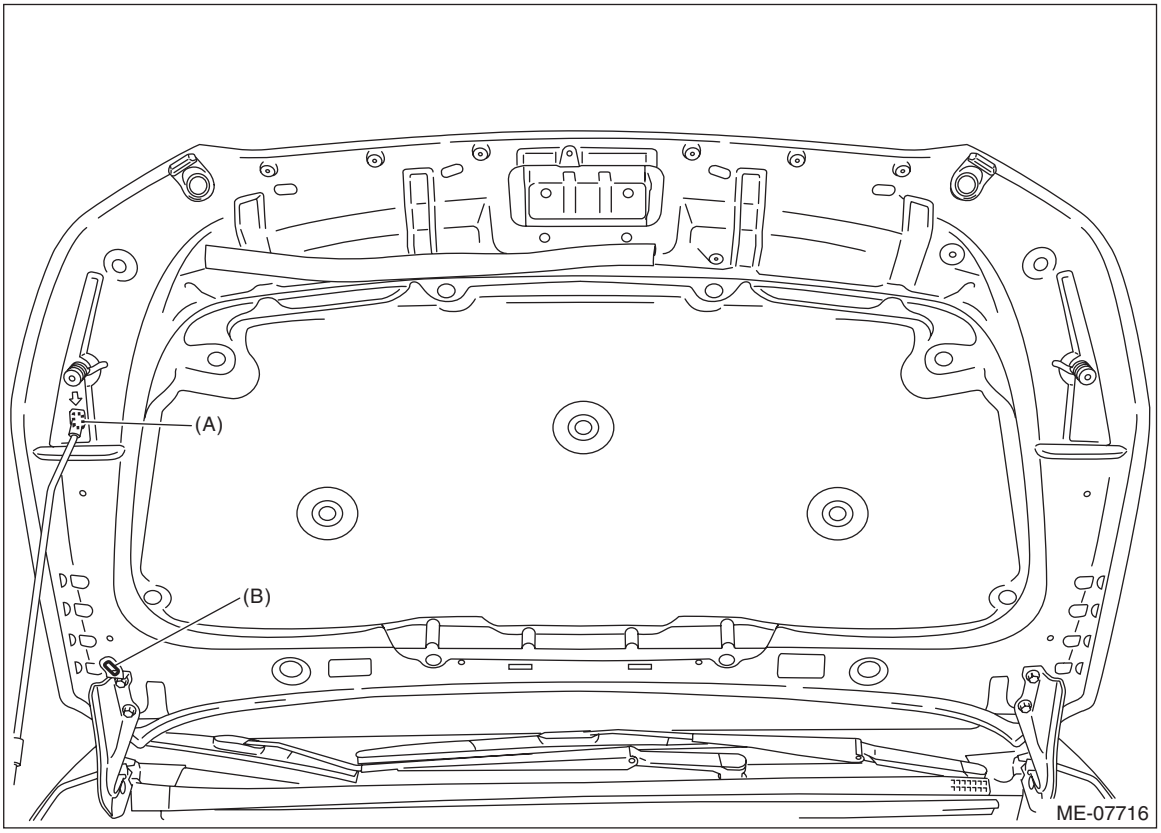


22) Connect the battery ground terminal.



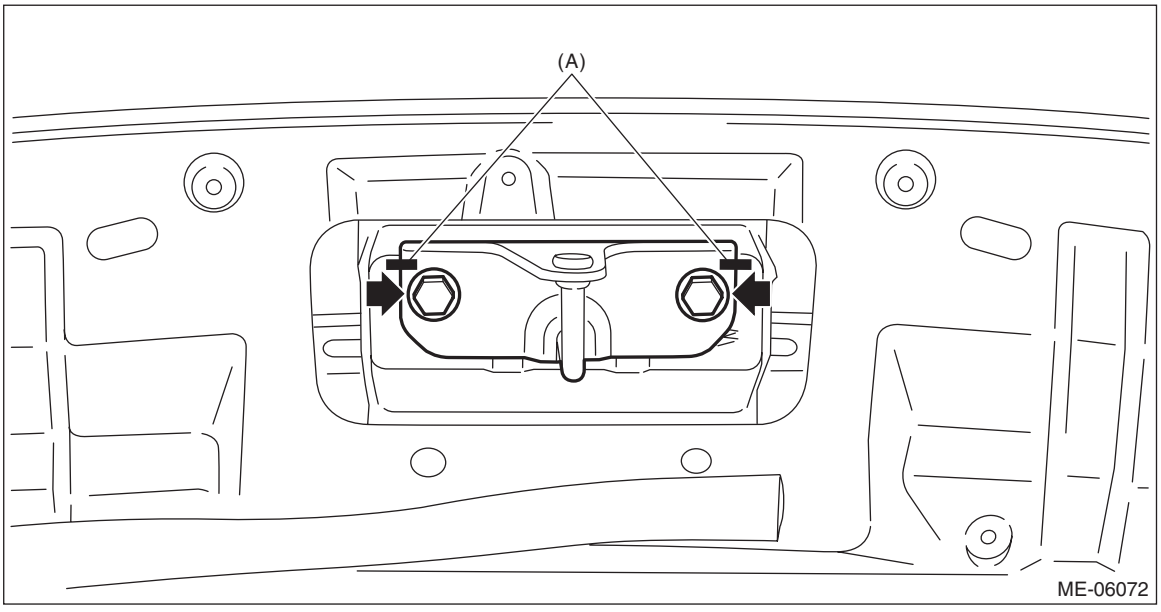
23) Fill engine coolant. <Ref. to CO(H4DO(w/o HEV))-16, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

24) Change the front hood stay position from (B) to (A).



25) Install the front hood striker to the front hood by aligning the alignment marks (A), and close the front hood.

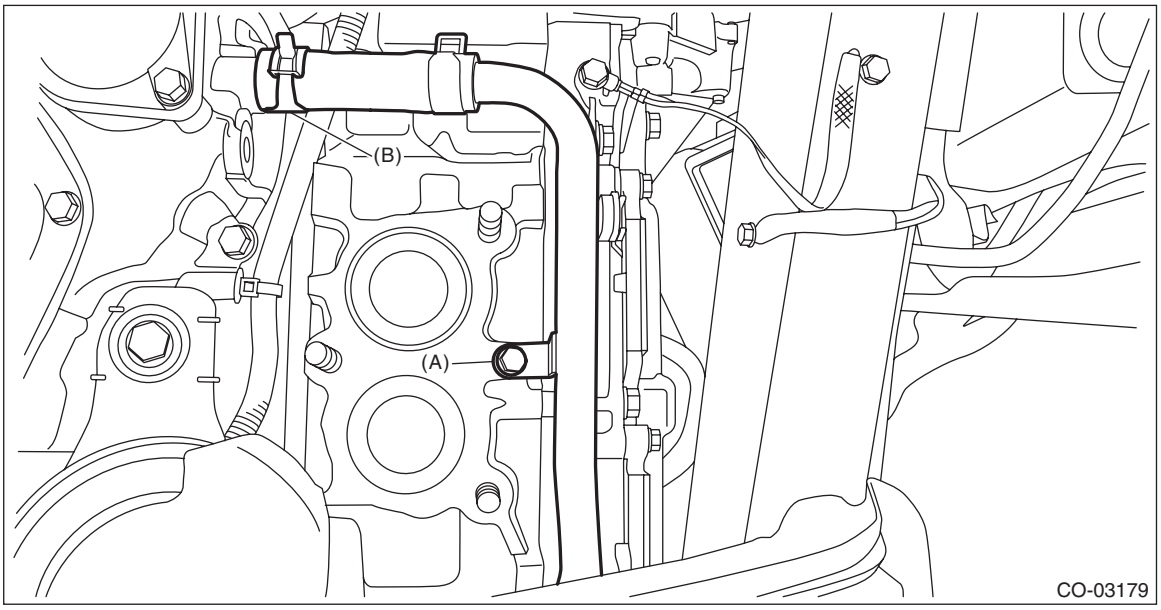
Tightening torque:
33 N·m (3.4 kgf-m, 24.3 ft-lb)



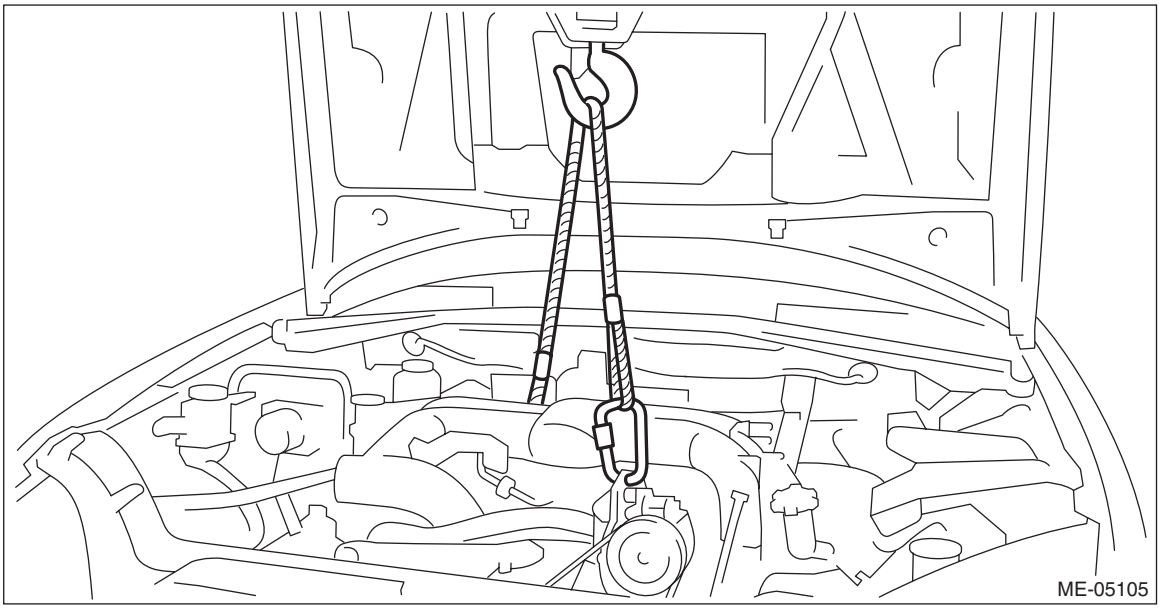
• **HEV model**

1) Set the water pipe assembly LH on the engine, and connect the water pipe hose LH (B) to the oil pan upper.
2) Secure the water pipe assembly LH to the cylinder head LH with bolt (A).

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

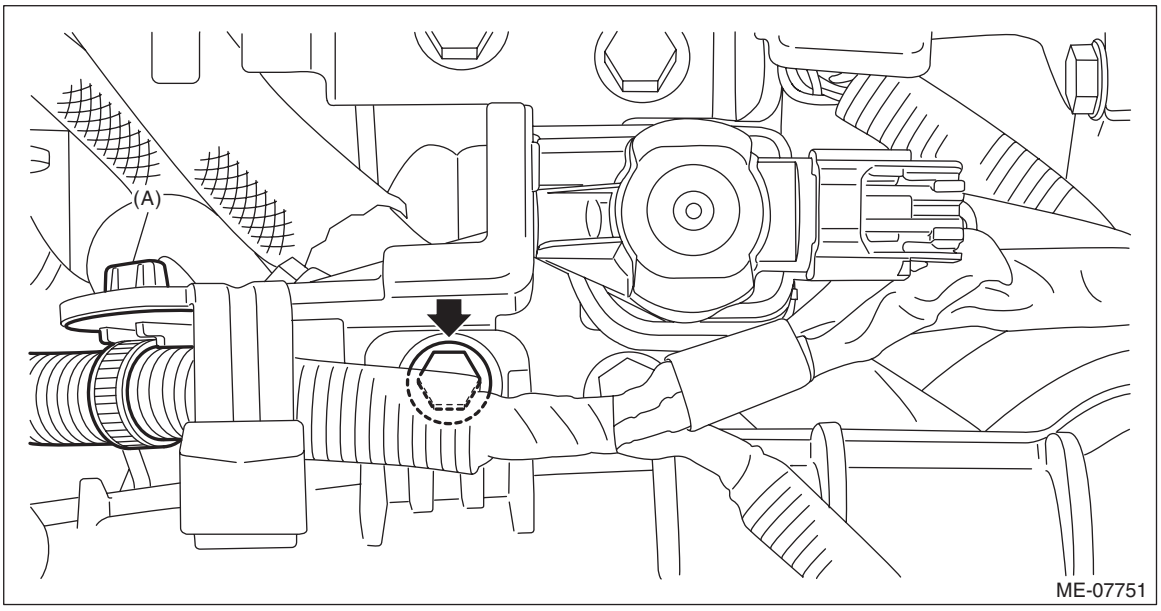


3) Remove the lifting device and wire ropes.



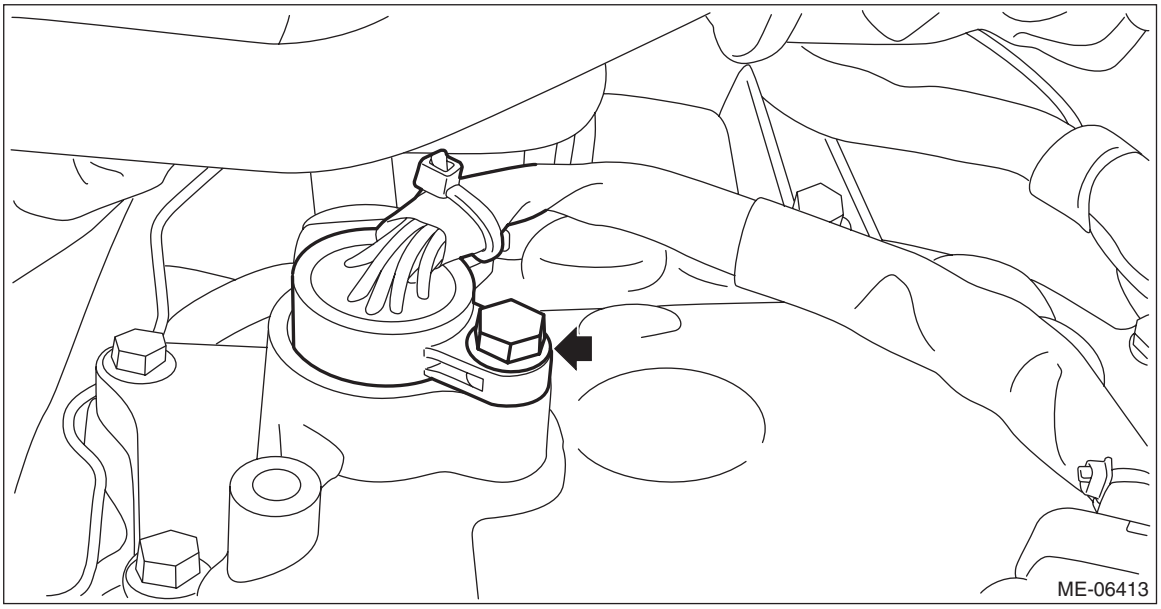
4) Install the bolts which secure the purge control solenoid valve bracket to the intake manifold, and secure the engine harness to the purge control solenoid valve bracket with the clip (A).

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



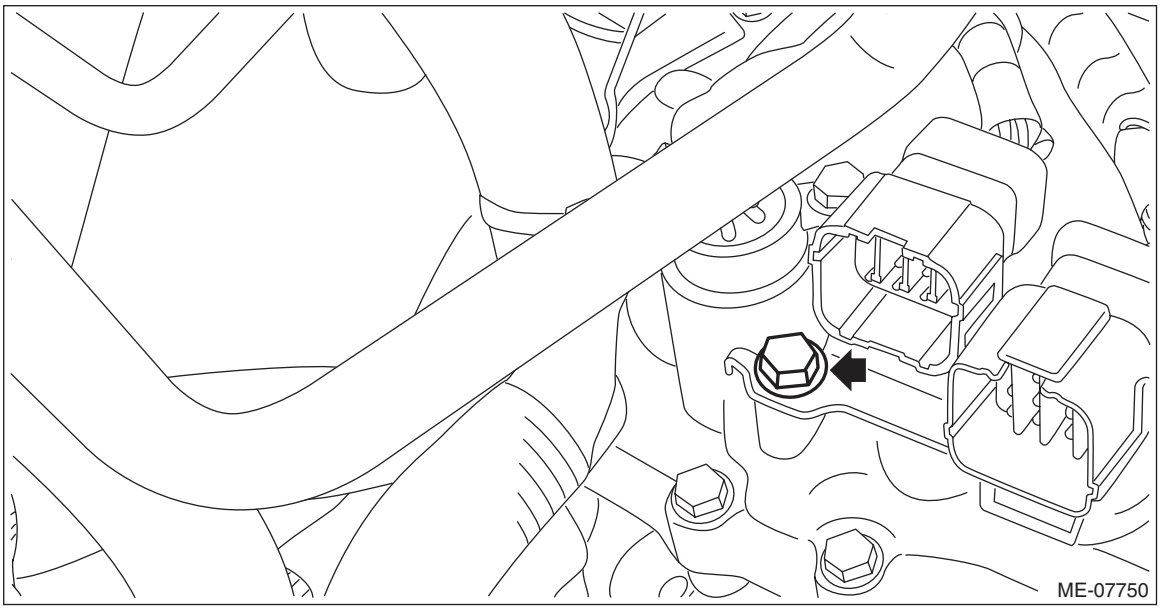
5) Remove the bolt and turn the transmission harness counterclockwise to install the transmission harness to the control valve body.

Tightening torque:
7 N·m (0.7 kgf-m, 5.2 ft-lb)



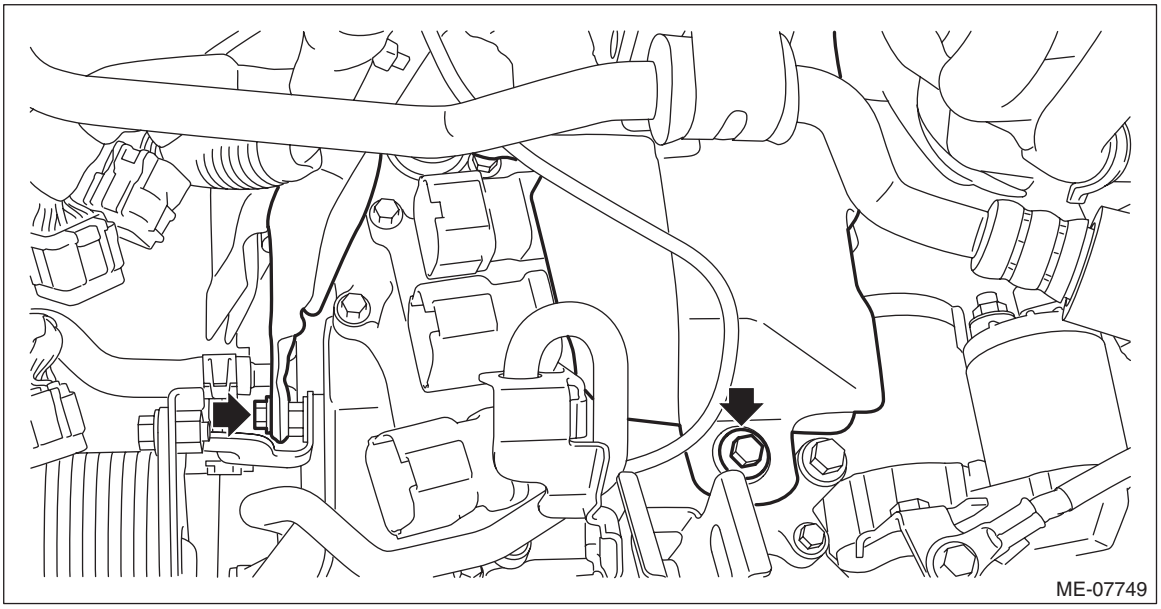
6) Install the bolt which holds the transmission harness stay.

Tightening torque:
7 N·m (0.7 kgf-m, 5.2 ft-lb)



7) Install the transmission case cover.

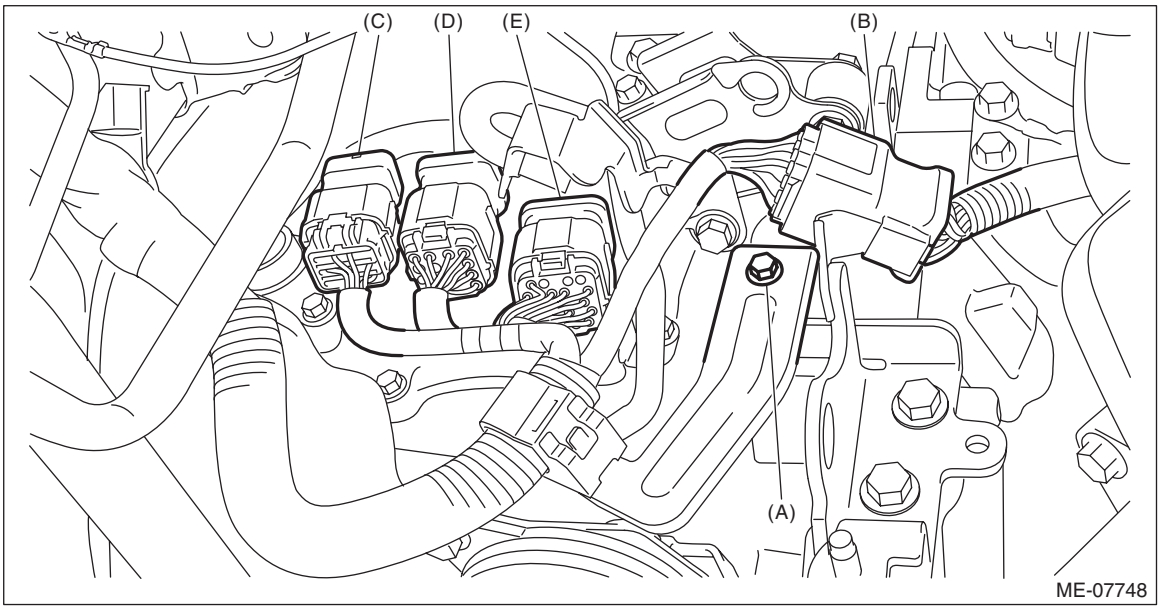
Tightening torque:
8 N·m (0.8 kgf-m, 5.9 ft-lb)



8) Connect the bulkhead harness connector to the transmission harness connector (C), inhibitor harness connector (D) and drive motor harness connector (E).

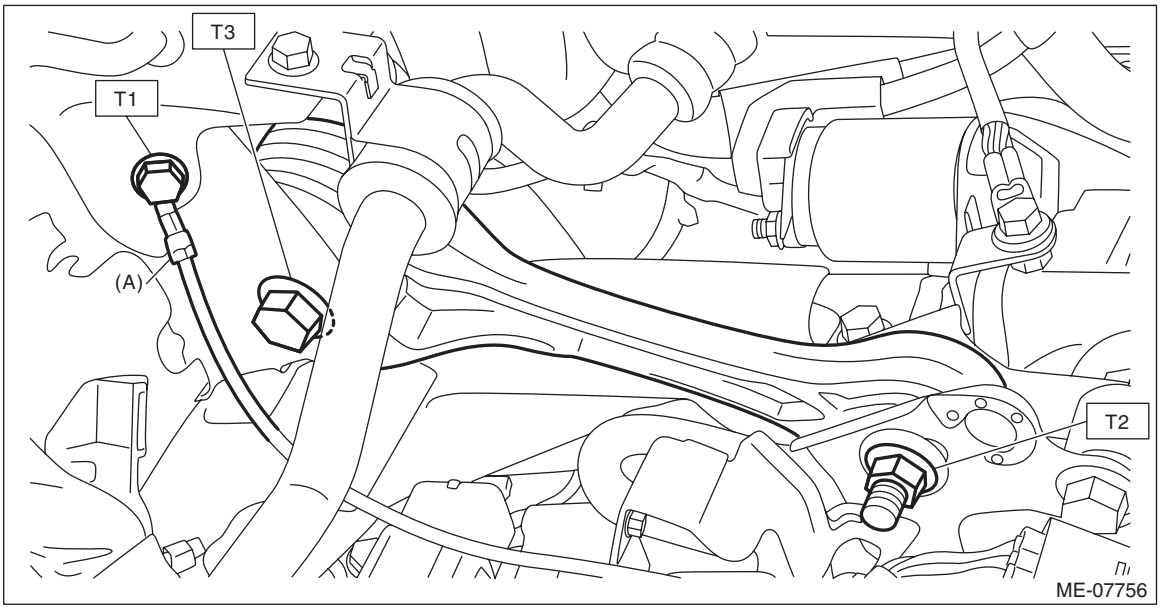
9) Connect the bulkhead harness connector to the engine harness connector (brown) (B), and install the bolt (A) securing the bulkhead harness connector bracket.

Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



10) Install the pitching stopper, and connect the transmission radio ground terminal (A) to the vehicle.

Tightening torque:
T1: 13 N·m (1.3 kgf-m, 9.6 ft-lb)
T2: 50 N·m (5.1 kgf-m, 36.9 ft-lb)
T3: 58 N·m (5.9 kgf-m, 42.8 ft-lb)

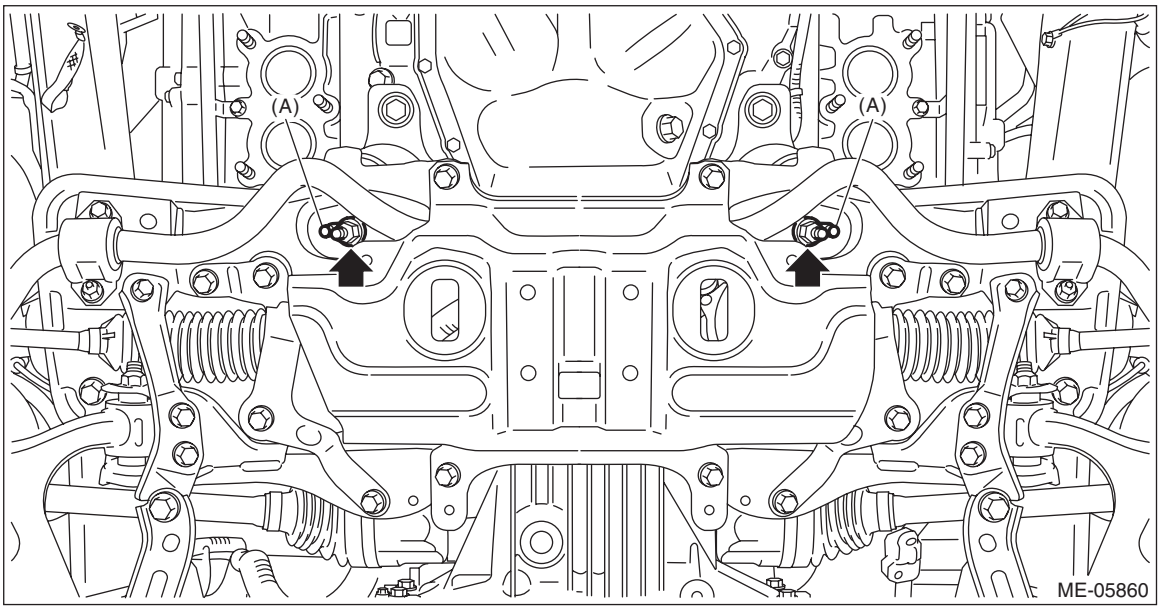


11) Lift up the vehicle.

12) Install the nuts which hold the engine mounting to the crossmember.

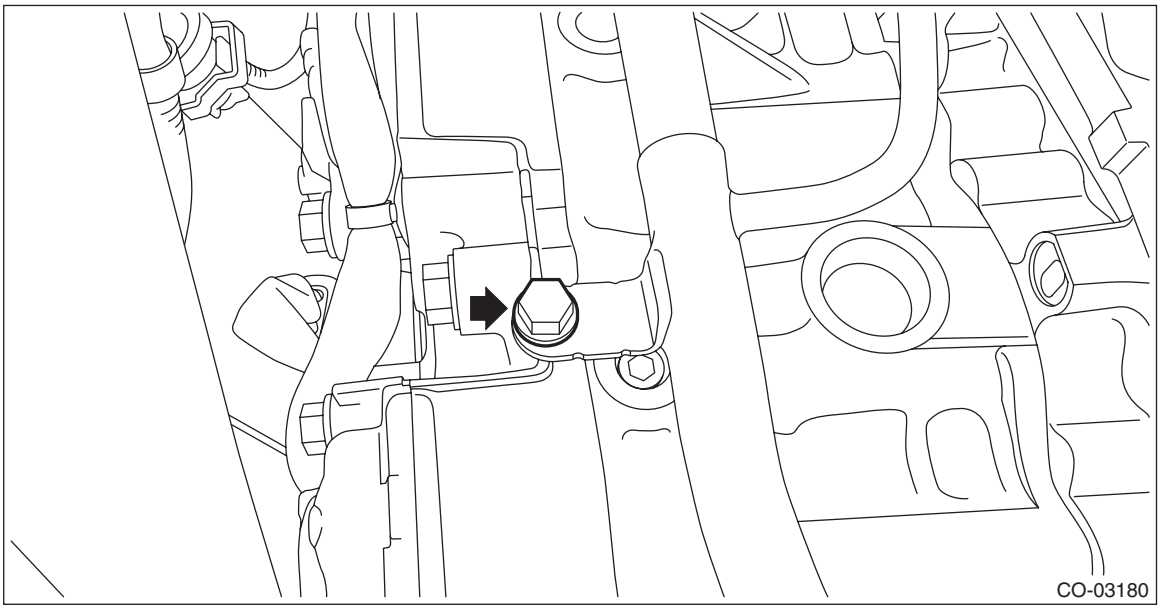
NOTE:
- Make sure that locators (A) of the engine mounting are securely inserted.
- Use a new nut.

Tightening torque:
60 N·m (6.1 kgf-m, 44.3 ft-lb)

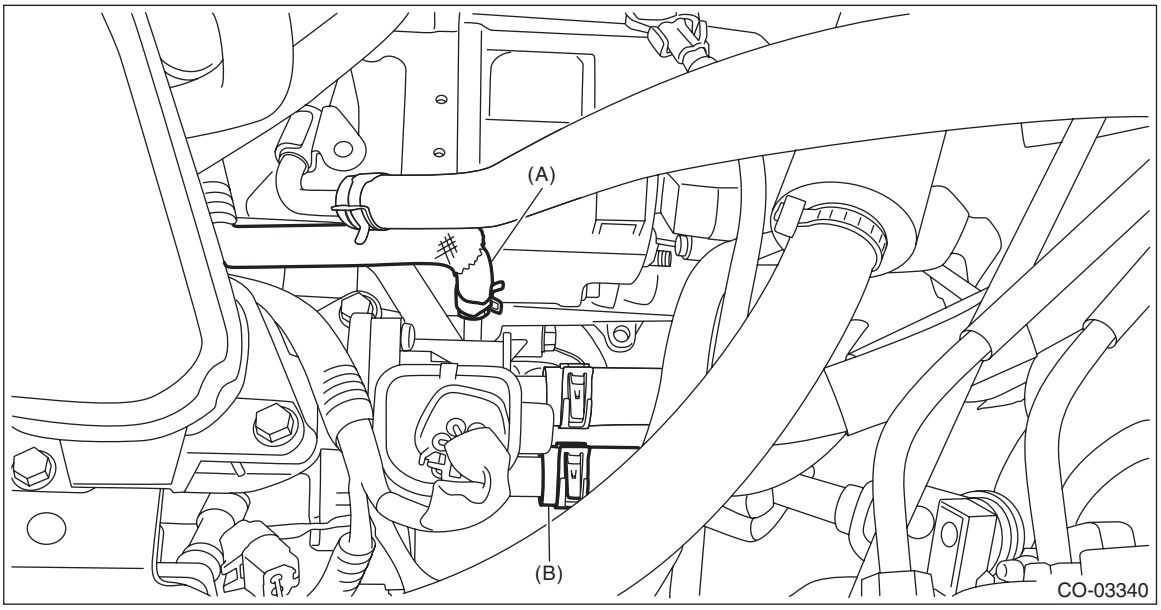


13) Install the front exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-8, INSTALLATION, Front Exhaust Pipe.>
14) Lower the vehicle.
15) Install the bolt which secures the water pipe assembly LH to the cylinder head LH.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

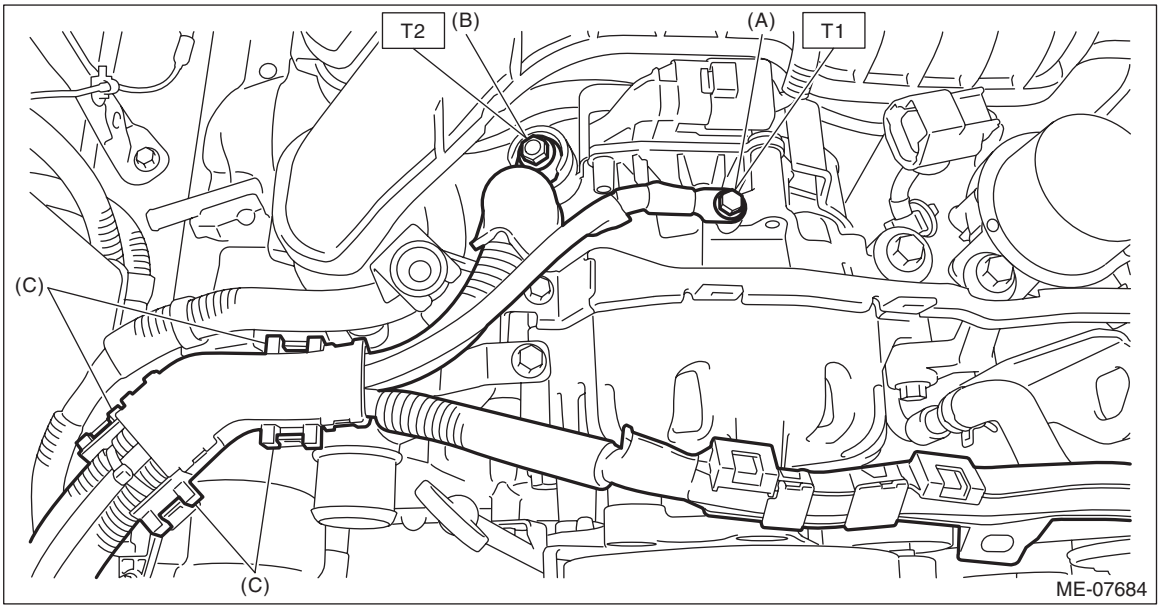


16) Connect the preheater hose (A) and the heater outlet hose (B) to the water pipe assembly LH.



17) Set the battery cable assembly, and install the clip (C) which secures the battery cable assembly to the battery cable bracket No. 1.
18) Connect the terminal (A) and the terminal (B) to ISG.

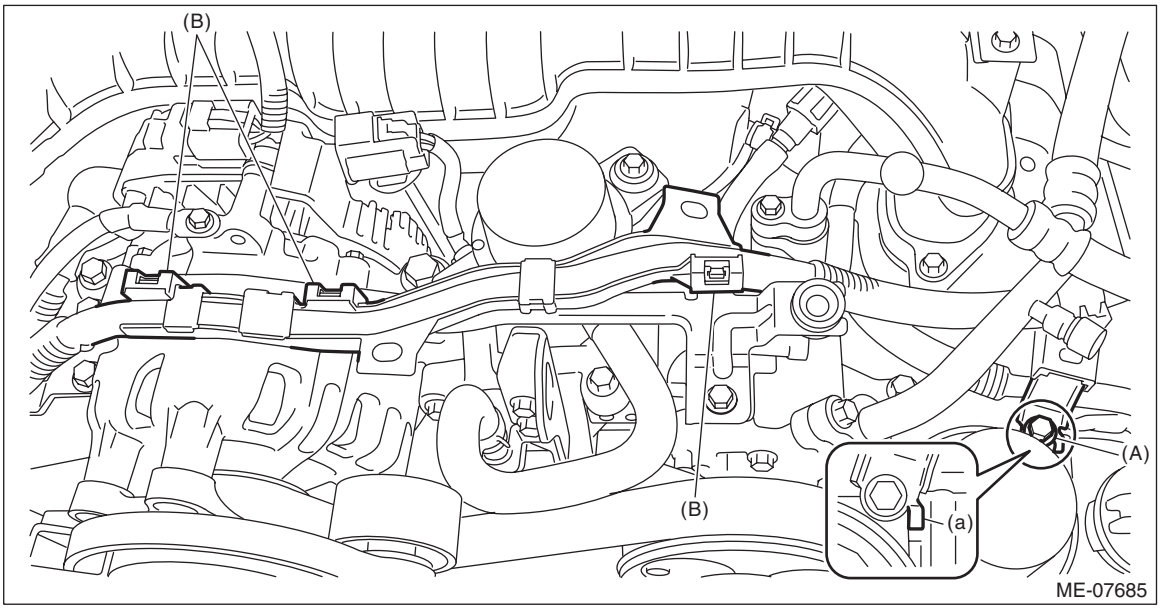
Tightening torque:
T1: 7.5 N·m (0.8 kgf-m, 5.5 ft-lb)
T2: 15.5 N·m (1.6 kgf-m, 11.4 ft-lb)



19) Secure the battery cable assembly to the collector cover bracket with the clip (B), and install the bolt (A) which secures the battery cable stay to the chain cover.

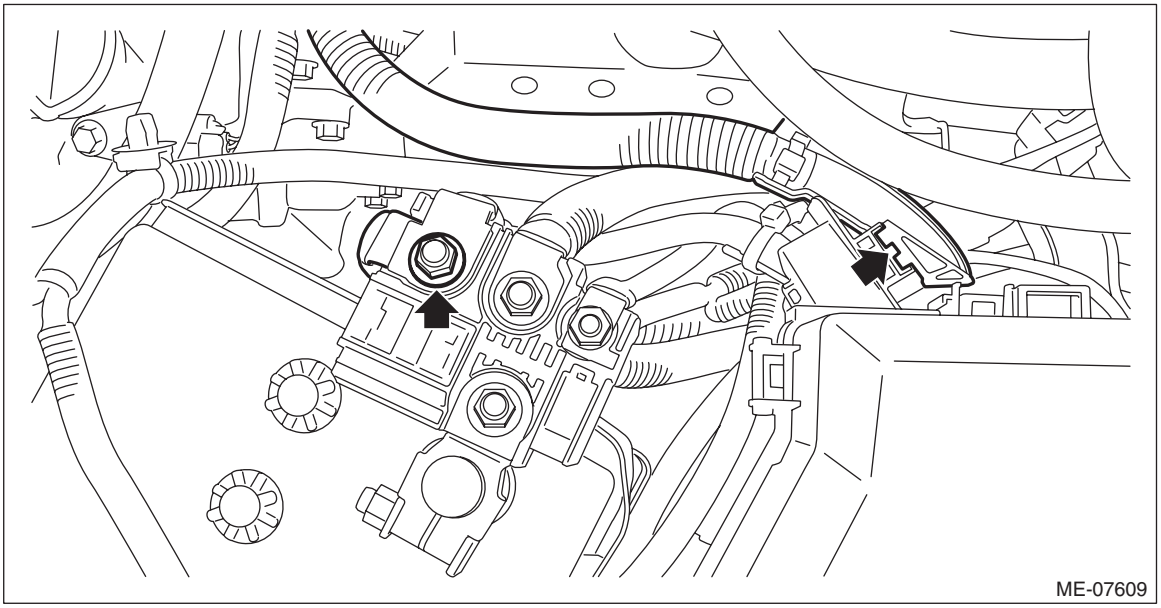
NOTE:
When installing the battery cable stay, install it by fitting the folded end (a) of the battery cable stay to the chain cover boss.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



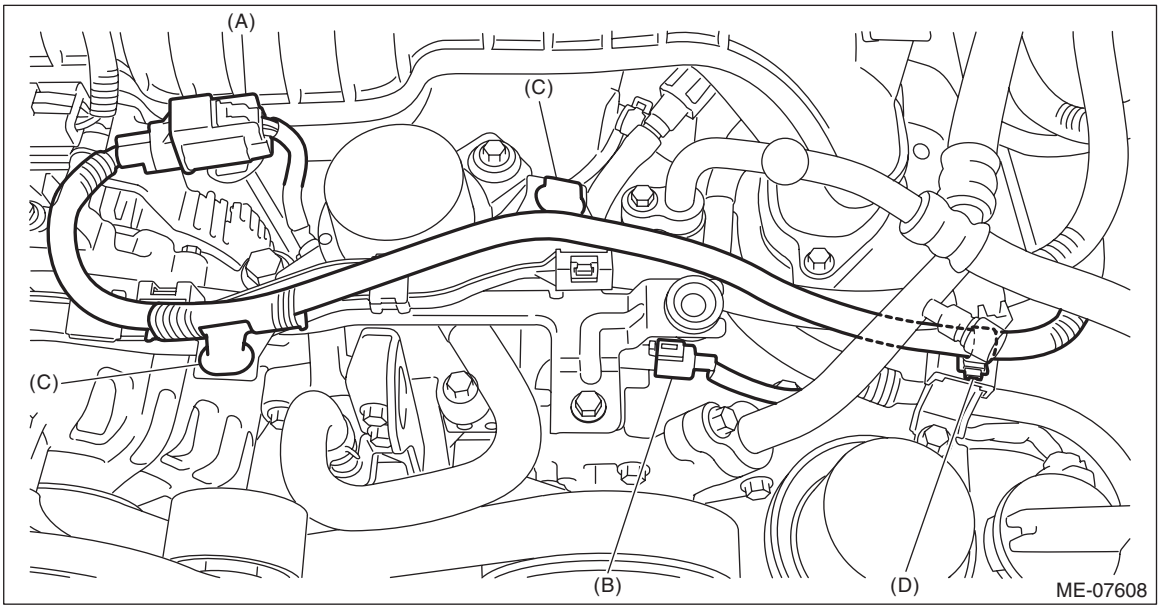
20) Install the battery cable assembly to the main fuse box, and install the nut which secures the battery cable assembly to the slow blow fuse (12 volt auxiliary battery).

Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

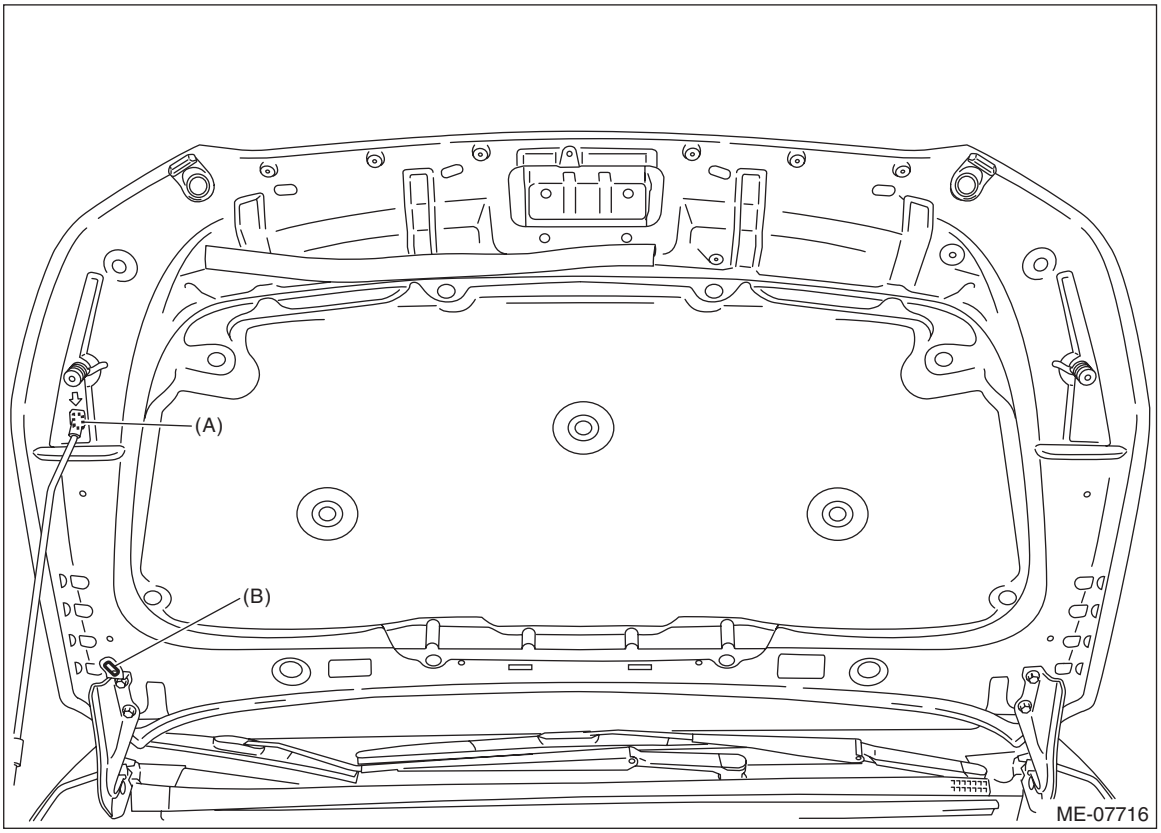


21) Install the terminal boot to the positive terminal of the 12 volt auxiliary battery.
22) Set the harness, and secure the harness to the battery cable assembly with the clip (C) and the clip (D).

23) Connect the connector (A) to the brake vacuum pump, and connect the connector (B) to the A/C compressor.

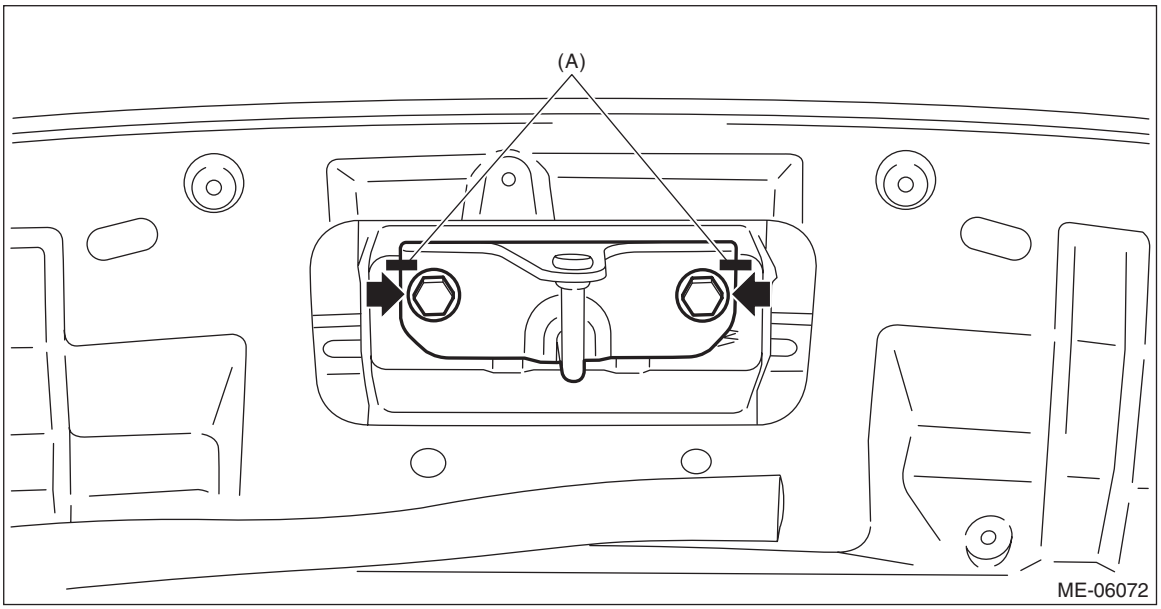


24) Install the air cleaner case. <Ref. to IN(H4DO(HEV))-8, INSTALLATION, Air Cleaner Case.>
25) Install the air intake duct. <Ref. to IN(H4DO(HEV))-15, INSTALLATION, Air Intake Duct.>
26) Fill engine coolant. <Ref. to CO(H4DO(w/o HEV))-16, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
27) Install the collector cover.
28) Connect the battery ground terminal. <Ref. to NT-5, BATTERY, NOTE, Note.>
29) Change the front hood stay position from (B) to (A).



30) Install the front hood striker to the front hood by aligning the alignment marks (A), and close the front hood.

Tightening torque:
33 N·m (3.4 kgf-m, 24.3 ft-lb)



C: INSPECTION

1) Check that the water pipe assembly has no deformation, cracks or other damages.
2) Check that the hose has no cracks, damage or loose part.

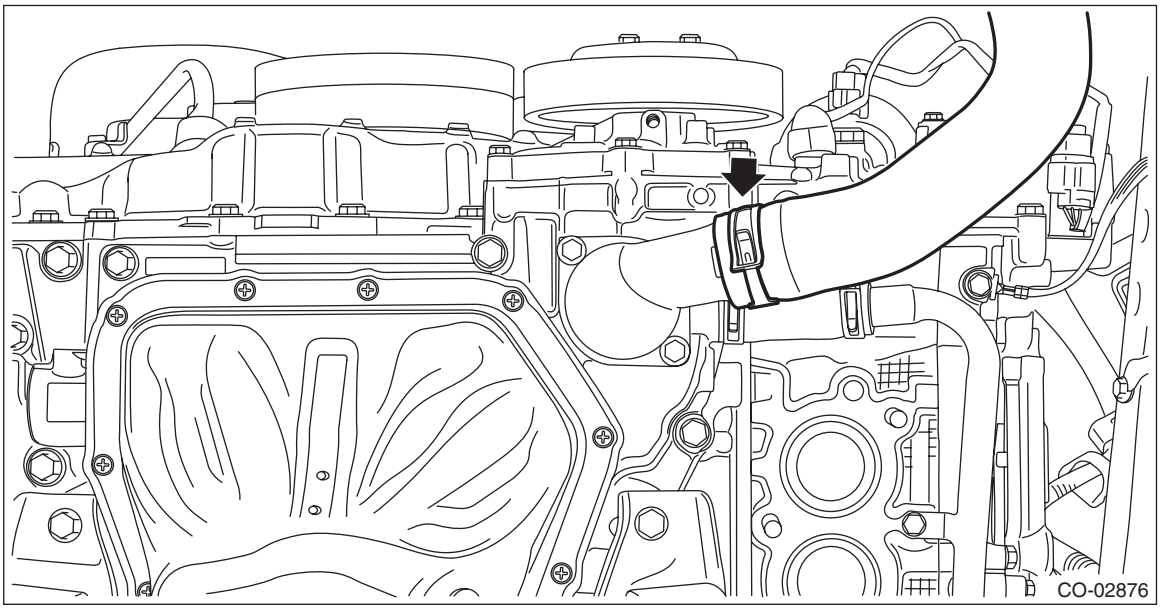
6. Thermostat

A: REMOVAL

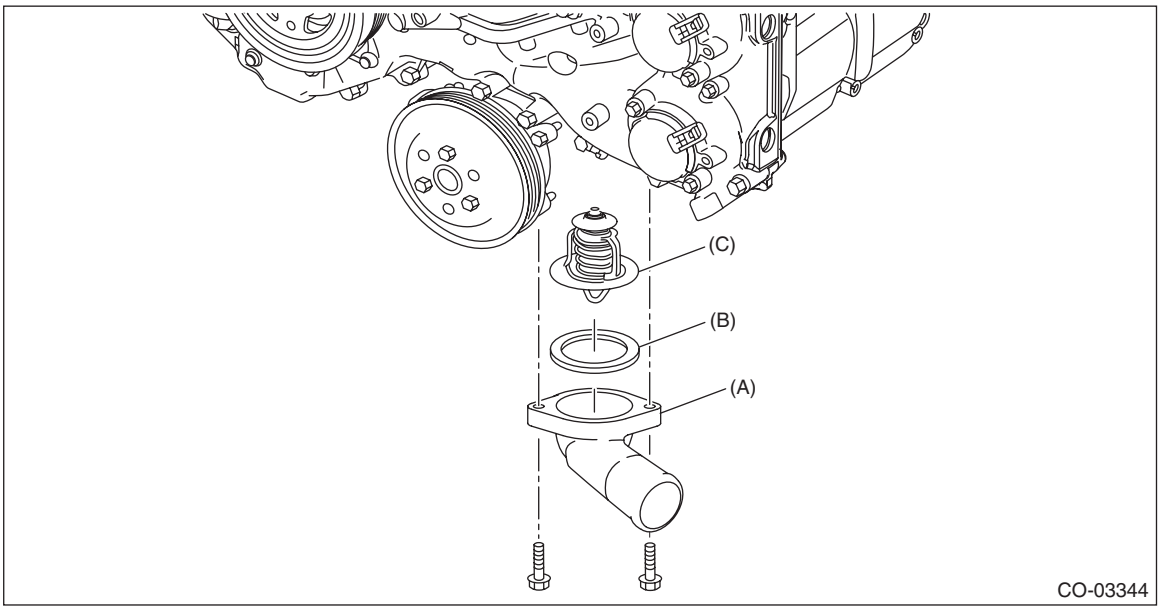
1. ENGINE SIDE

1) Disconnect the ground cable from battery. <Ref. to NT-5, BATTERY, NOTE, Note.>

NOTE:
For the 12 volt engine restart battery of HEV model, disconnect the ground terminal from 12V engine restart battery sensor.
2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-32, REMOVAL, Front Under Cover.>
4) Drain engine coolant. <Ref. to CO(H4DO(w/o HEV))-16, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
5) Remove the front exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-6, REMOVAL, Front Exhaust Pipe.>
6) Disconnect the radiator outlet hose from thermostat cover.



7) Remove the thermostat cover, and then remove the thermostat.



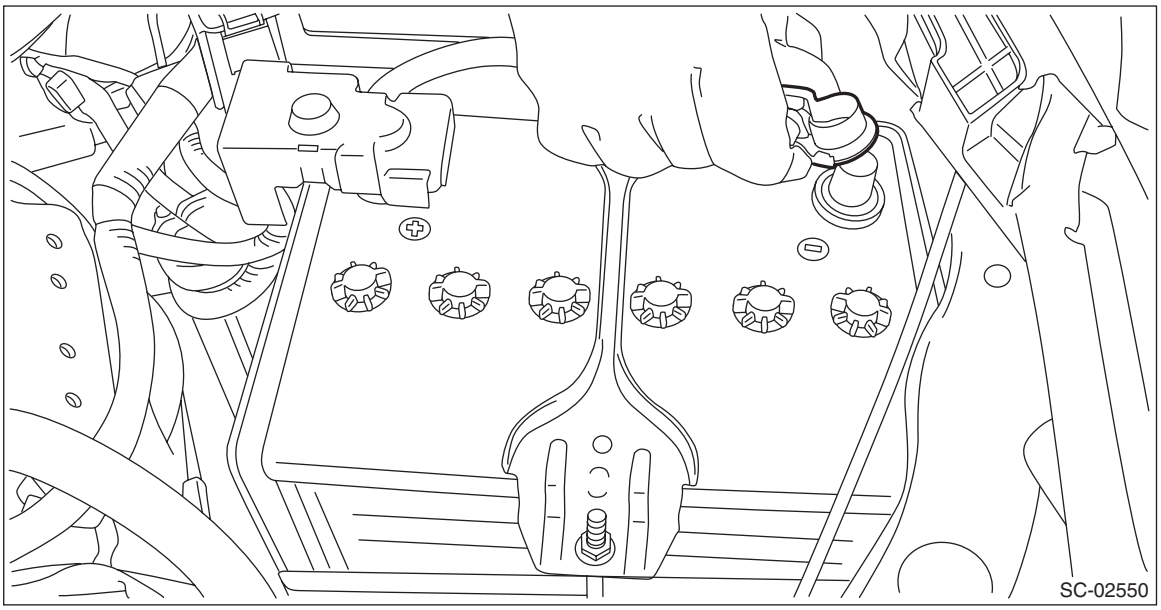
(A) Thermostat cover (B) Gasket (C) Thermostat

8) Remove the gasket from thermostat.

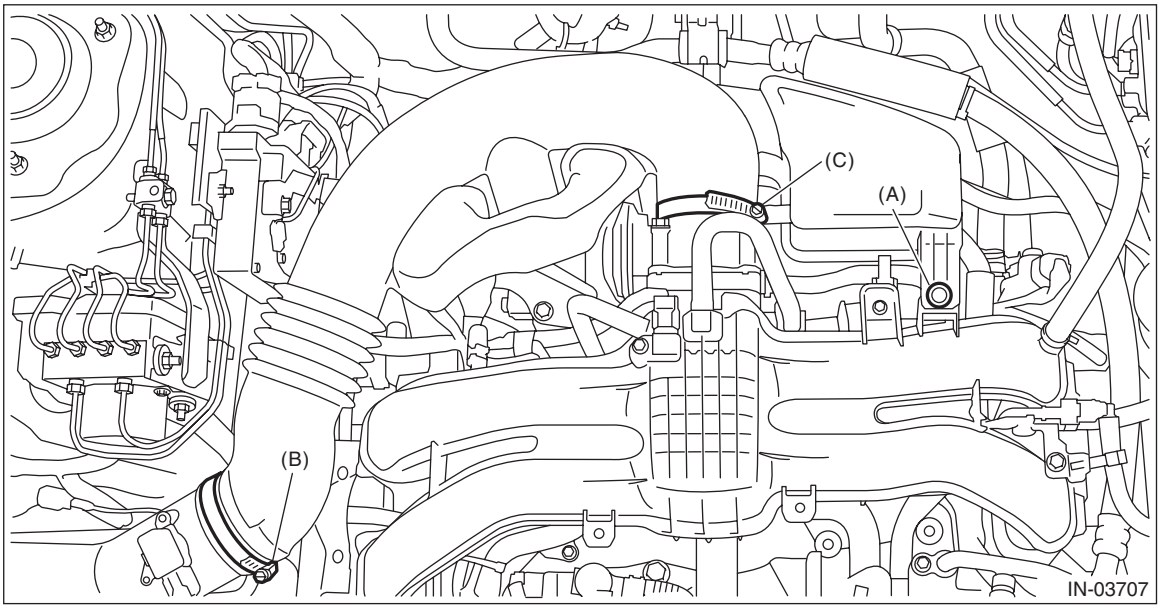
2. CVTF COOLER (WITH WARMER FEATURE) SIDE

• Gasoline engine model

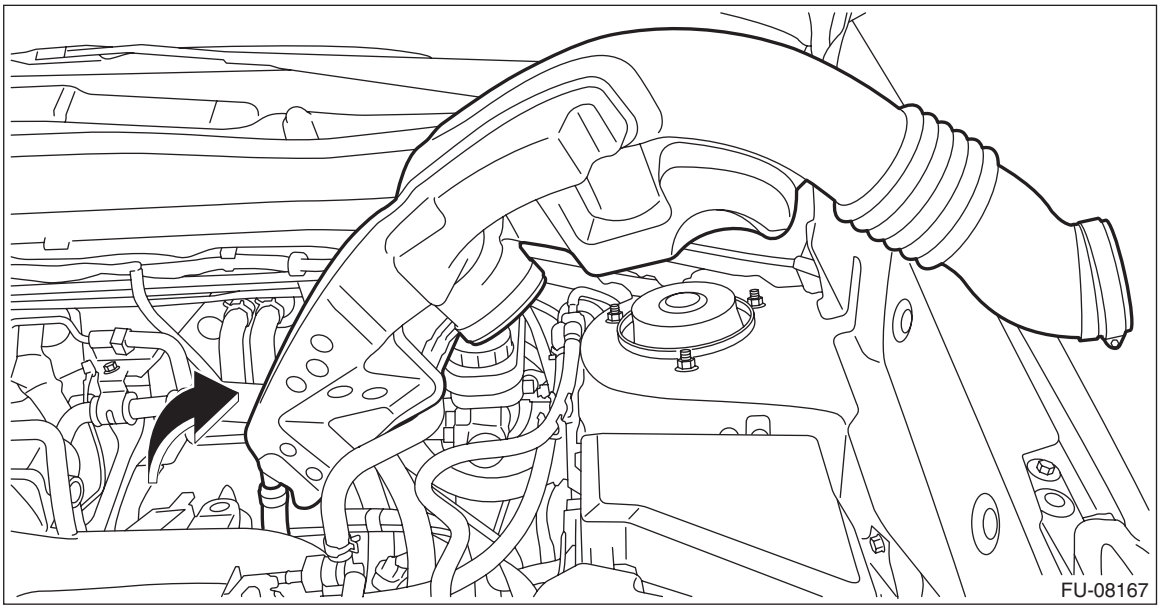
1) Disconnect the ground cable from battery.



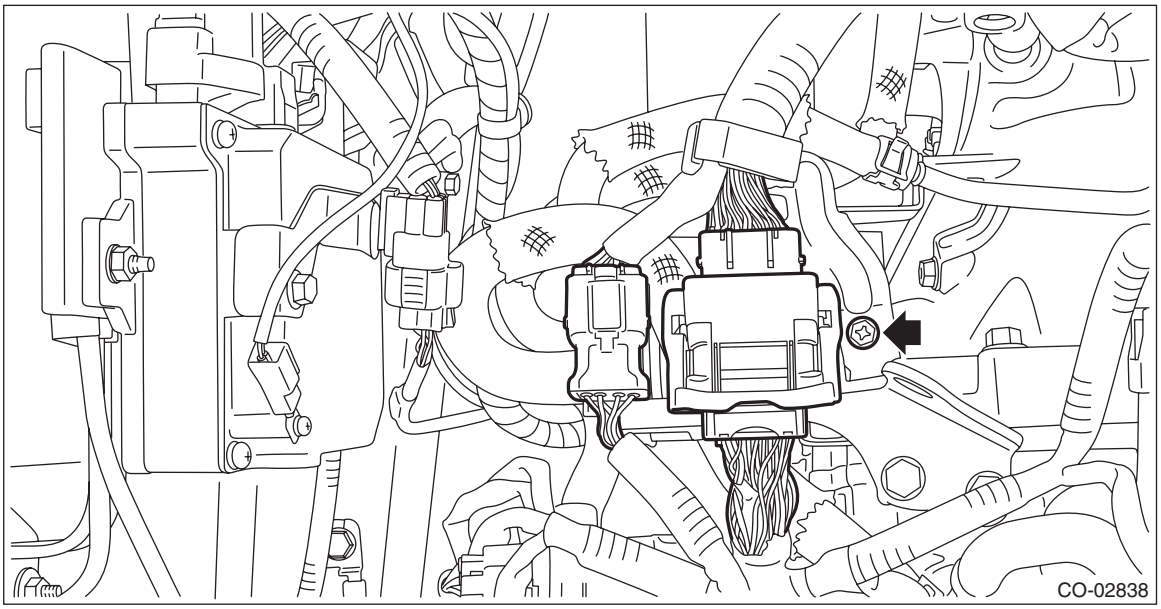
2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-32, REMOVAL, Front Under Cover.>
4) Drain engine coolant. <Ref. to CO(H4DO(w/o HEV))-16, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
5) Lower the vehicle.
6) Remove the clip (A) from the air intake boot.
7) Loosen the clamp (B) securing the air cleaner case (rear) to the air intake boot.
8) Loosen the clamp (C) which secures the throttle body to the air intake boot.



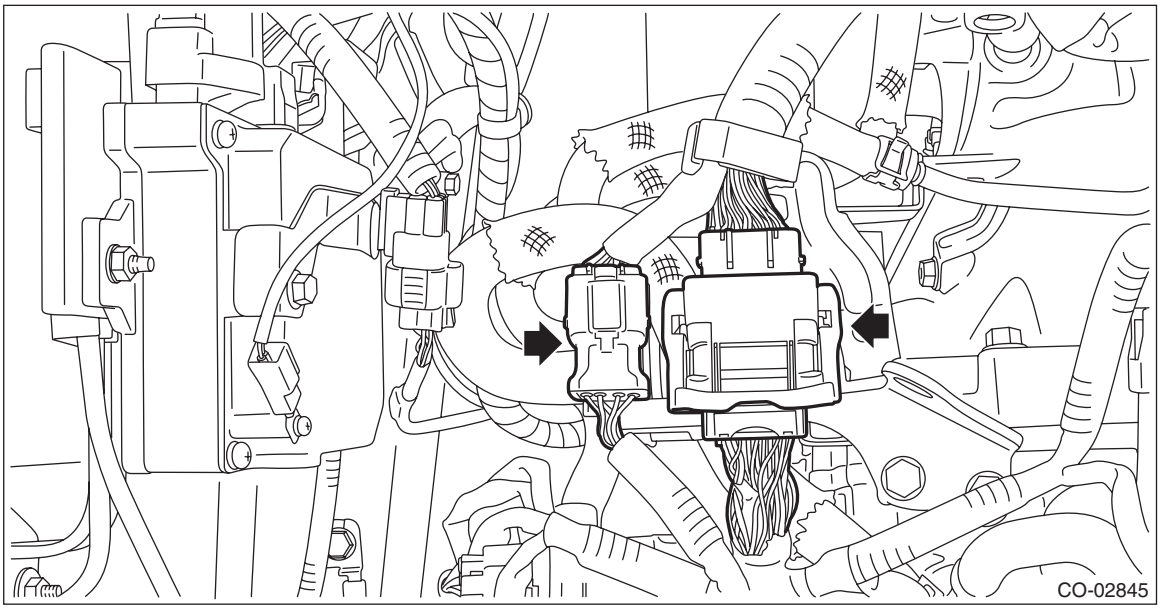
9) Remove the air intake boot from the throttle body, and move it to the left side wheel apron.



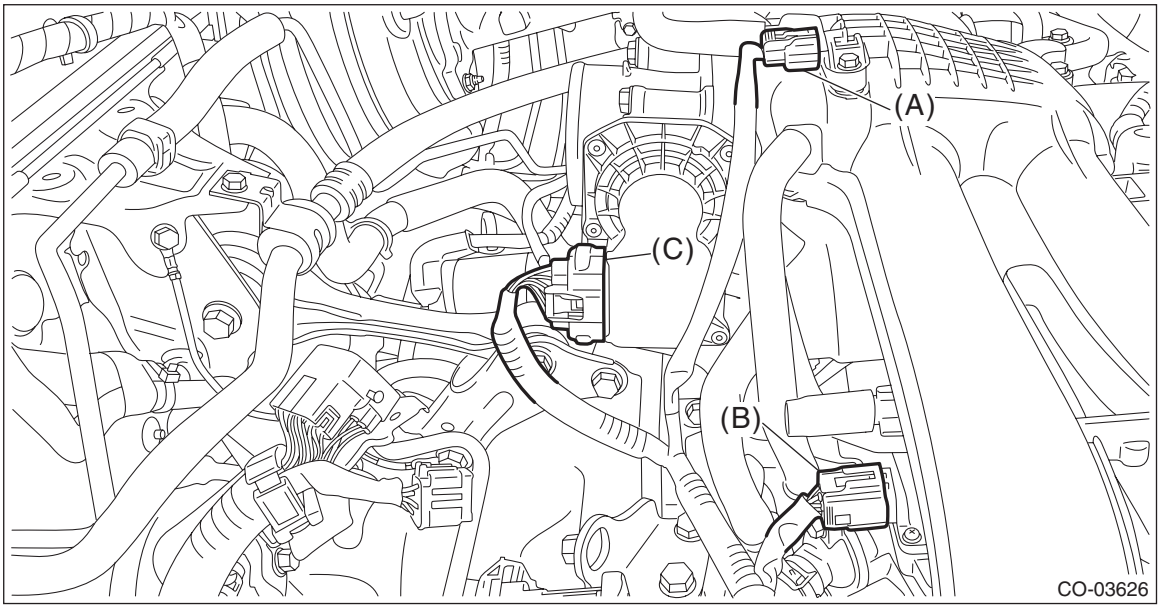
10) Disconnect the engine harness connector.
(1) Remove the bolt securing the bulkhead harness connector bracket.



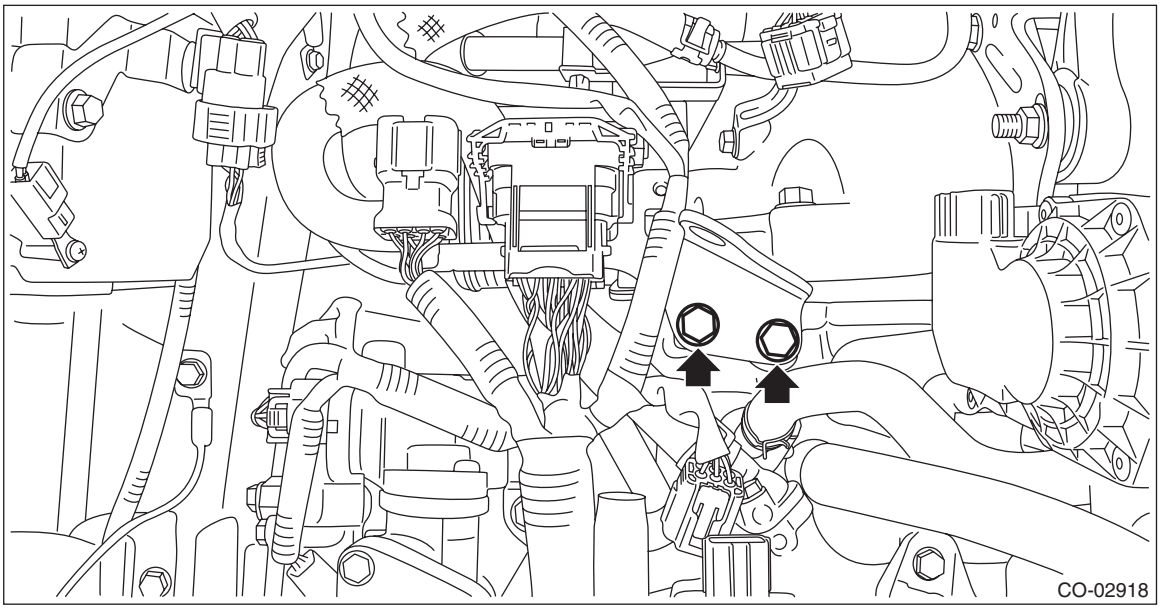
(2) Disconnect the bulkhead harness connector from the engine harness connector (black) and engine harness connector (brown).



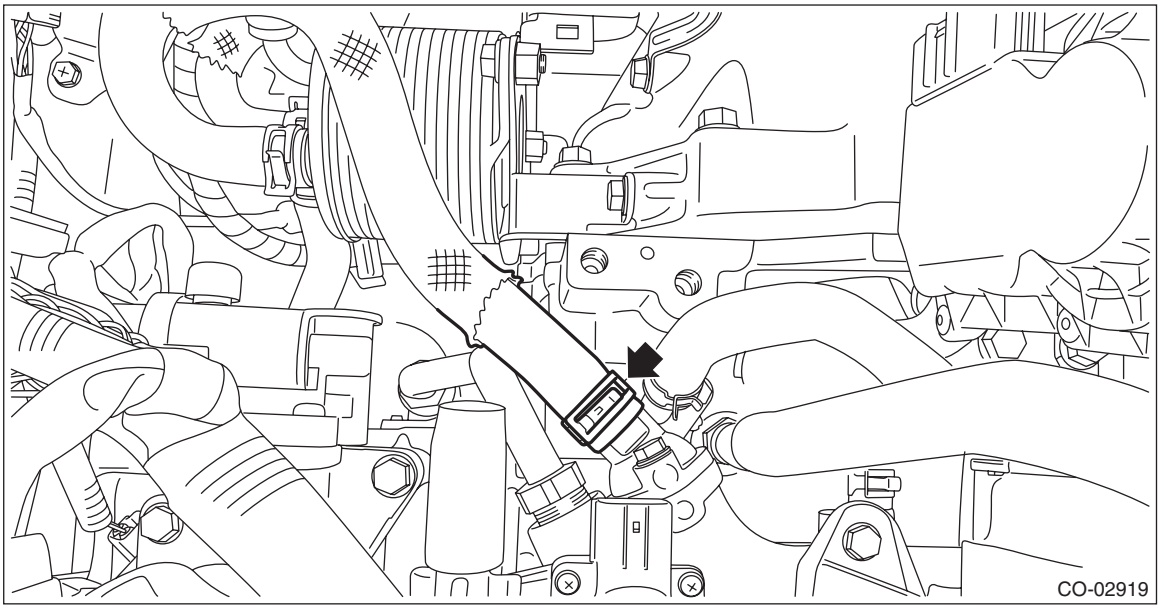
11) Disconnect the connector (A) from manifold absolute pressure sensor.
12) Disconnect the connector (B) from the throttle position sensor.
13) Disconnect the connector (C) from the EGR control valve.



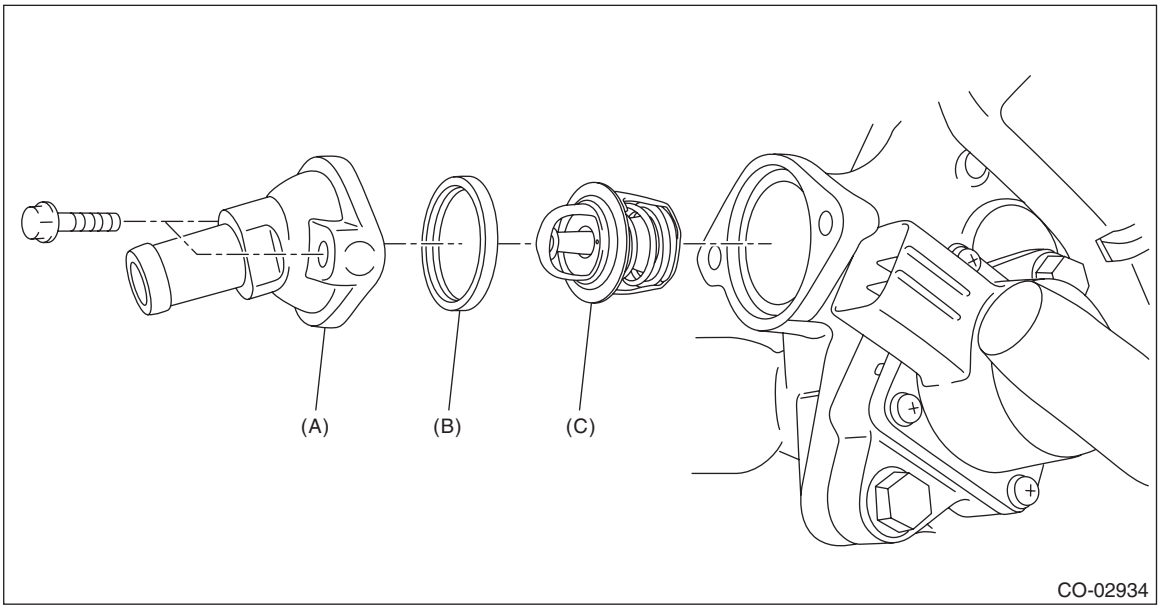
14) Remove the bolt securing the engine hanger from the cylinder block RH, and move the hanger to the right side wheel apron.



15) Disconnect the engine coolant hose from the thermostat cover.



16) Remove the thermostat cover, and then remove the thermostat.



(A) Thermostat cover (B) Gasket (C) Thermostat

17) Remove the gasket from thermostat.

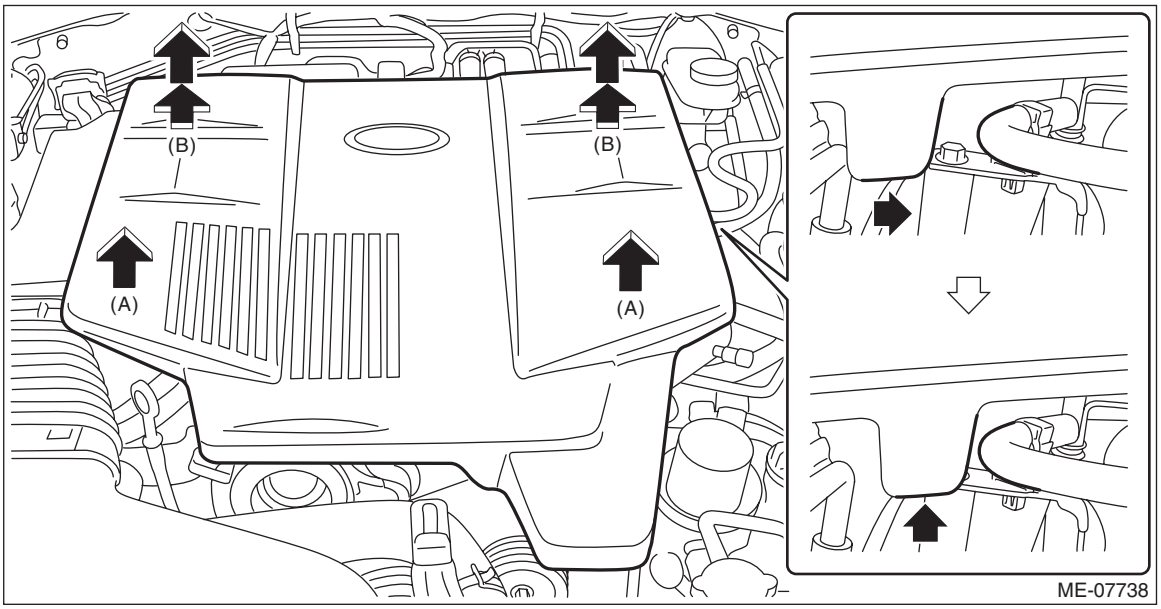
- **HEV model**

1) Disconnect the ground cable from battery. <Ref. to NT-5, BATTERY, NOTE, Note.>

NOTE:
For the 12 volt engine restart battery, disconnect the ground terminal from 12V engine restart battery sensor.

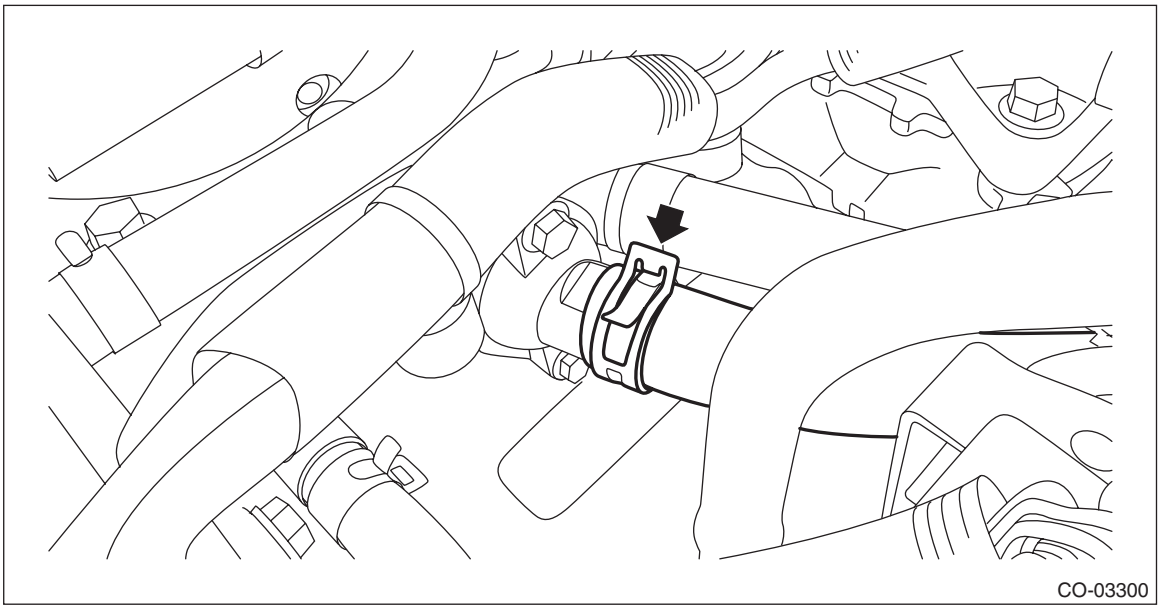
2) Remove the collector cover.
   (1) Carefully pull up the front of collector cover at two positions (A).
   (2) Carefully pull up the rear of collector cover at two positions (B) while moving it backward.

NOTE:
Be careful not to contact the fuel delivery tube when moving the collector cover rearward.

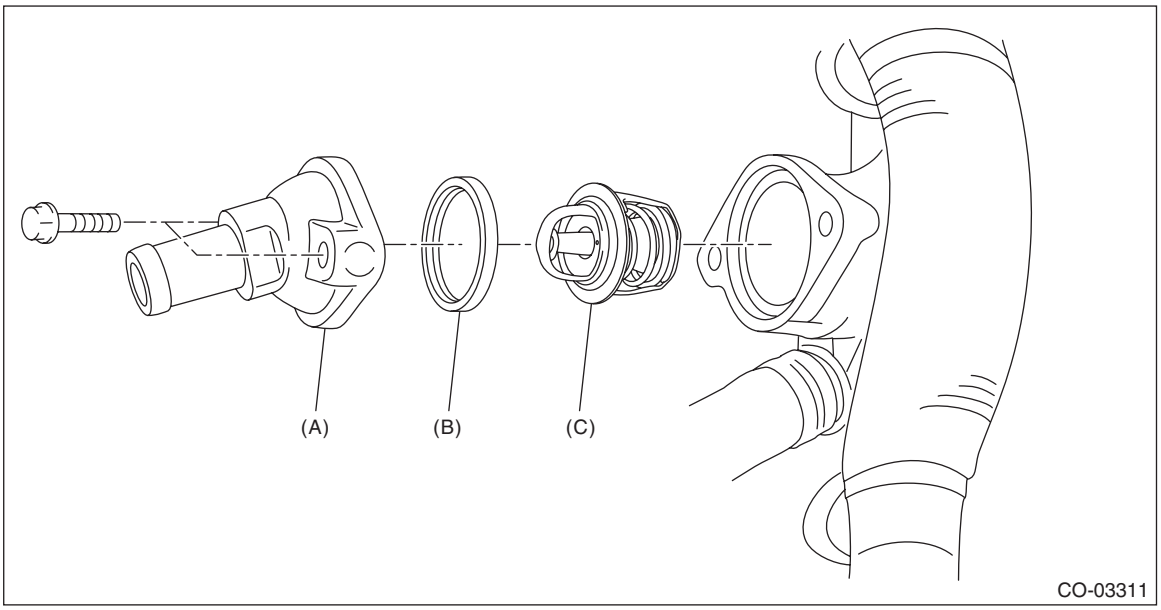


3) Lift up the vehicle.
4) Remove the under cover. <Ref. to EI-32, REMOVAL, Front Under Cover.>

5) Drain engine coolant. <Ref. to CO(H4DO(w/o HEV))-16, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
6) Lower the vehicle.
7) Remove the intake manifold. <Ref. to FU(H4DO(HEV))-19, REMOVAL, Intake Manifold.>
8) Disconnect the engine coolant hose from the thermostat cover.


CO-03300

9) Remove the thermostat cover, and then remove the thermostat.



CO-03311

(A) Thermostat cover (B) Gasket (C) Thermostat

10) Remove the gasket from thermostat.

B: INSTALLATION

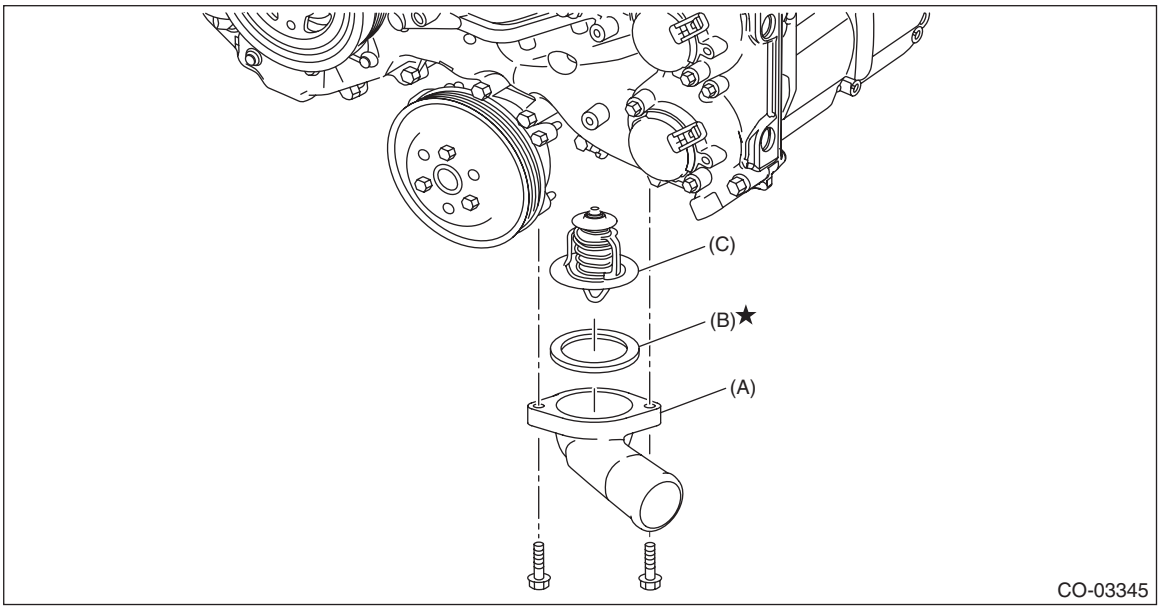
1. ENGINE SIDE

1) Install a gasket to thermostat.

NOTE:
Use a new gasket.

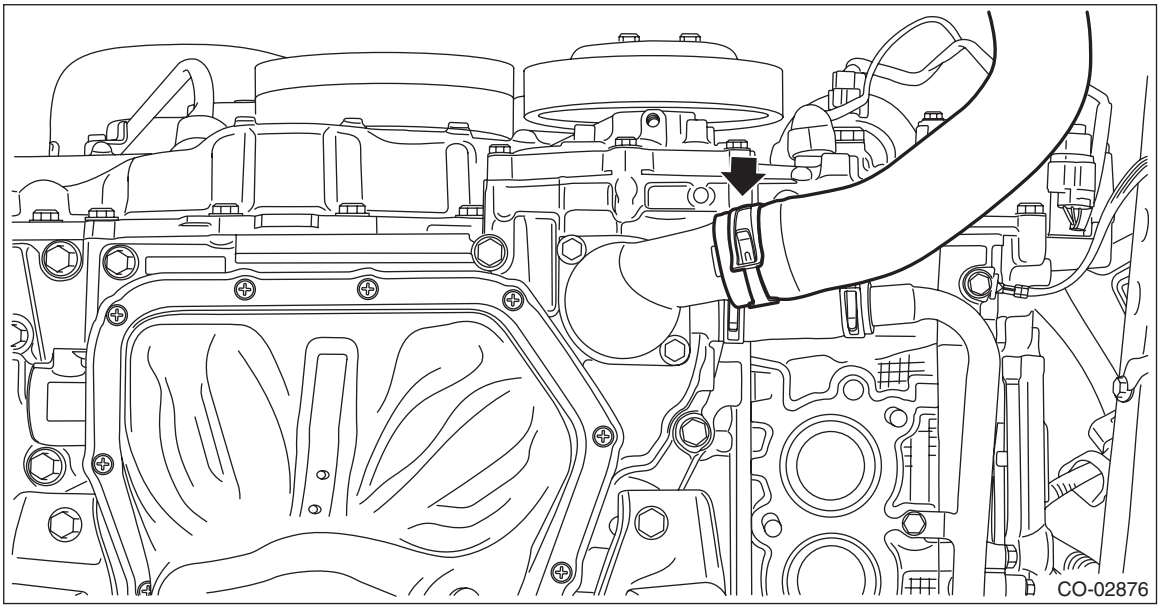
2) Install the thermostat and thermostat cover.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



(A) Thermostat cover (B) Gasket (C) Thermostat

3) Connect the radiator outlet hose to thermostat cover.



4) Install the front exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-8, INSTALLATION, Front Exhaust Pipe.>
5) Install the under cover. <Ref. to EI-32, INSTALLATION, Front Under Cover.>
6) Lower the vehicle.
7) Connect the battery ground terminal. <Ref. to NT-5, BATTERY, NOTE, Note.>
8) Fill engine coolant. <Ref. to CO(H4DO(w/o HEV))-16, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

2. CVTF COOLER (WITH WARMER FEATURE) SIDE

• Gasoline engine model

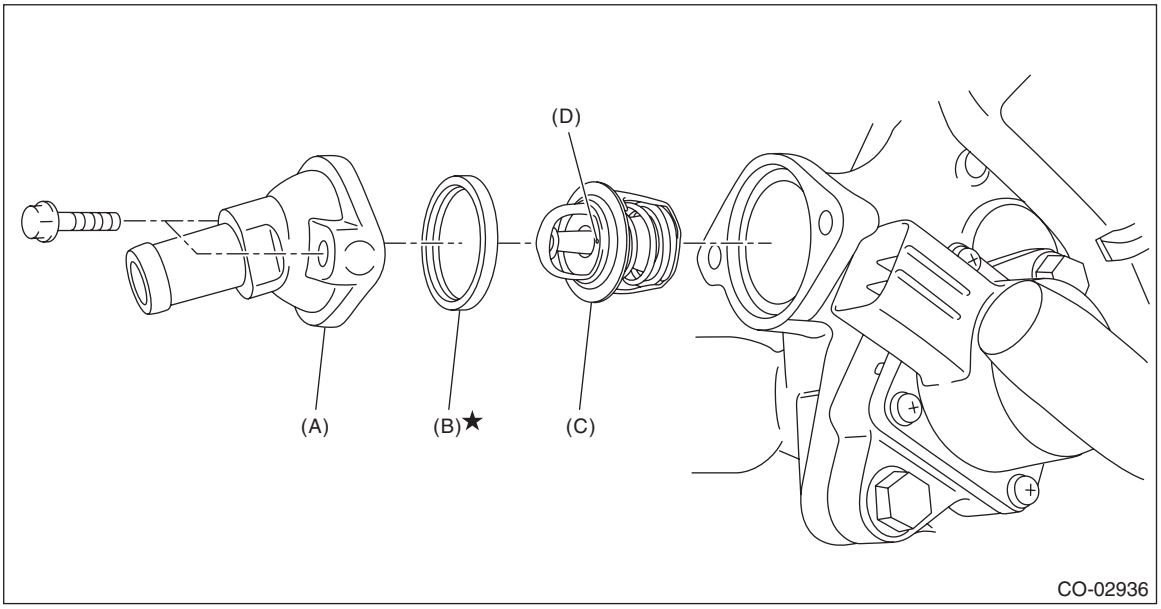
1) Install a gasket to thermostat.

NOTE:
Use a new gasket.

2) Install the thermostat and thermostat cover.

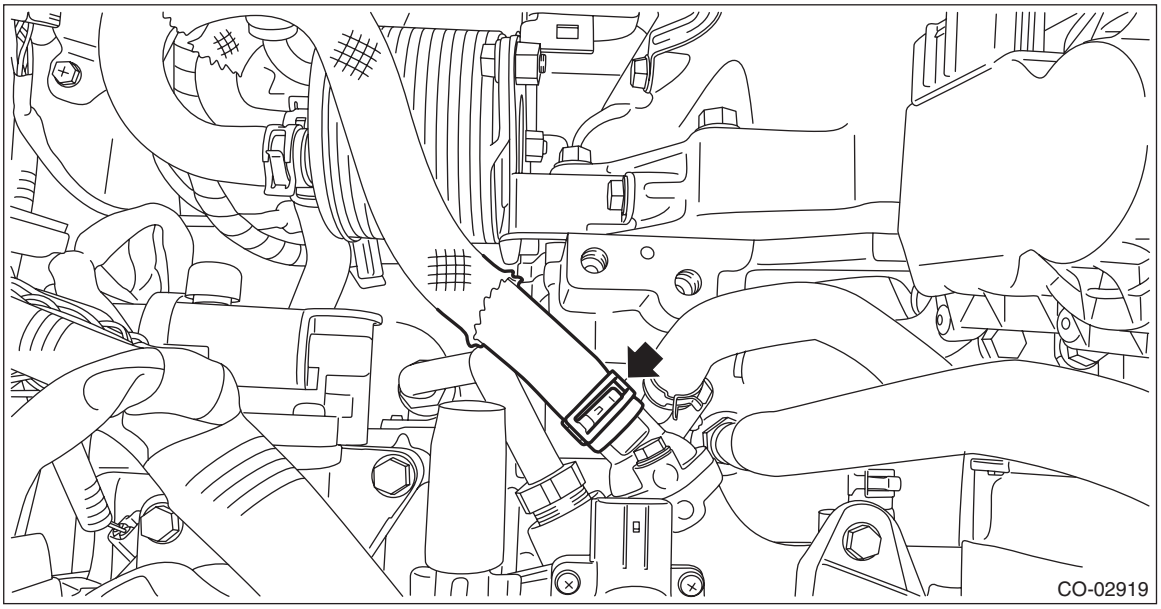
NOTE:
Install the parts with the air vent hole facing upward.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



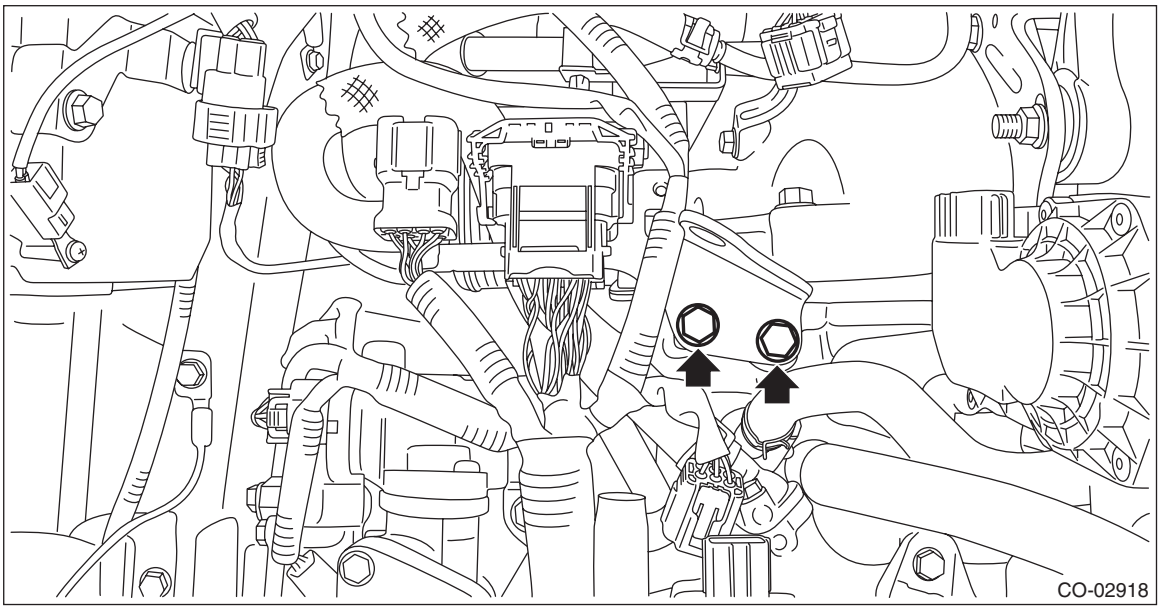
(A) Thermostat cover (B) Gasket (C) Thermostat
(D) Air vent hole

3) Connect the engine coolant hose to the thermostat cover.

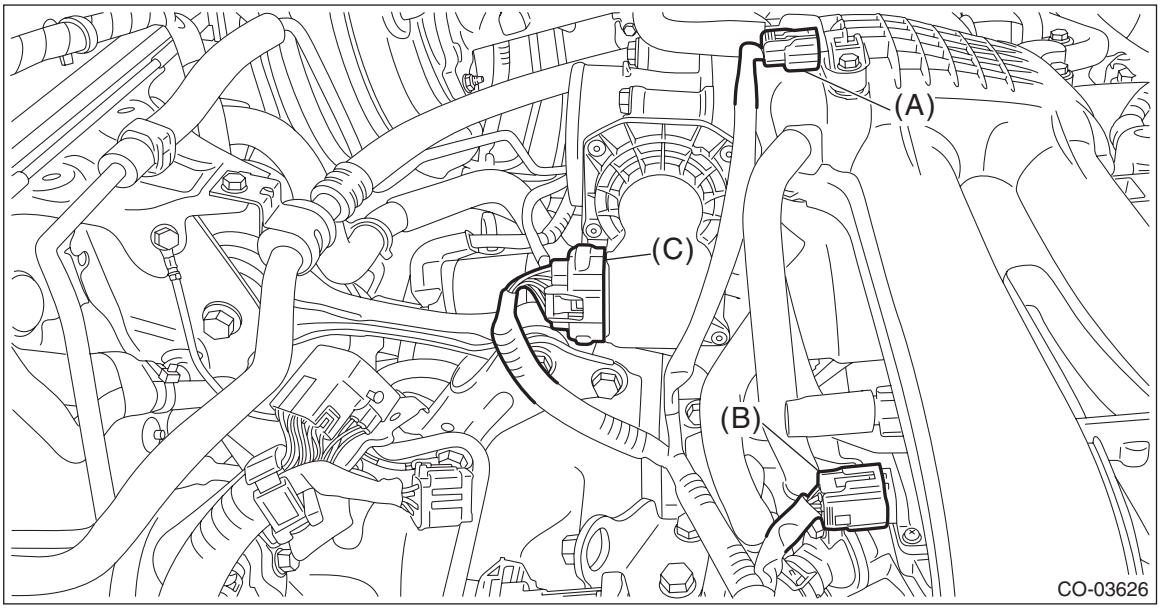


4) Install the engine hanger to the cylinder block RH.

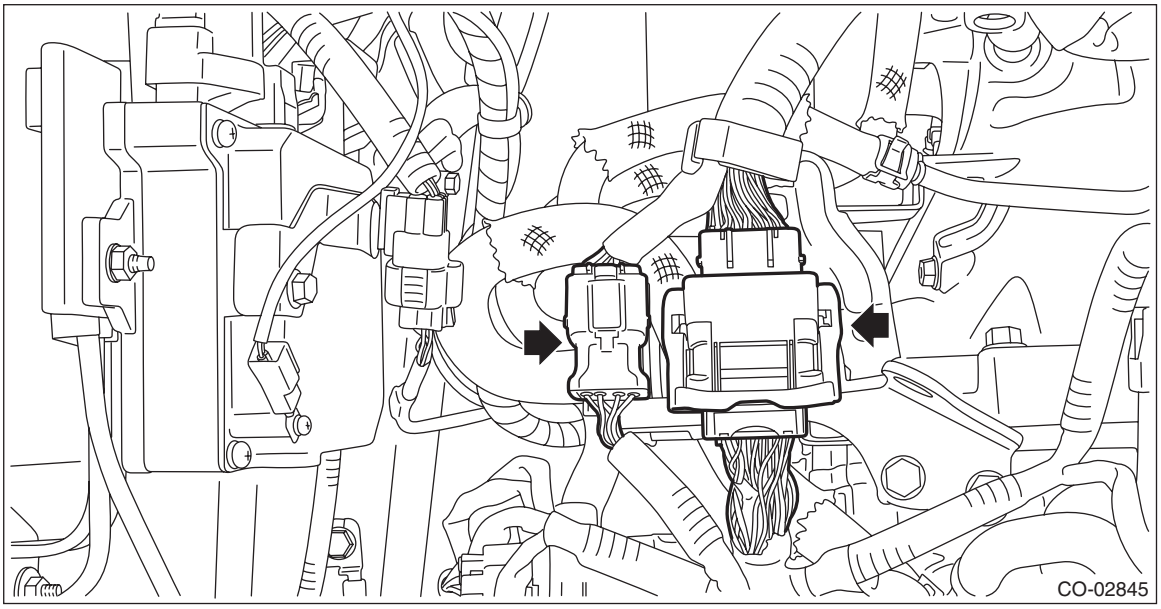
Tightening torque:
21 N·m (2.1 kgf-m, 15.5 ft-lb)



5) Connect the connector (A) to the manifold absolute pressure sensor.
6) Connect the connector (B) to the throttle position sensor.
7) Connect the connector (C) to the EGR control valve.

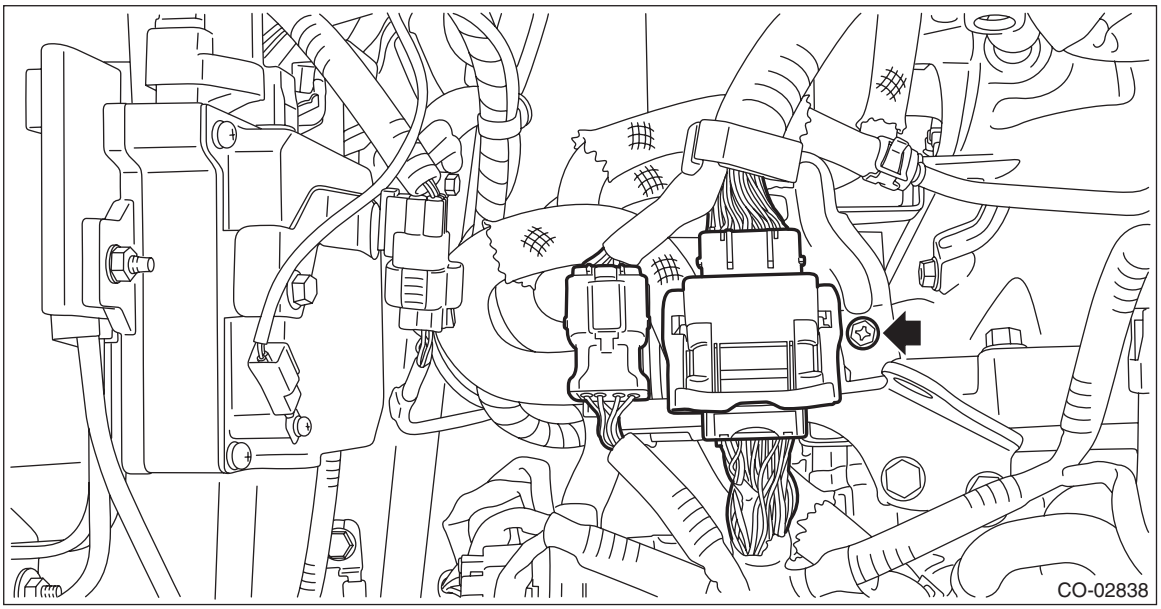


8) Connect the engine harness connector.
(1) Connect the bulkhead harness connector to the engine harness connector (black) and engine harness connector (brown).



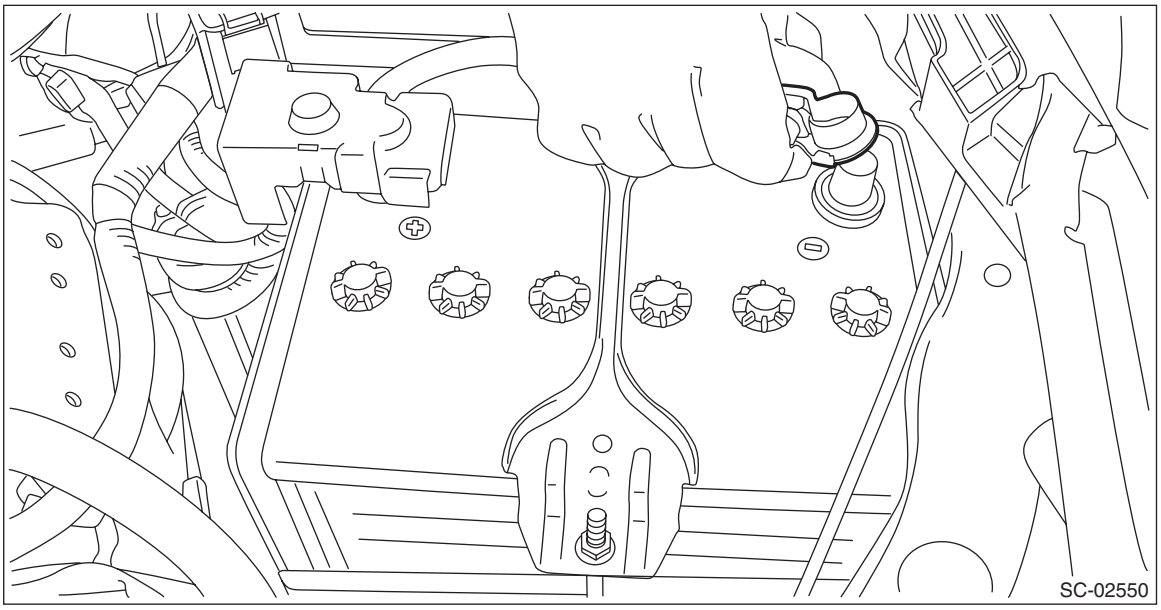
(2) Install the bolt which secures the bulkhead harness connector bracket.

Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



9) Install the air intake boot. <Ref. to IN(H4DO(w/o HEV))-12, INSTALLATION, Air Intake Boot.>
10) Lift up the vehicle.
11) Install the under cover. <Ref. to EI-32, INSTALLATION, Front Under Cover.>
12) Lower the vehicle.

13) Connect the battery ground terminal.



14) Fill engine coolant. <Ref. to CO(H4DO(w/o HEV))-16, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

- **HEV model**

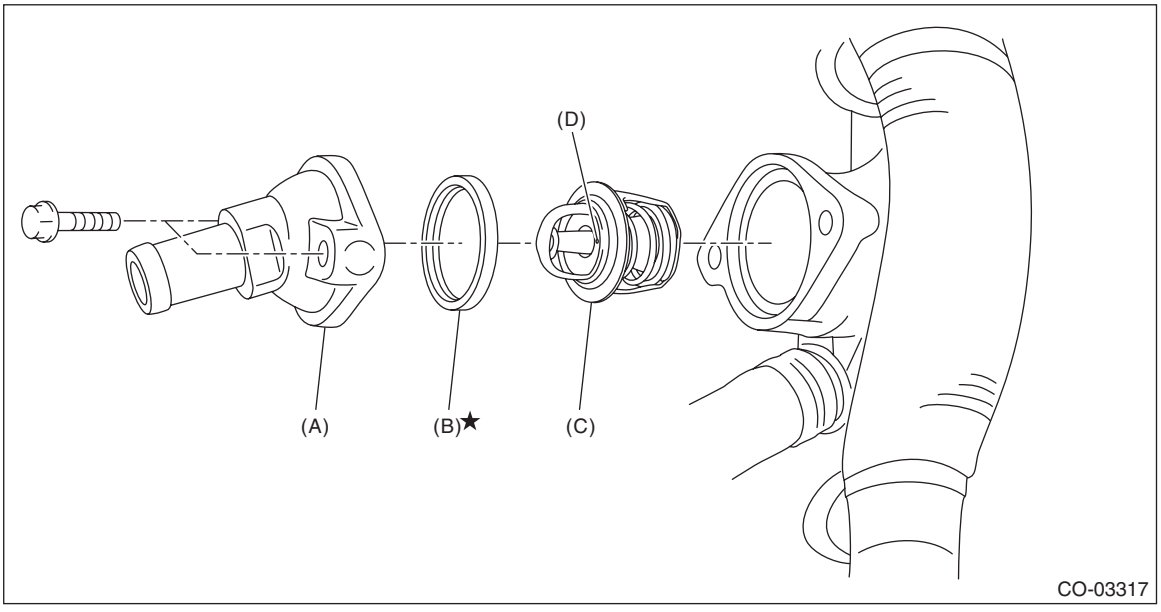
1) Install a gasket to thermostat.

NOTE:
Use a new gasket.

2) Install the thermostat and thermostat cover.

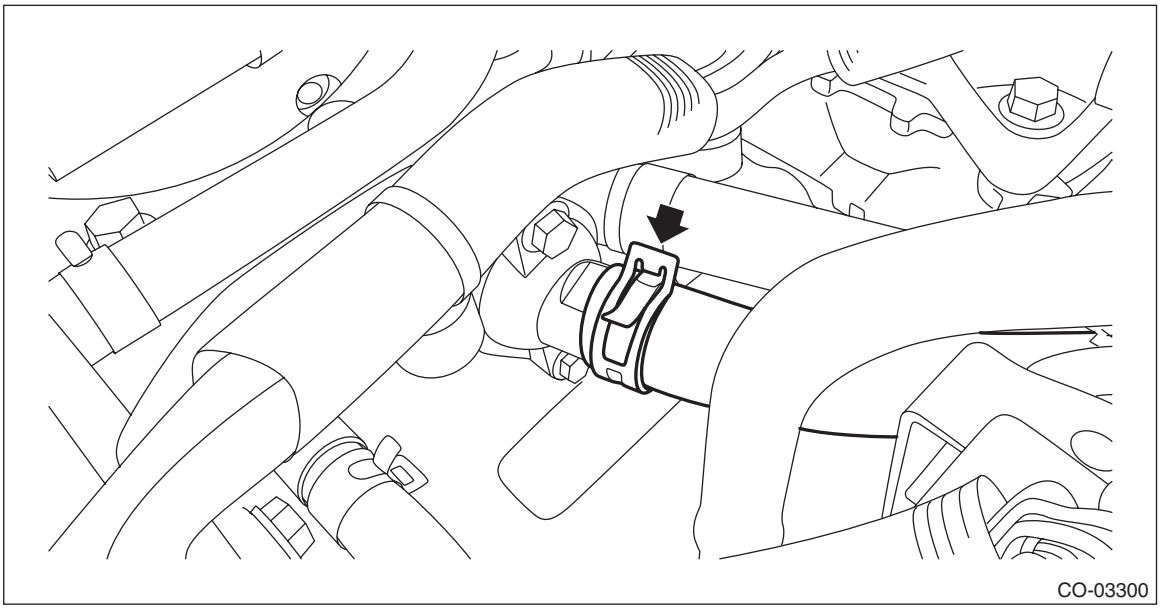
NOTE:
Install the parts with the air vent hole facing upward.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



(A) Thermostat cover
(B) Gasket
(C) Thermostat
(D) Air vent hole

3) Connect the engine coolant hose to the thermostat cover.



4) Install the intake manifold. <Ref. to FU(H4DO(HEV))-25, INSTALLATION, Intake Manifold.>
5) Install the collector cover.
6) Lift up the vehicle.
7) Install the under cover. <Ref. to EI-32, INSTALLATION, Front Under Cover.>
8) Lower the vehicle.
9) Connect the battery ground terminal. <Ref. to NT-5, BATTERY, NOTE, Note.>
10) Fill engine coolant. <Ref. to CO(H4DO(w/o HEV))-16, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

C: INSPECTION

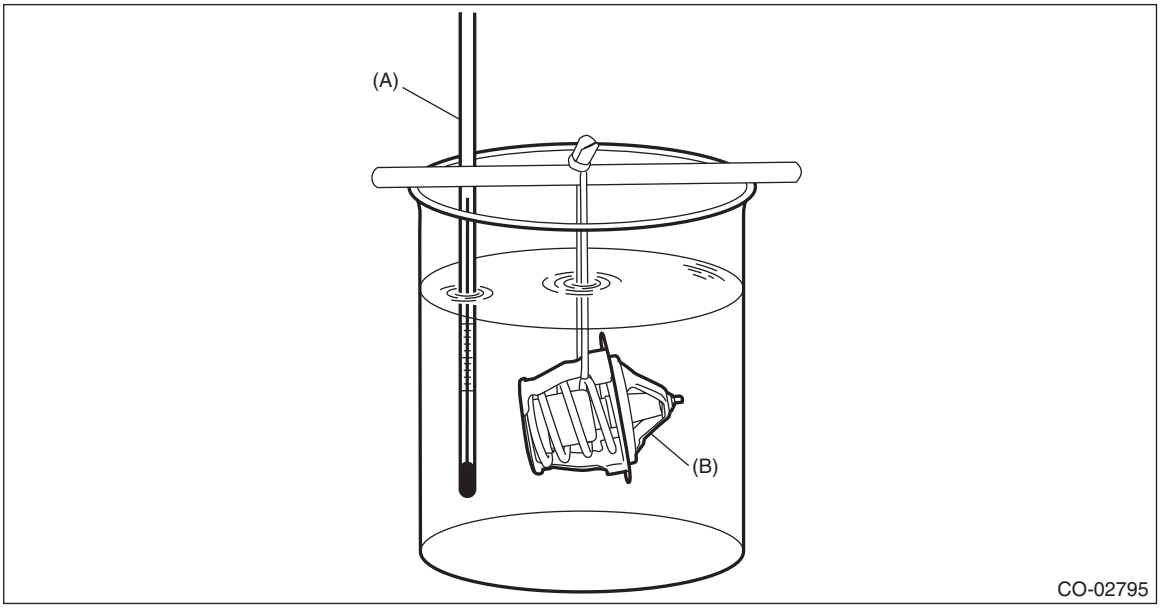
1) Check that the thermostat does not have deformation, cracks or damage.
2) Check that the thermostat valve closes completely at an ambient temperature.
3) Immerse the thermostat and a thermometer in water. Raise water temperature gradually, and check the temperature and valve lift when the valve begins to open and when the valve is fully opened. Replace the thermostat if faulty.

NOTE:
- During the test, agitate the water for even temperature distribution.
- Leave the thermostat in the boiling water for five minutes or more before measuring the valve lift.
- Hold the thermostat with a wire or the like to avoid contacting with container bottom.

Starting temperature to open:
Engine side
Gasoline engine model
90 — 94°C (194 — 201°F)
HEV model
87 — 91°C (189 — 196°F)
CVTF cooler (with warmer feature) side
48 — 52°C (118 — 126°F)

Full open temperature:
Engine side
Gasoline engine model
100°C (212°F)
HEV model
98°C (208°F)
CVTF cooler (with warmer feature) side
63°C (145°F)

Total valve lift:
Engine side
8.0 mm (0.315 in) or more
CVTF cooler (with warmer feature) side
6.0 mm (0.236 in) or more



(A) Thermometer (B) Thermostat

7. Radiator

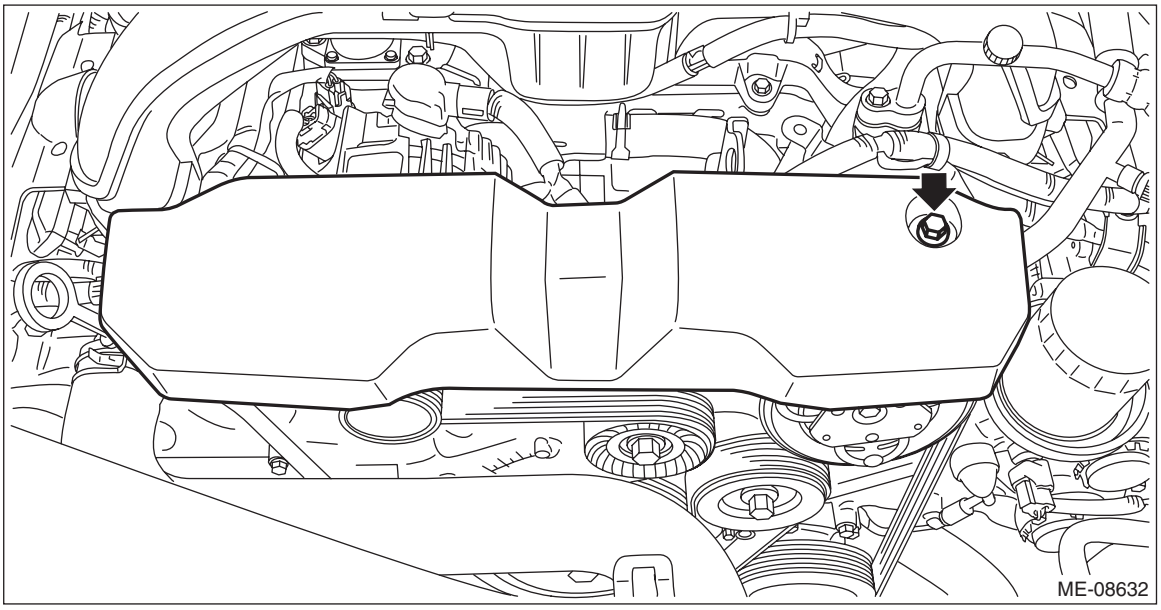
A: REMOVAL

CAUTION:
The radiator is pressurized when the engine and radiator are hot. Wait until engine and radiator cool down before working on the radiator.

1) Disconnect the ground cable from battery. <Ref. to NT-5, BATTERY, NOTE, Note.>

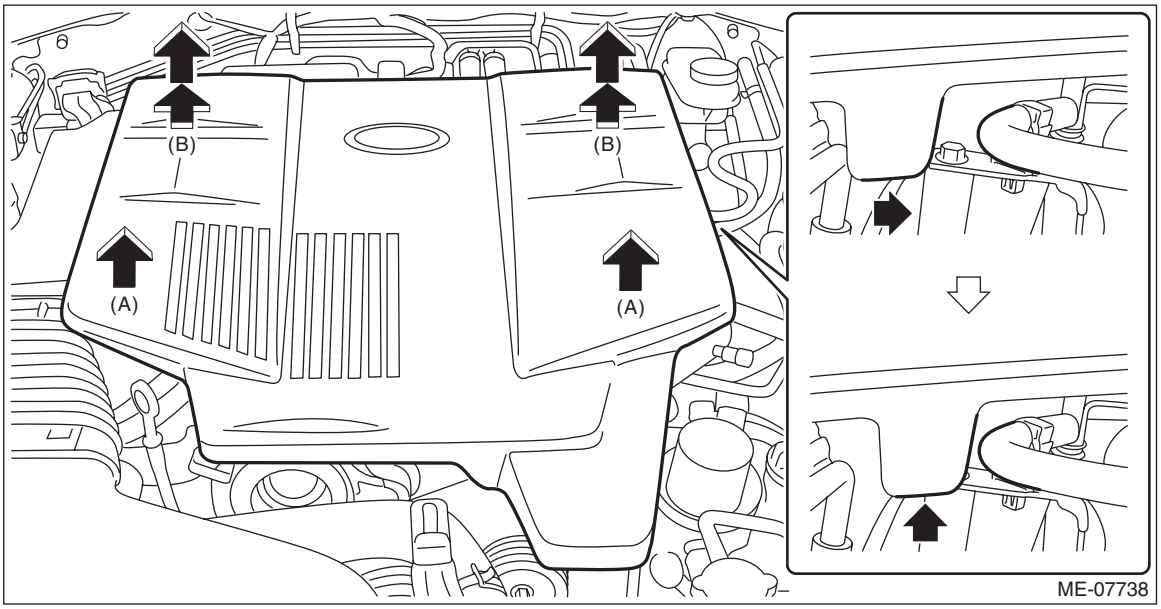
NOTE:
For the 12 volt engine restart battery of HEV model, disconnect the ground terminal from 12V engine restart battery sensor.

2) Remove the V-belt covers. (Gasoline engine model)



3) Remove the collector cover. (HEV model)
   (1) Carefully pull up the front of collector cover at two positions (A).
   (2) Carefully pull up the rear of collector cover at two positions (B) while moving it backward.

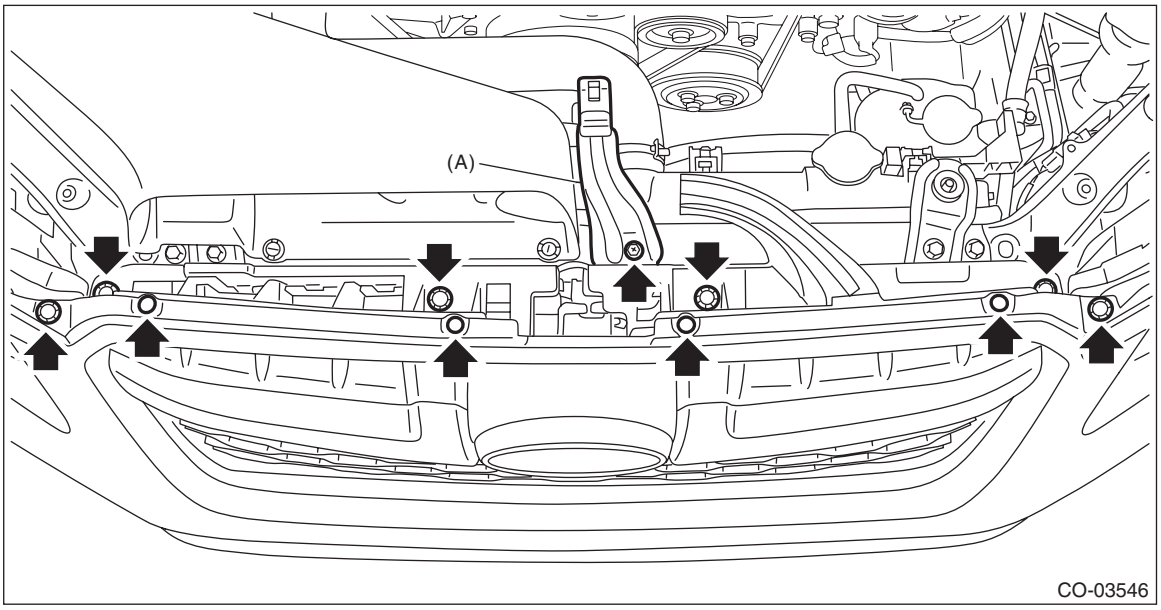
NOTE:
Be careful not to contact the fuel delivery tube when moving the collector cover rearward.



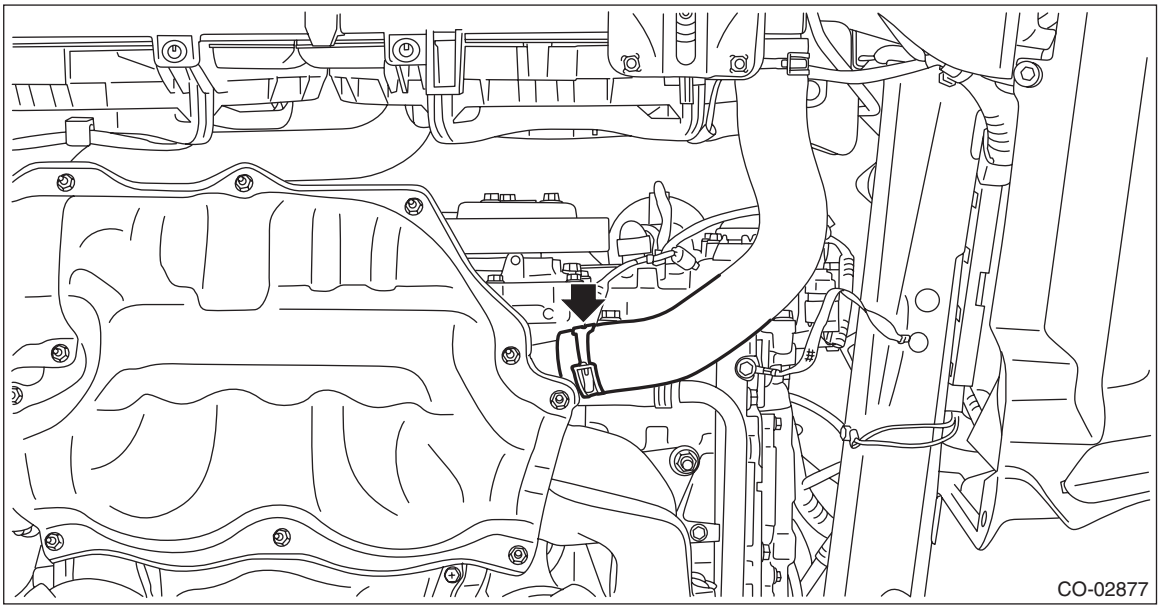
4) Remove the grille bracket.

NOTE:
Remove the ten clips.

5) Remove the bolts, and remove the bracket - plate (A).

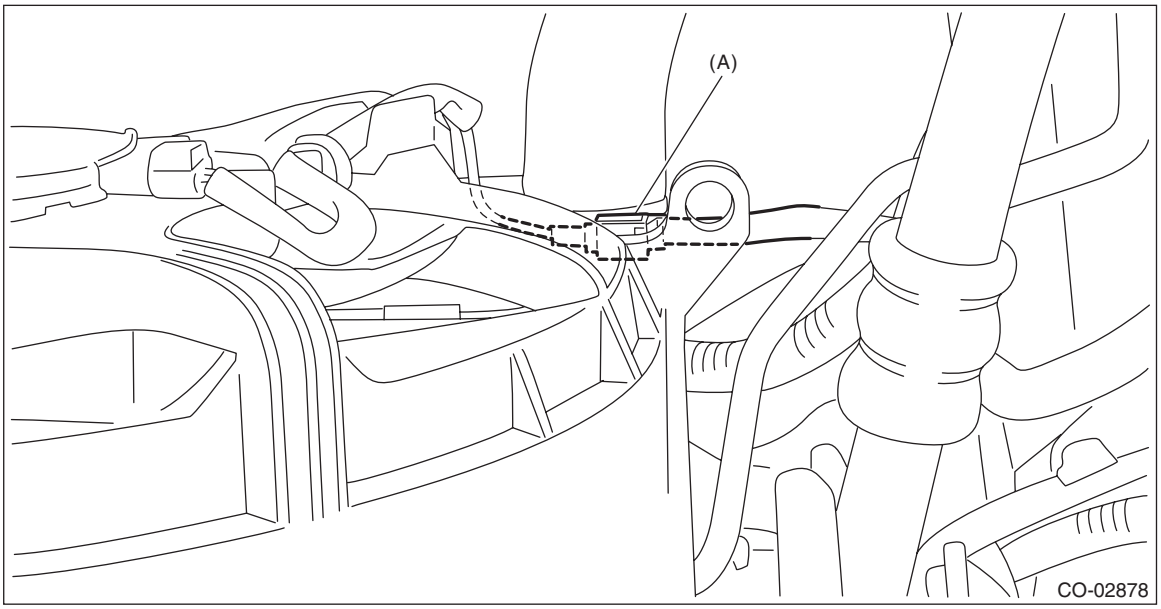


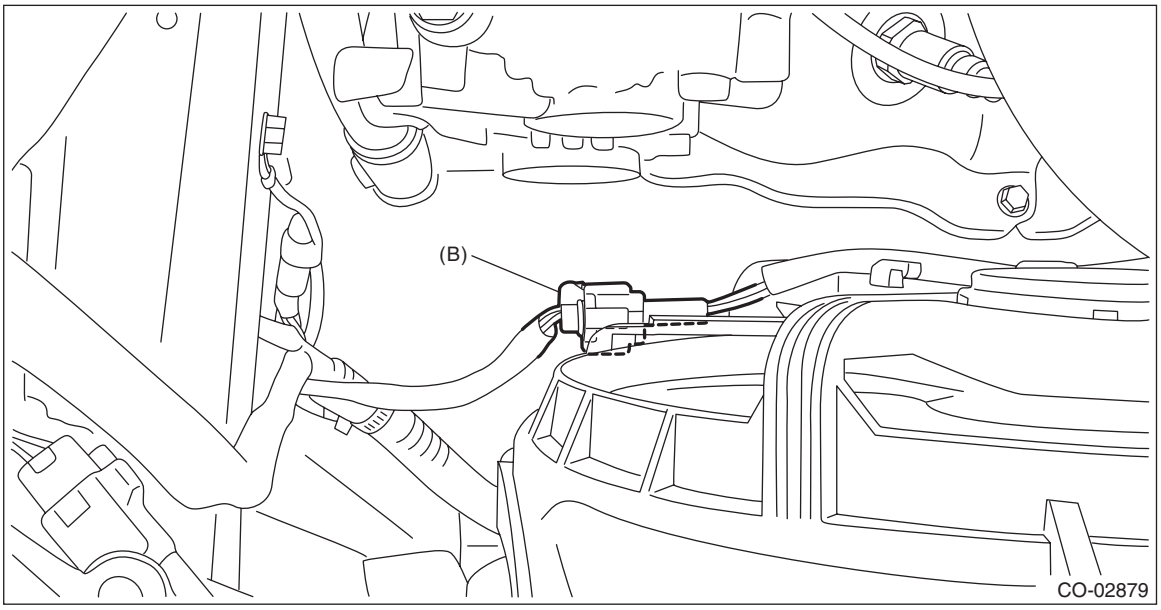
6) Lift up the vehicle.
7) Remove the under cover. <Ref. to EI-32, REMOVAL, Front Under Cover.>
8) Drain engine coolant. <Ref. to CO(H4DO(w/o HEV))-16, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
9) Disconnect the radiator outlet hose from thermostat cover.



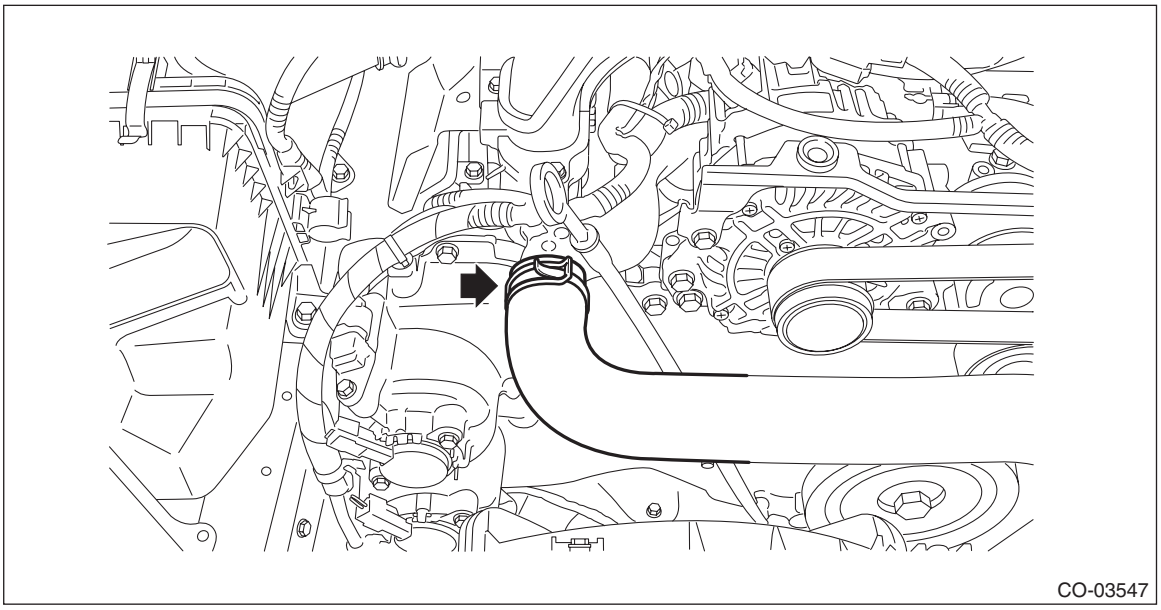
10) Lower the vehicle.
11) Remove the air intake duct. <Ref. to IN(H4DO(w/o HEV))-13, REMOVAL, Air Intake Duct.> <Ref. to IN(H4DO(HEV))-15, REMOVAL, Air Intake Duct.>
12) Remove the air intake boot No. 1. (HEV model) <Ref. to IN(H4DO(HEV))-10, AIR INTAKE BOOT NO. 1, REMOVAL, Air Intake Boot.>
13) Remove the reservoir tank. <Ref. to CO(H4DO(w/o HEV))-97, REMOVAL, Reservoir Tank.>

14) Disconnect the connector (A) from the main fan motor assembly and the connector (B) from the sub fan motor assembly.

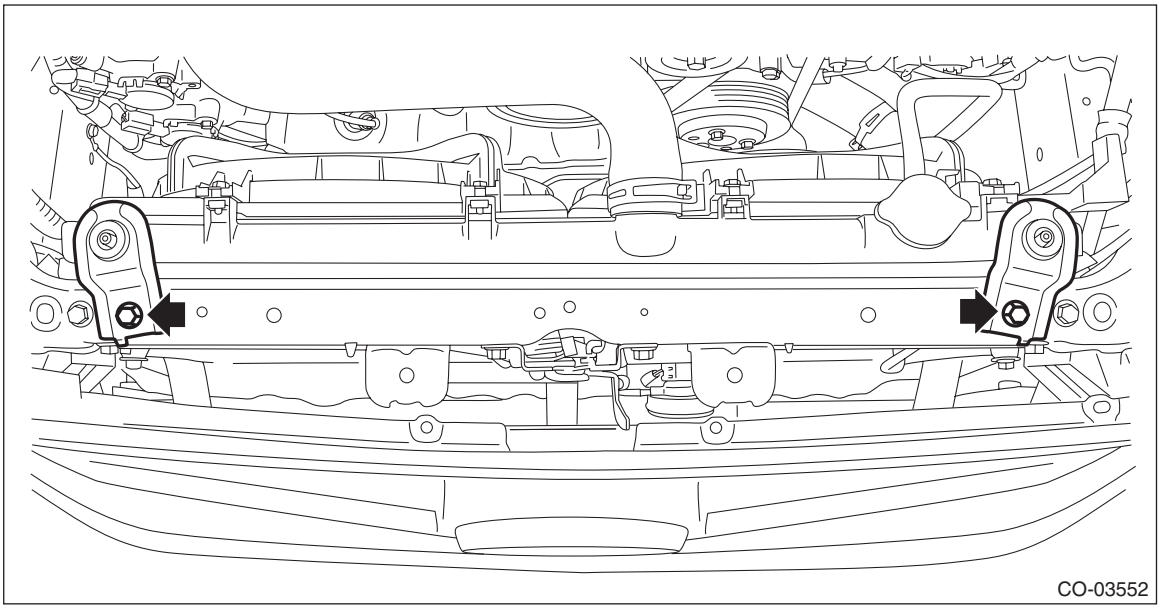




15) Disconnect the radiator inlet hose from the water pipe assembly.

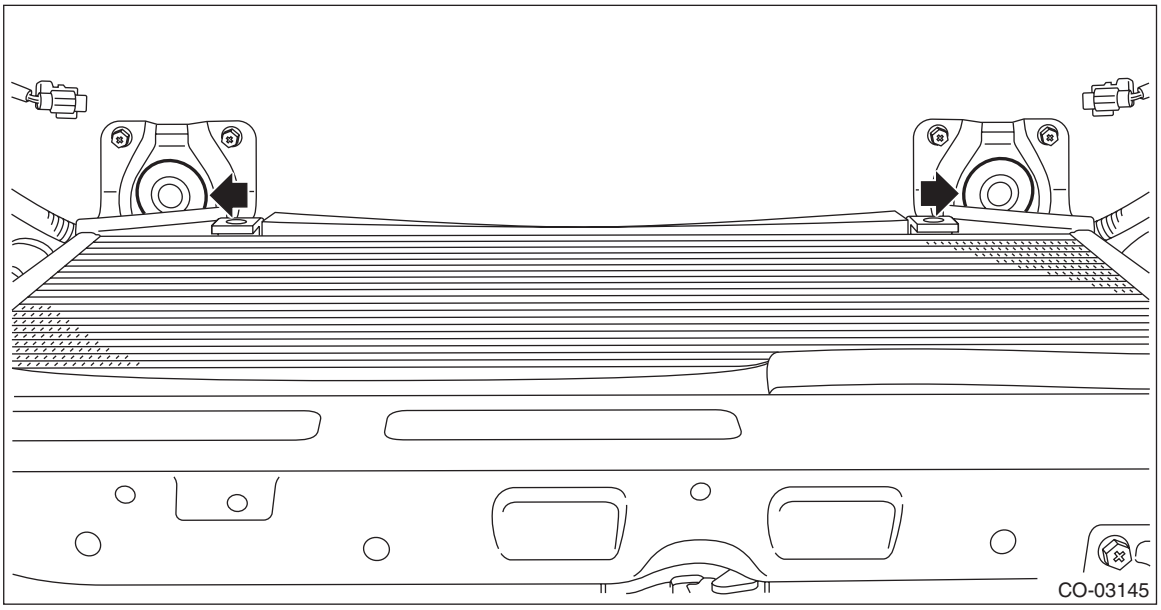


16) Remove the radiator upper brackets.



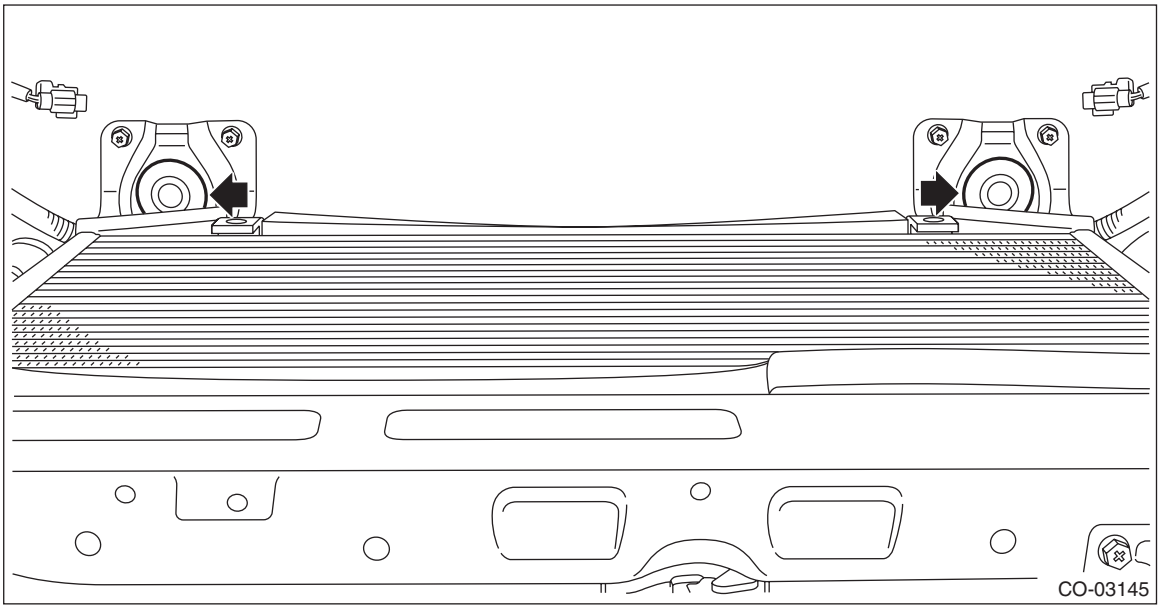
17) Remove the radiator from vehicle.

18) Remove the radiator lower cushion from the radiator lower bracket.



B: INSTALLATION

1) Attach the radiator lower cushion to the radiator lower bracket.

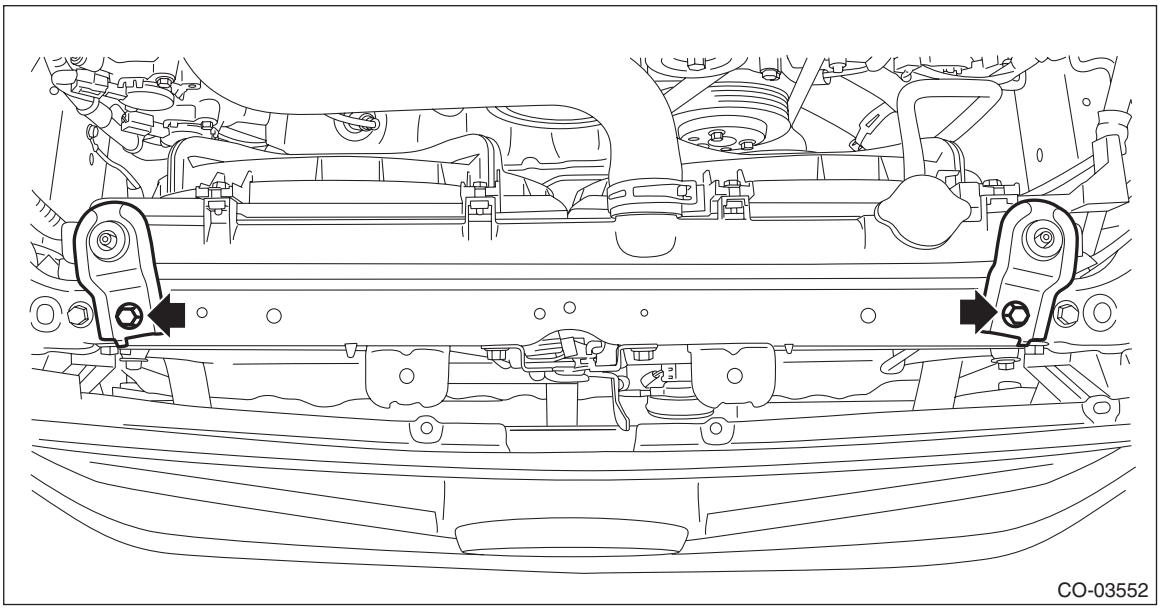


2) Install the radiator to vehicle.

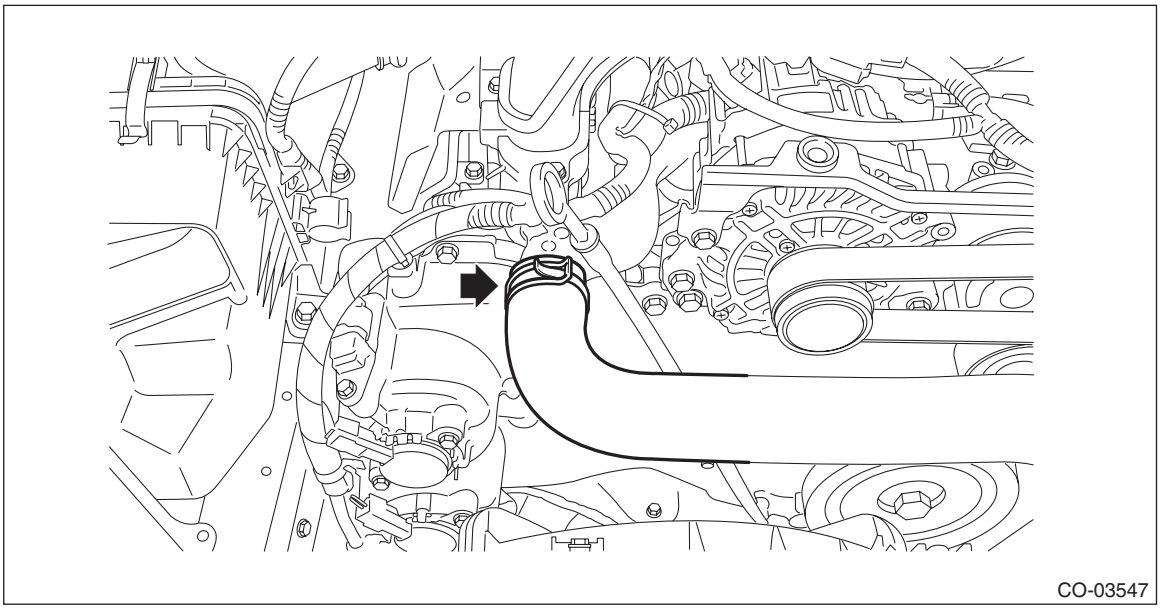
NOTE:
Make pins on the lower side of radiator be fitted into the radiator lower cushions.

3) Install the radiator upper brackets.

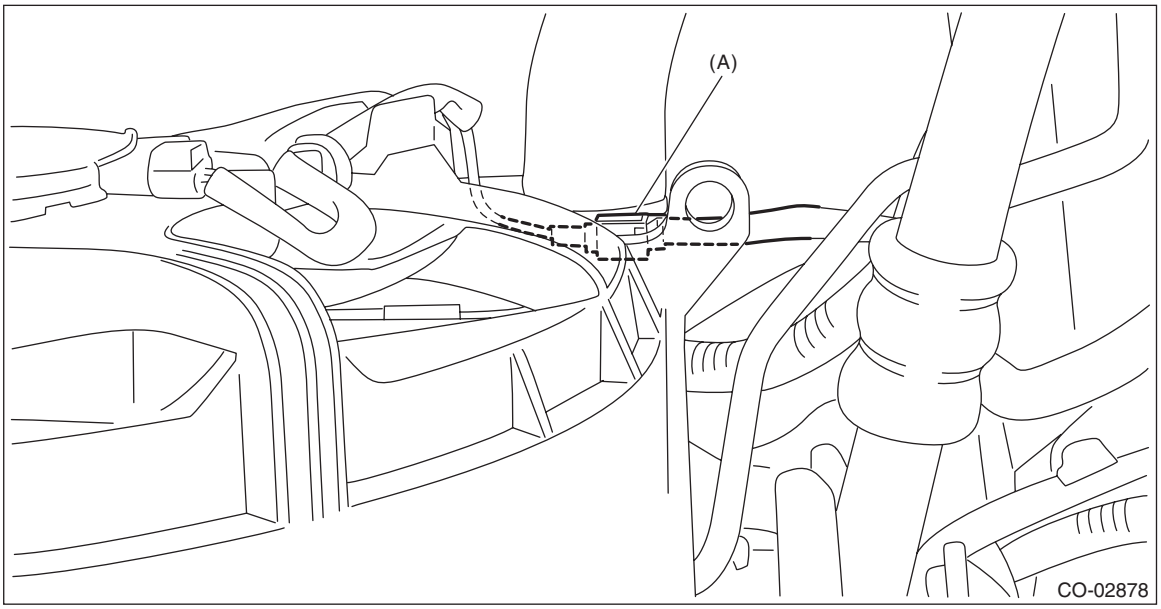
Tightening torque:
12 N·m (1.2 kgf-m, 8.9 ft-lb)

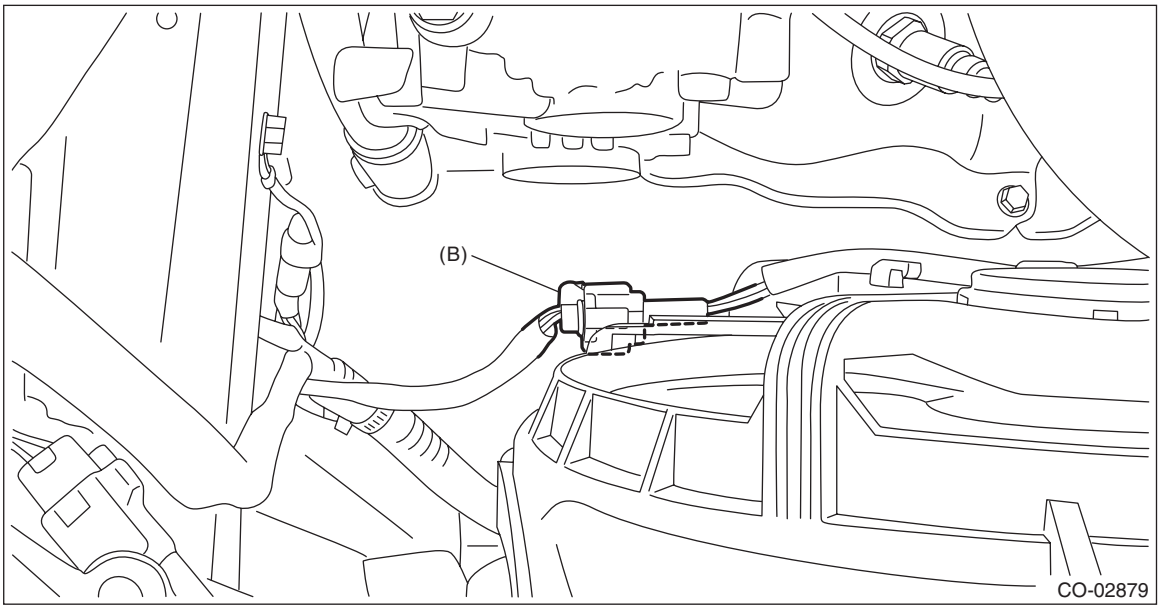


4) Connect the radiator inlet hose to the water pipe assembly.



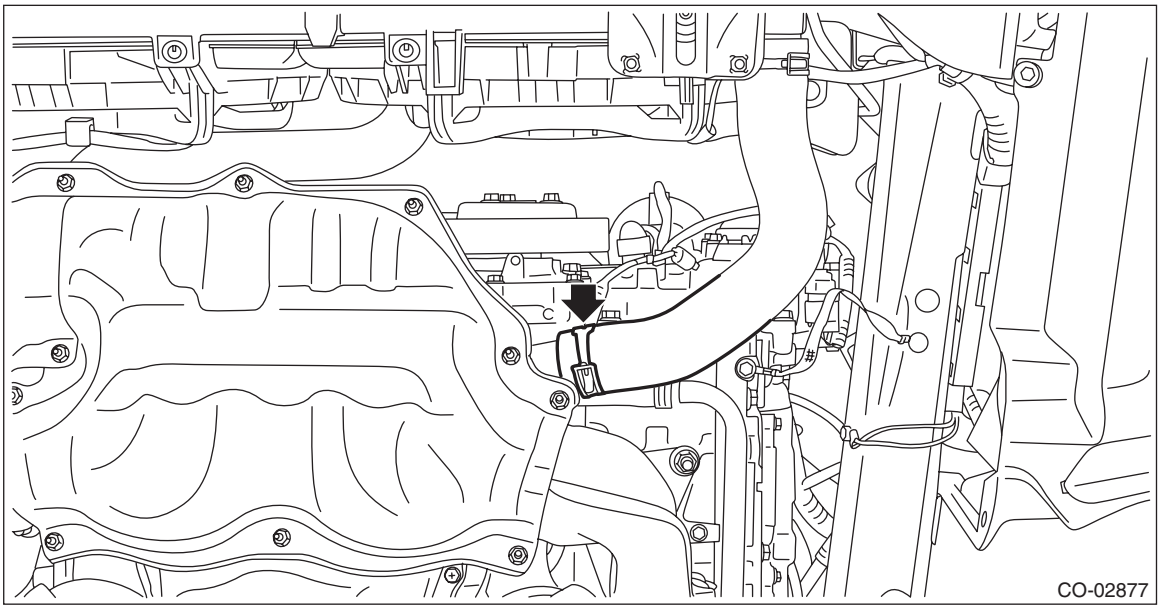
5) Connect the connector (A) to the main fan motor assembly and the connector (B) to the sub fan motor assembly.





6) Install the reservoir tank. <Ref. to CO(H4DO(w/o HEV))-97, INSTALLATION, Reservoir Tank.>
7) Install the air intake boot No. 1. (HEV model) <Ref. to IN(H4DO(HEV))-13, AIR INTAKE BOOT NO. 1, INSTALLATION, Air Intake Boot.>
8) Install the air intake duct. <Ref. to IN(H4DO(w/o HEV))-13, INSTALLATION, Air Intake Duct.> <Ref. to IN(H4DO(HEV))-15, INSTALLATION, Air Intake Duct.>
9) Lift up the vehicle.

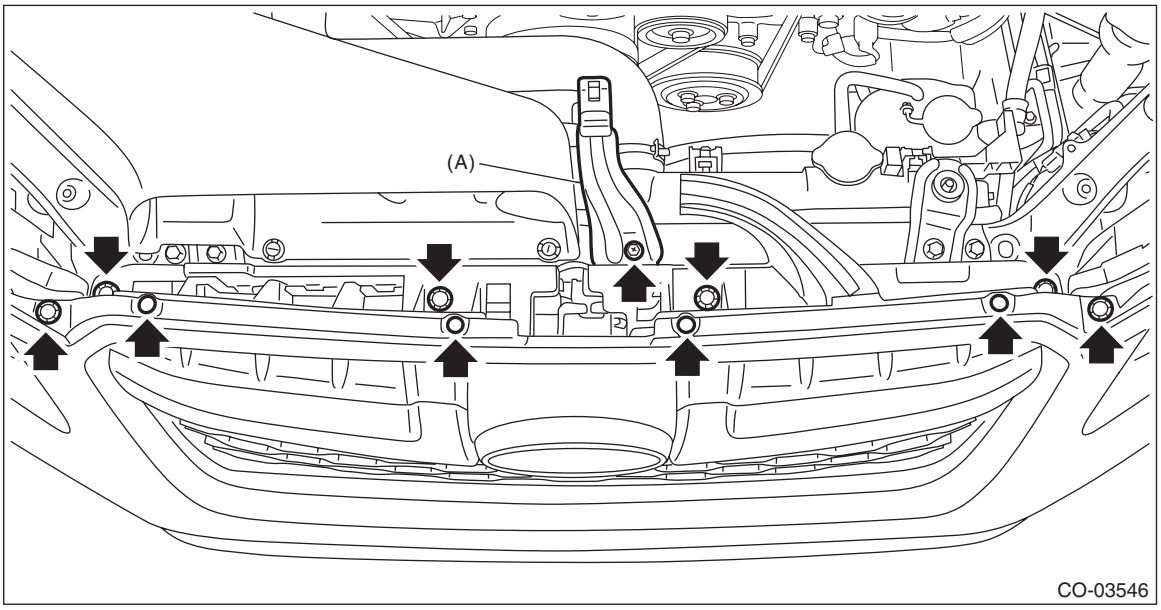
10) Connect the radiator outlet hose to thermostat cover.



11) Install the under cover. <Ref. to EI-32, INSTALLATION, Front Under Cover.>
12) Lower the vehicle.
13) Attach the bracket - plate (A).

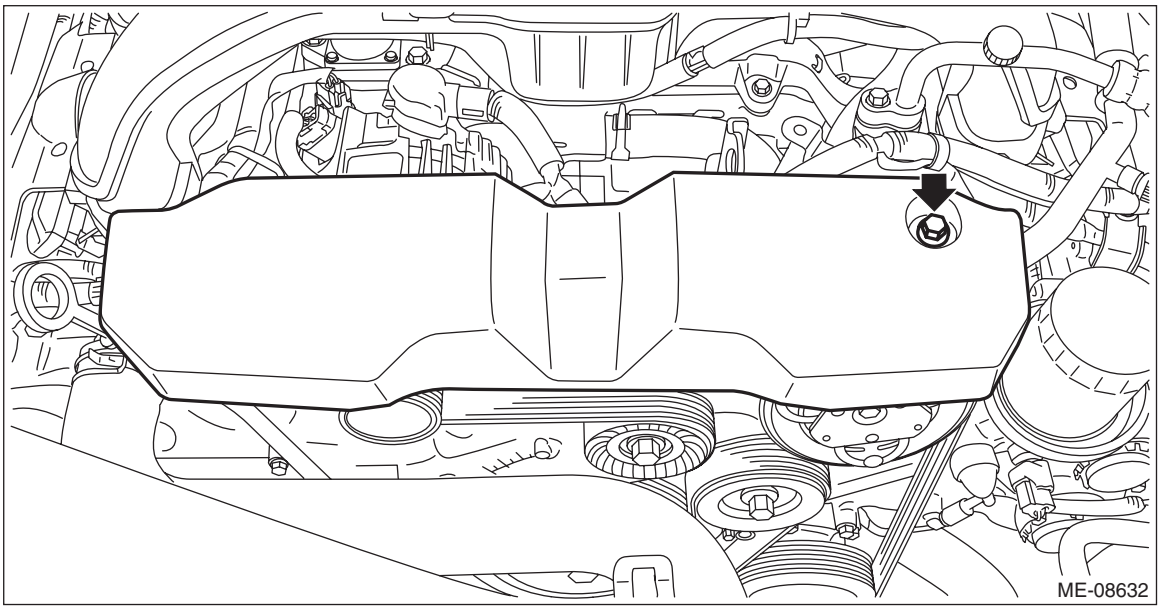
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

14) Attach the grille bracket.



15) Install the V-belt cover. (Gasoline engine model)

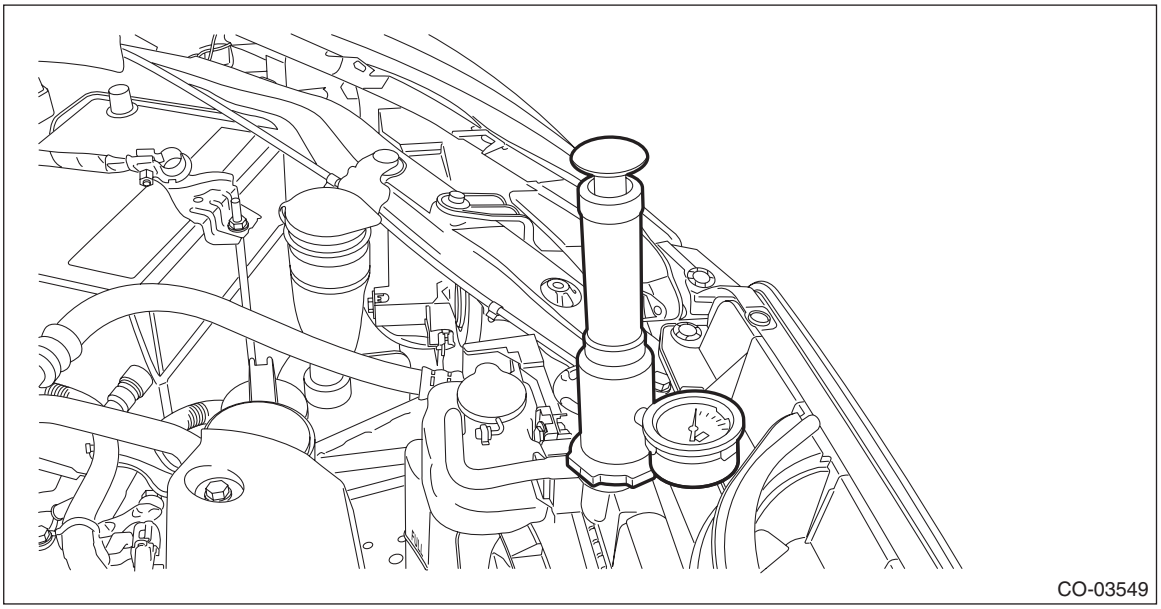
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



16) Install the collector cover. (HEV model)
17) Connect the battery ground terminal. <Ref. to NT-5, BATTERY, NOTE, Note.>
18) Fill engine coolant. <Ref. to CO(H4DO(w/o HEV))-16, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

C: INSPECTION

1) Check that the radiator does not have deformation, cracks or damage.
2) Check that the hose has no cracks, damage or loose part.
3) Remove the radiator cap, fill the radiator with engine coolant, and then install the radiator cap tester to the filler neck of radiator.



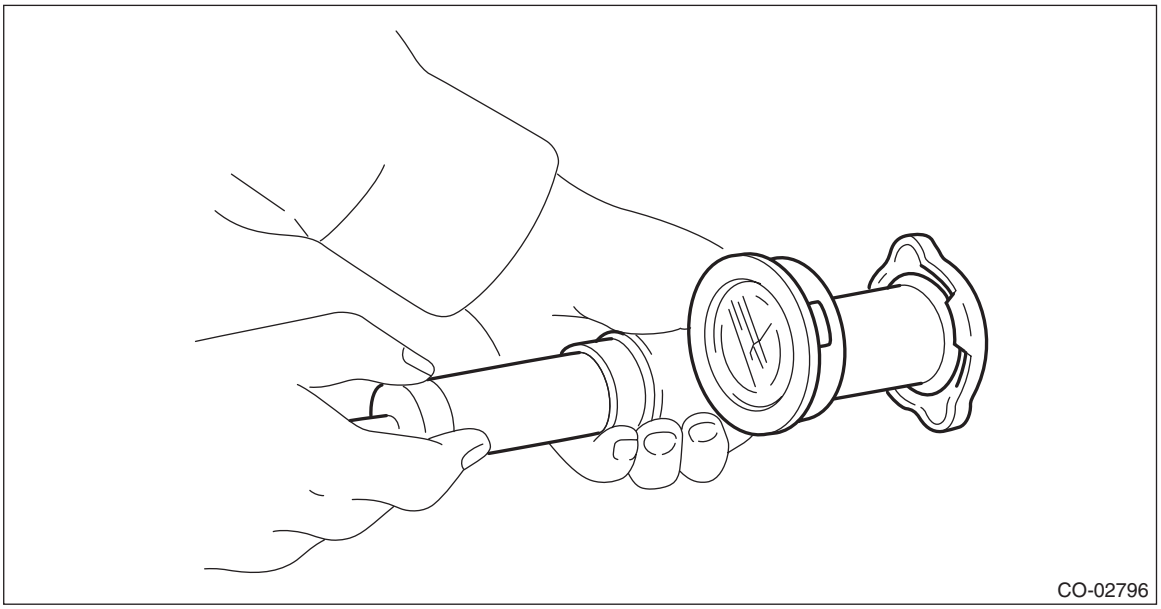
4) Apply a pressure of 157 kPa (1.6 kg/cm^2, 23 psi) to the radiator, and check the following items.

CAUTION:
- **Engine should be turned off.**
- **Wipe engine coolant from check points in advance.**
- **Be careful not to deform the filler neck of radiator when installing and removing the radiator cap tester.**
- **Be careful of engine coolant from spurting out when removing the radiator cap tester.**
- Leakage from the radiator or its vicinity
- Leakage from the hose or its connections

8. Radiator Cap

A: INSPECTION

1) Check that the radiator cap does not have deformation, cracks or damage.
2) Attach the radiator cap tester to radiator cap.



3) Increase pressure until the radiator cap tester gauge needle stops. Radiator cap is functioning properly if it holds the service limit pressure for 5 — 6 seconds. Replace the radiator cap if its valve opens at less than the service limit.

CAUTION:
Be sure to remove foreign matter and rust from the cap in advance. Otherwise, results of pressure test will be incorrect.

Standard:
93 — 123 kPa (0.95 — 1.25 kg/cm^2, 14 — 18 psi)

Service limit:
83 kPa (0.85 kg/cm^2, 12 psi)

9. Radiator Main Fan and Fan Motor

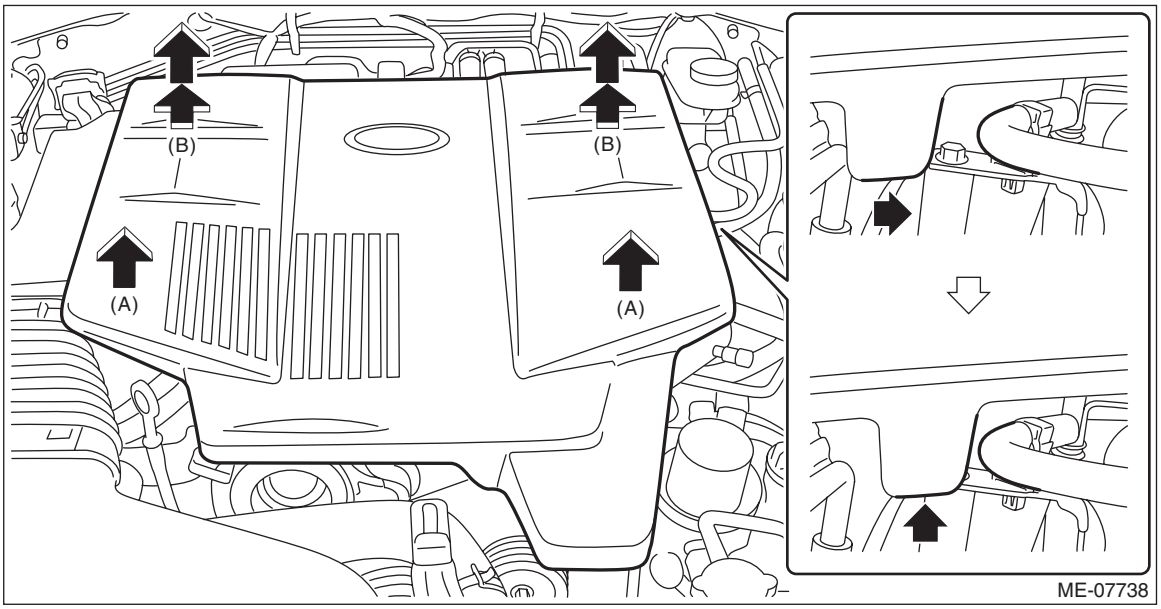
A: REMOVAL

1) Disconnect the ground cable from battery. <Ref. to NT-5, BATTERY, NOTE, Note.>

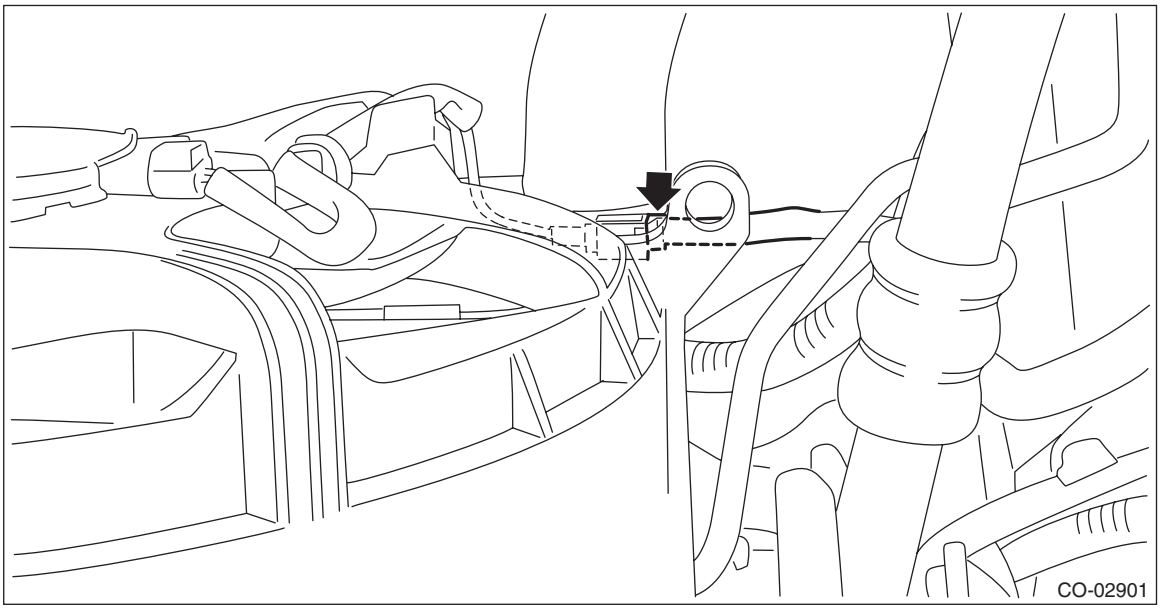
NOTE:
For the 12 volt engine restart battery of HEV model, disconnect the ground terminal from 12V engine restart battery sensor.

2) Remove the collector cover. (HEV model)
   (1) Carefully pull up the front of collector cover at two positions (A).
   (2) Carefully pull up the rear of collector cover at two positions (B) while moving it backward.

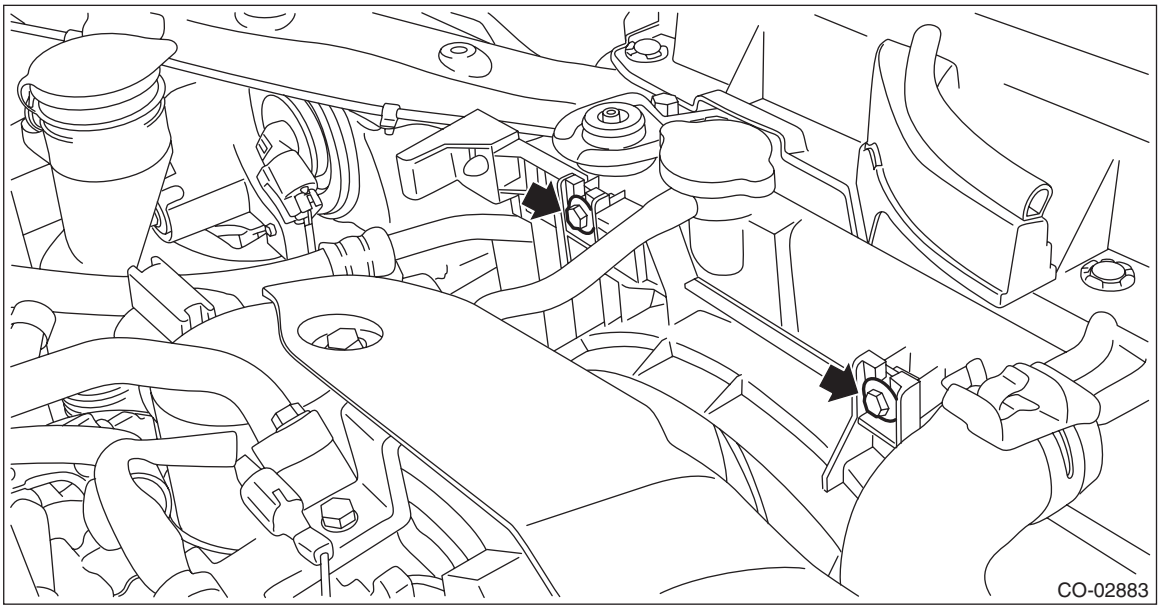
NOTE:
Be careful not to contact the fuel delivery tube when moving the collector cover rearward.



3) Remove the reservoir tank. <Ref. to CO(H4DO(w/o HEV))-97, REMOVAL, Reservoir Tank.>
4) Disconnect the connector from the main fan motor assembly.



5) Remove the bolts which hold the radiator main fan shroud onto the radiator.



6) Remove the radiator main fan and fan motor from the vehicle.

B: INSTALLATION

Install in the reverse order of removal.

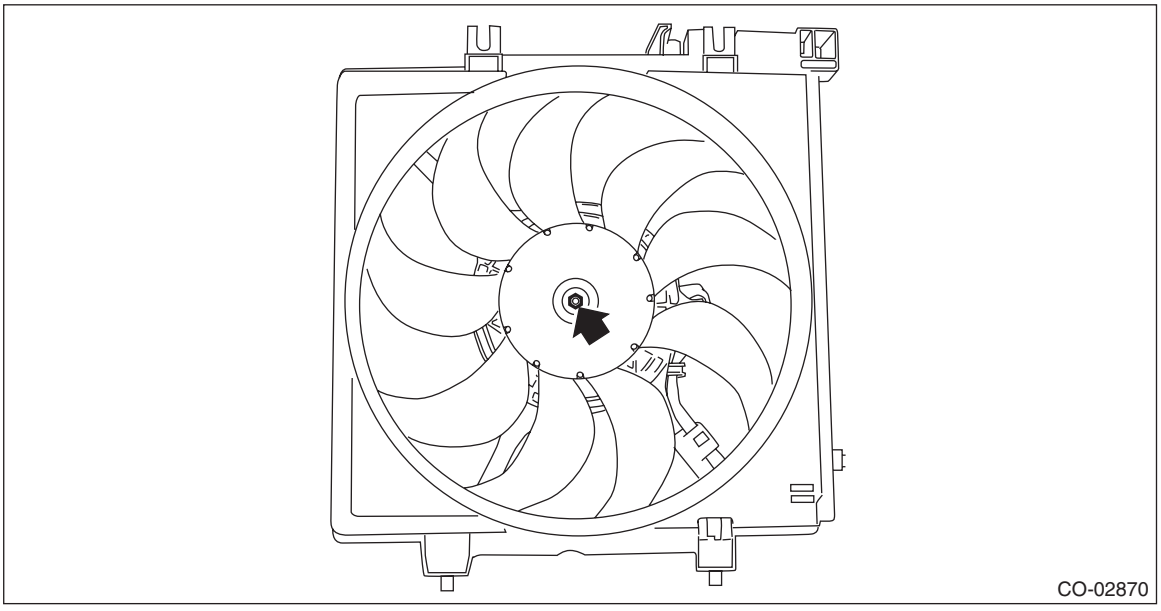
CAUTION:
Confirm that the radiator hose is securely connected.

NOTE:
If the installation of the radiator main fan and fan motor is difficult, attempt installation after loosening the bolts which hold the radiator sub fan shroud to the radiator.

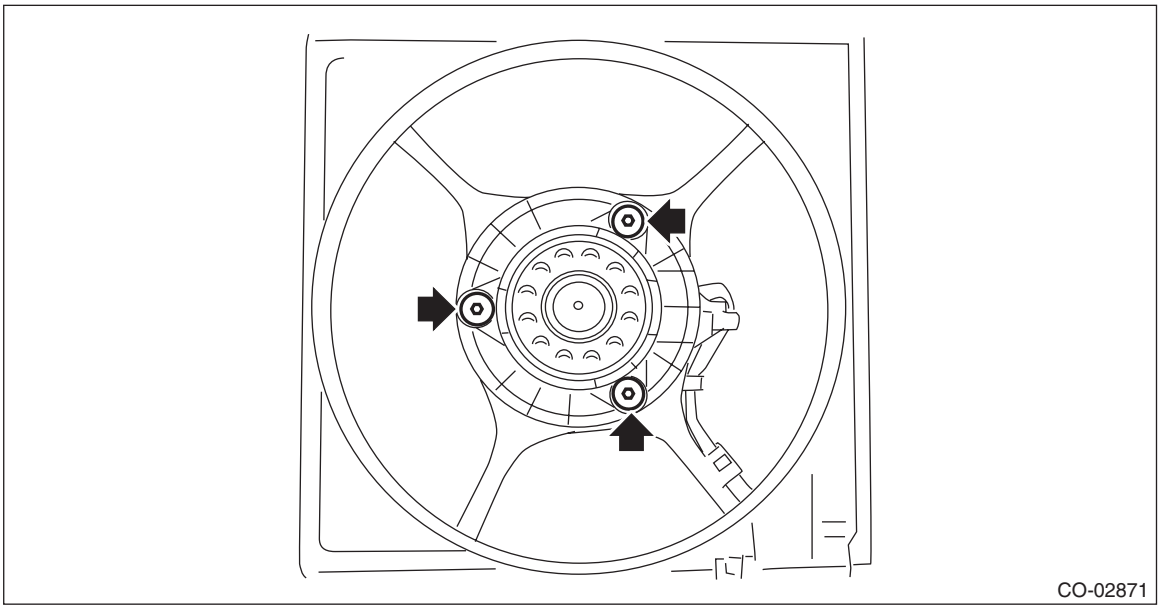
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

C: DISASSEMBLY

1) Remove the clip which holds the main fan motor connector onto the radiator main fan shroud.
2) Disconnect the radiator main fan from the main fan motor.



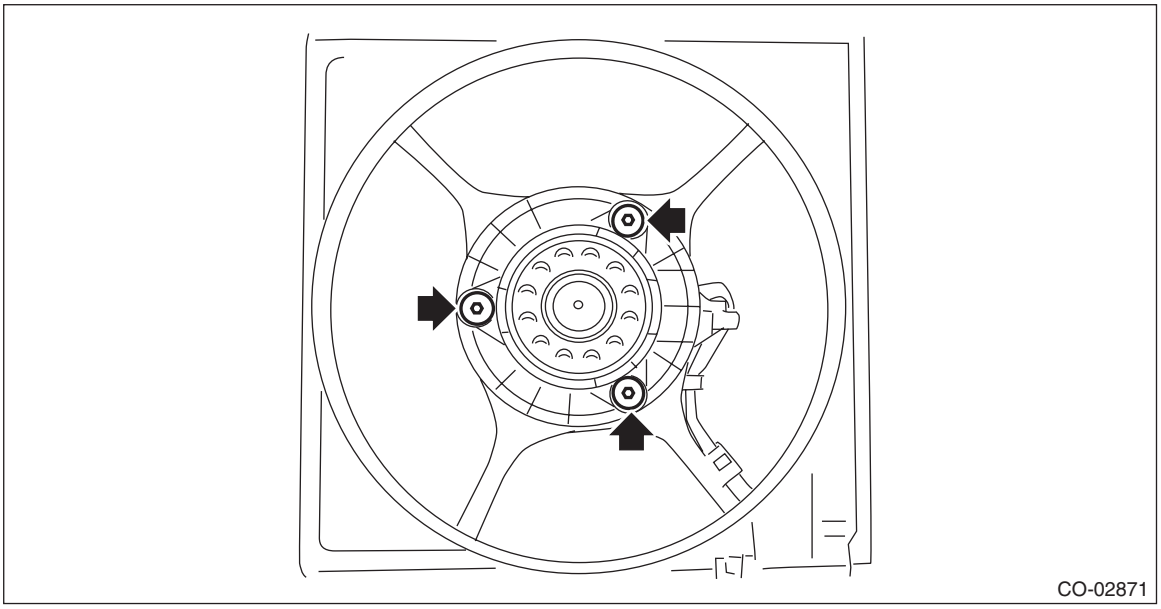
3) Disconnect the main fan motor from the radiator main fan shroud.



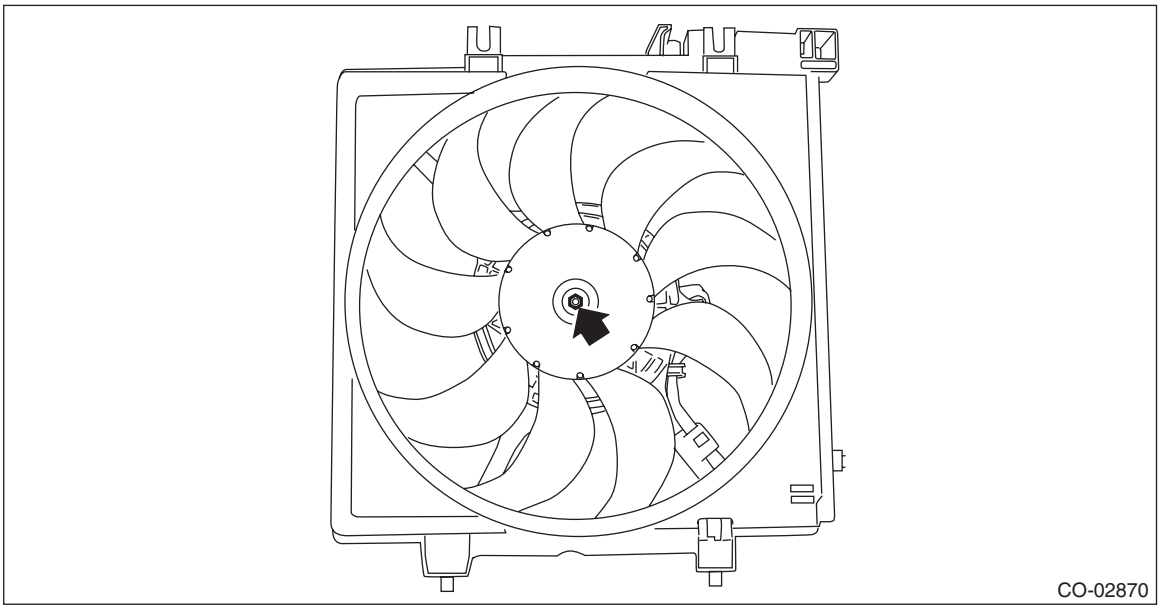
D: ASSEMBLY

Assemble in the reverse order of disassembly.

Tightening torque:
4.41 N·m (0.45 kgf-m, 3.25 ft-lb)



Tightening torque:
3.4 N·m (0.3 kgf-m, 2.5 ft-lb)



E: INSPECTION

Check that the radiator main fan, radiator main fan shroud and main fan motor assembly do not have deformation, cracks or damage.

10.Radiator Sub Fan and Fan Motor

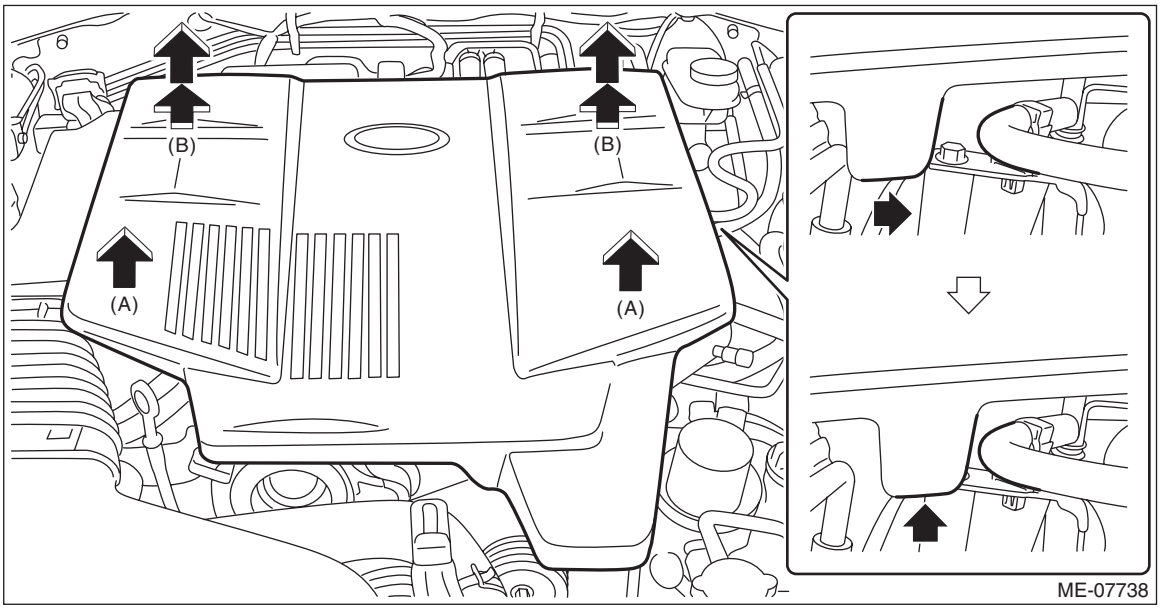
A: REMOVAL

1) Disconnect the ground cable from battery. <Ref. to NT-5, BATTERY, NOTE, Note.>

NOTE:
For the 12 volt engine restart battery of HEV model, disconnect the ground terminal from 12V engine restart battery sensor.

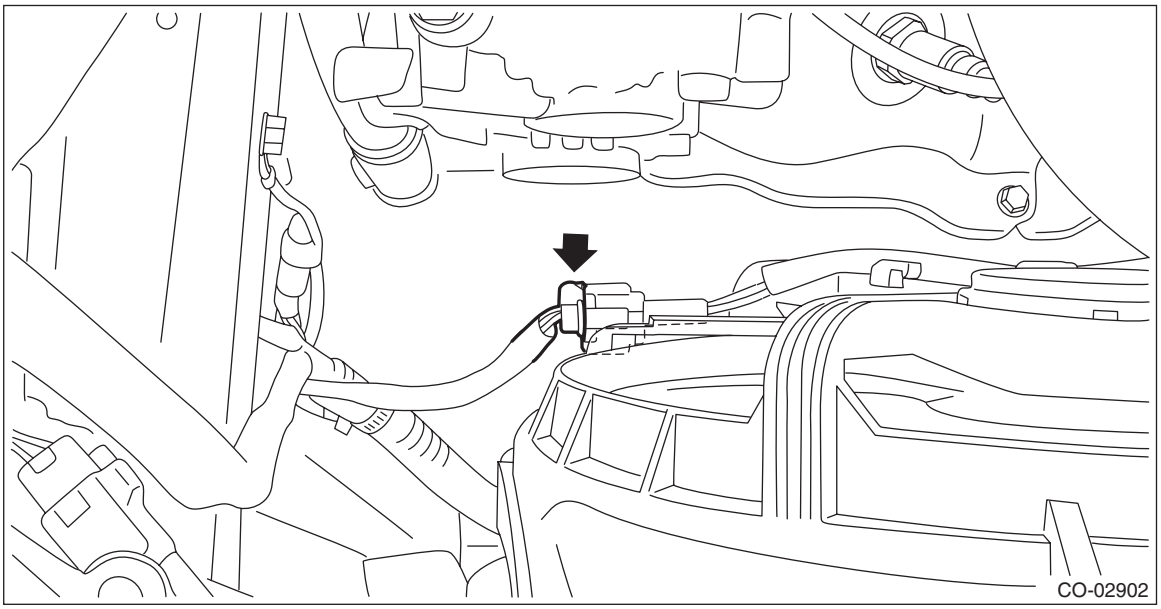
2) Remove the collector cover. (HEV model)
   (1) Carefully pull up the front of collector cover at two positions (A).
   (2) Carefully pull up the rear of collector cover at two positions (B) while moving it backward.

NOTE:
Be careful not to contact the fuel delivery tube when moving the collector cover rearward.

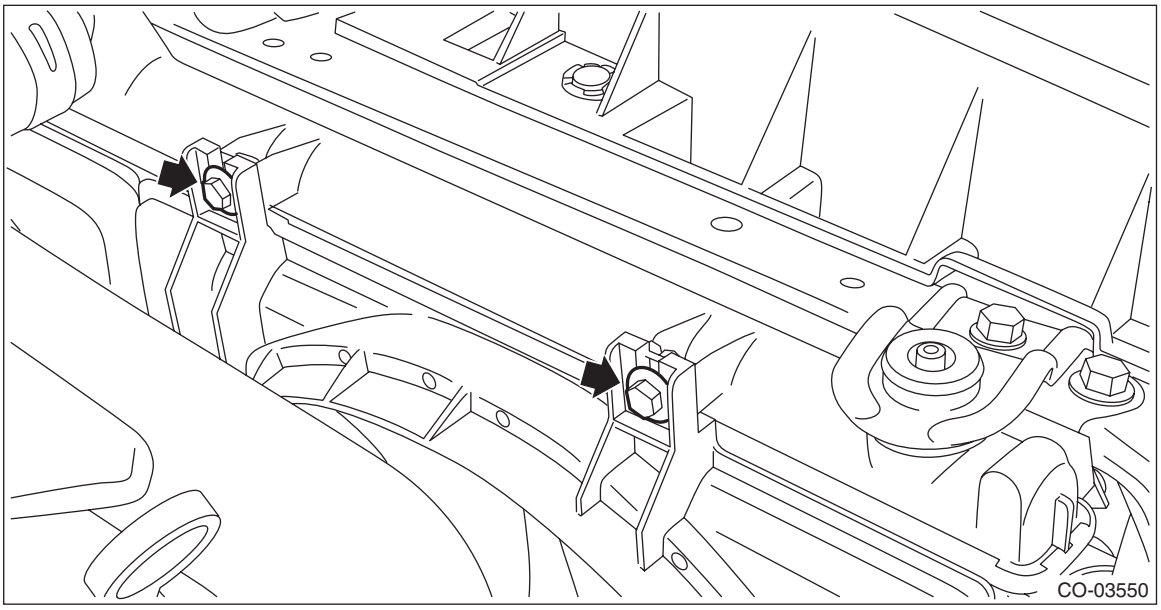


3) Remove the air intake duct. <Ref. to IN(H4DO(w/o HEV))-13, REMOVAL, Air Intake Duct.> <Ref. to IN(H4DO(HEV))-15, REMOVAL, Air Intake Duct.>

4) Disconnect the connector from the sub fan motor assembly.



5) Remove the bolts which hold the radiator sub fan shroud onto the radiator.



6) Remove the radiator sub fan and fan motor from vehicle.

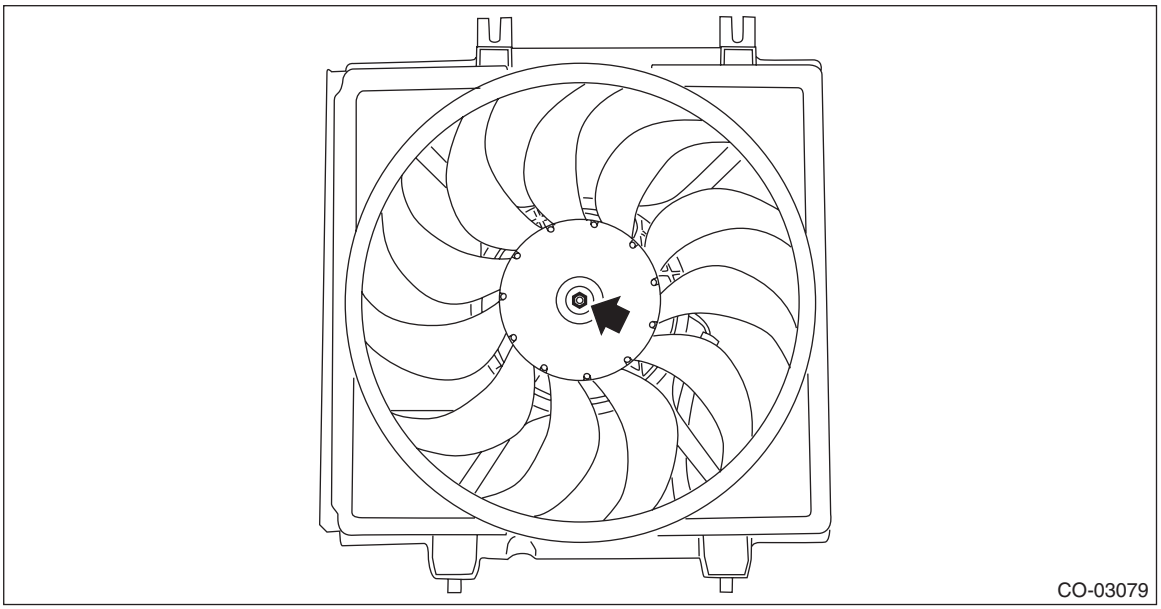
B: INSTALLATION

CAUTION:
Confirm that the radiator hose is securely connected.
Install in the reverse order of removal.

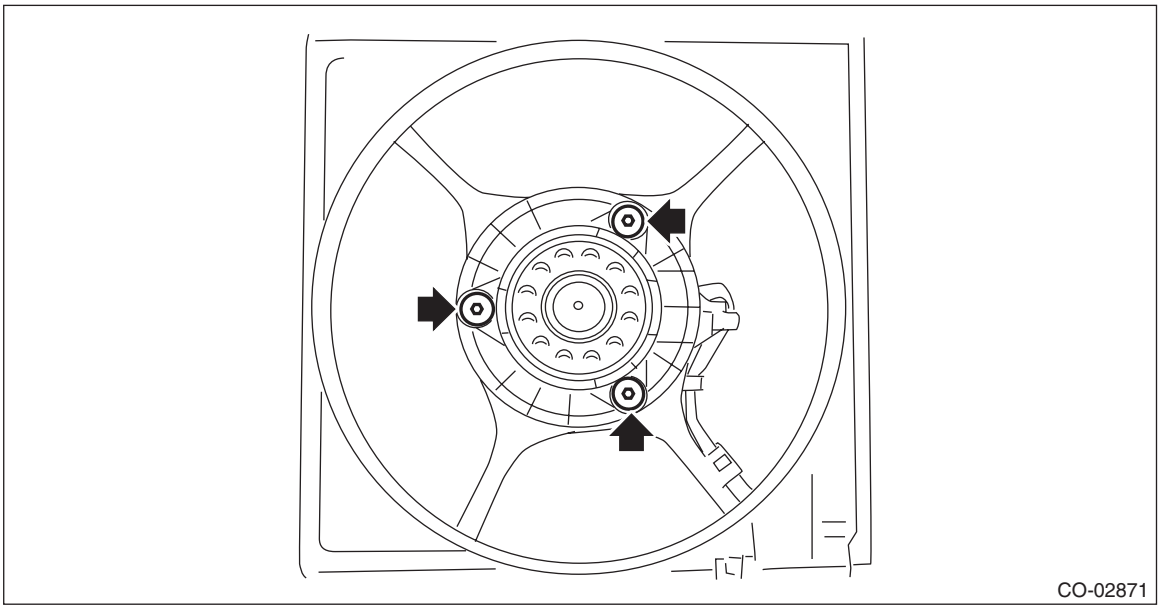
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

C: DISASSEMBLY

1) Remove the clip which holds the sub fan motor connector onto the radiator sub fan shroud.
2) Disconnect the radiator sub fan from the sub fan motor.



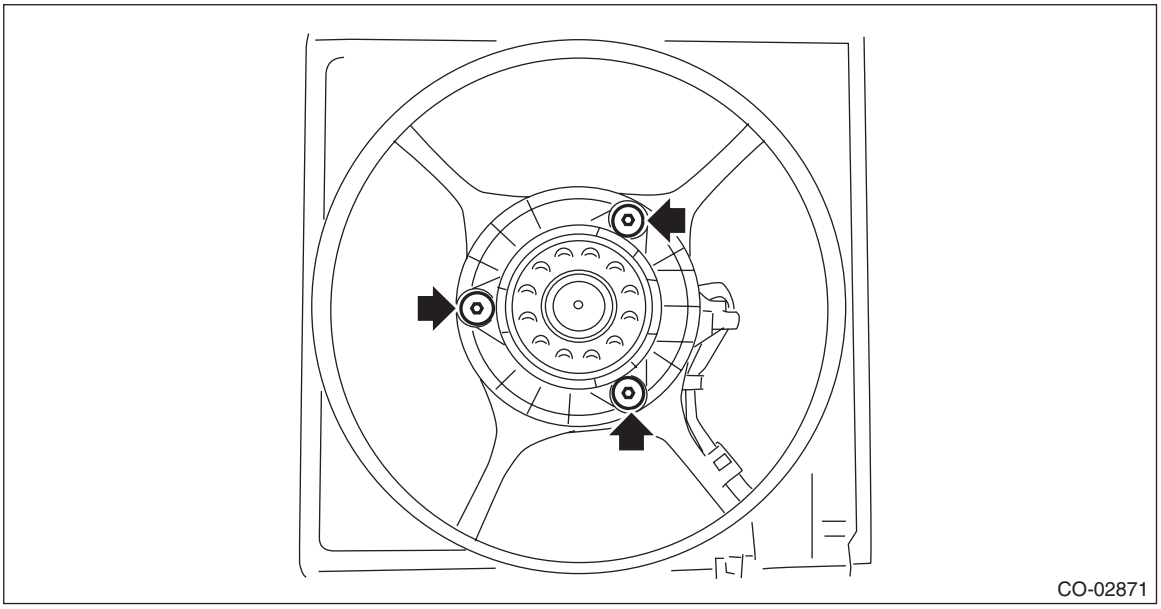
3) Disconnect the sub fan motor from the radiator sub fan shroud.



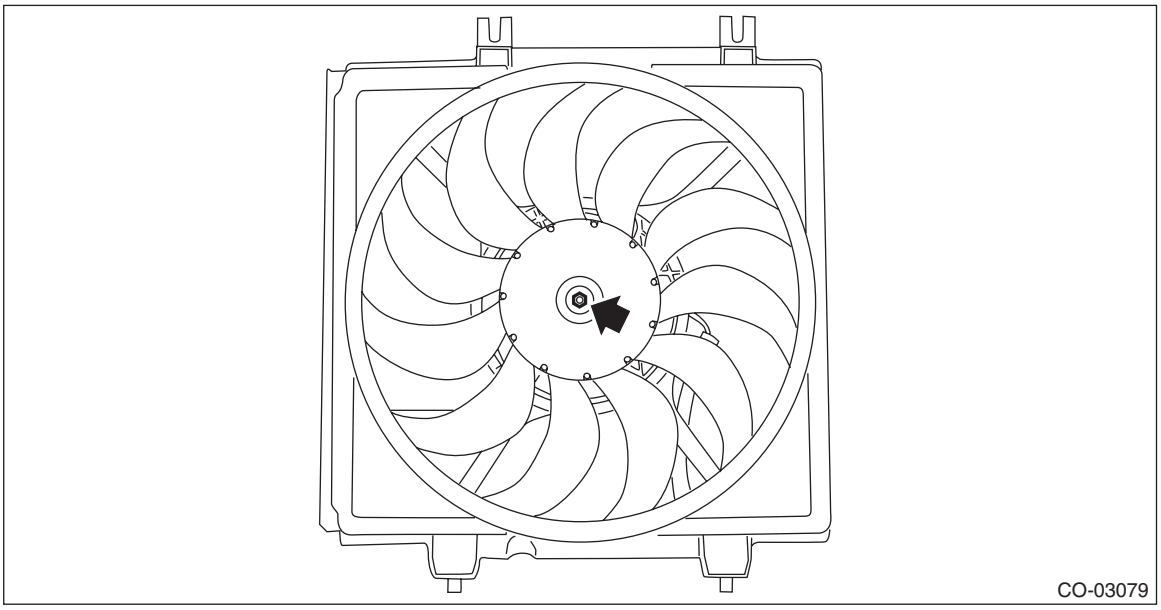
D: ASSEMBLY

Assemble in the reverse order of disassembly.

Tightening torque:
4.41 N·m (0.45 kgf-m, 3.25 ft-lb)



Tightening torque:
3.4 N·m (0.3 kgf-m, 2.5 ft-lb)



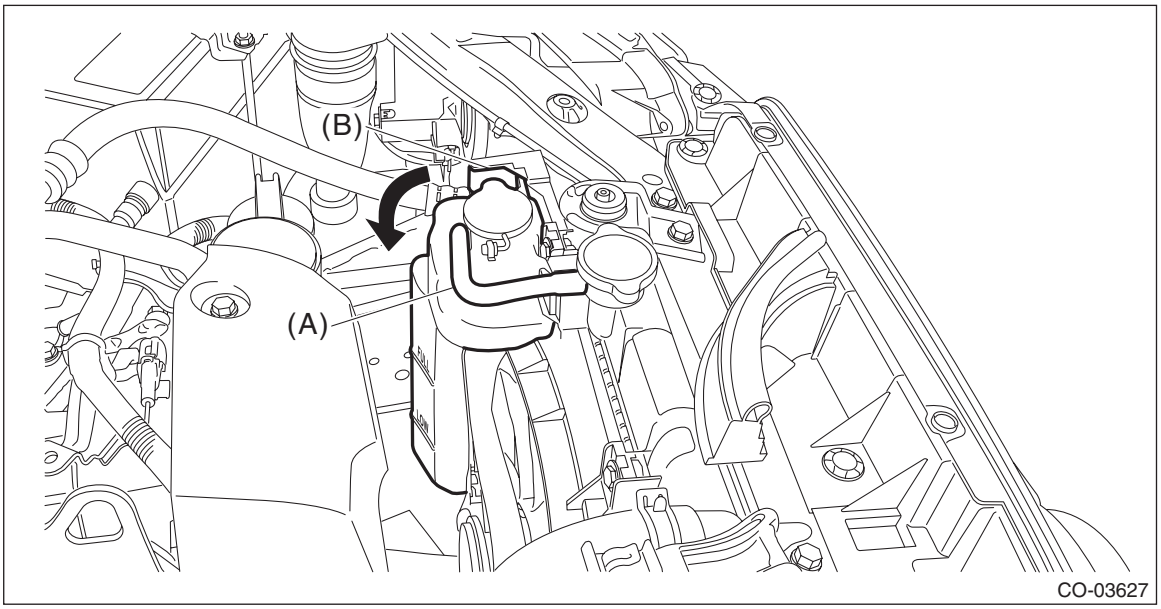
E: INSPECTION

Check that the radiator sub fan, radiator sub fan shroud and sub fan motor assembly do not have deformation, cracks or damage.

11.Reservoir Tank

A: REMOVAL

1) Disconnect the over flow hose (A) connected to the radiator filler neck from the reservoir tank.
2) Pull out the reservoir tank to the arrow direction while pushing the claw (B).



B: INSTALLATION

Install in the reverse order of removal.

C: INSPECTION

1) Check that the reservoir tank does not have deformation, cracks or damage.
2) Make sure the over flow hoses are not cracked, damaged or loose.
3) Make sure the engine coolant level is between “FULL” and “LOW”.

12.Engine Cooling System Trouble in General

A: INSPECTION

Trouble	Possible cause	Corrective action
Over-heating	a. Insufficient engine coolant	Replenish engine coolant, inspect for leakage, and repair it if necessary.
	b. Defective thermostat	Replace.
	c. Malfunction of water pump	Replace.
	d. Clogged engine coolant passage	Clean.
	e. Improper ignition timing	Inspect and repair ignition control system. <Ref. to EN(H4DO w/o HEV)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(H4DO HEV)(diag)-2, Basic Diagnostic Procedure.>
	f. Clogged or leaking radiator	Clean, repair or replace.
	g. Defective radiator cap	Replace.
	h. Improper engine oil in engine coolant	Replace the engine coolant. If ineffective, check, repair or replace engine components.
	i. Air/fuel mixture ratio too lean	Inspect and repair the fuel injection system. <Ref. to EN(H4DO w/o HEV)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(H4DO HEV)(diag)-2, Basic Diagnostic Procedure.>
	j. Excessive back pressure in exhaust system	Clean or replace.
	k. Insufficient clearance between piston and cylinder	Adjust or replace.
	l. Slipping clutch	Repair or replace.
	m. Dragging brake	Adjust.
	n. Malfunction of radiator fan	Inspect the radiator fan relay, engine coolant temperature sensor or fan motor and replace them.
Over-cooling	a. Ambient temperature extremely low	Partly cover radiator front area.
	b. Defective thermostat	Replace.
Engine coolant leaks	a. Loosened or damaged connecting units on hoses	Repair or replace.
	b. Leakage from water pump	Replace.
	c. Leakage from water pipe	Repair or replace.
	d. Leakage around cylinder head gasket	Retighten cylinder head bolts or replace cylinder head gasket.
	e. Damaged or cracked cylinder head and cylinder block	Repair or replace.
	f. Damaged or cracked thermostat cover	Repair or replace.
	g. Leakage from radiator	Repair or replace.
Noise	a. Defective radiator fan	Replace.
	b. Defective water pump bearing	Replace water pump.
	c. Defective water pump mechanical seal	Replace water pump.

LUBRICATION

LU(H4DO(w/o HEV))

Page

1. General Description 2
2. Oil Pressure System 8
3. Engine Oil 12
4. Oil Pump 15
5. Oil Pan and Strainer 16
6. Oil Pressure Switch 25
7. Engine Oil Filter 29
8. Oil Level Switch 31
9. Engine Lubrication System Trouble in General 74

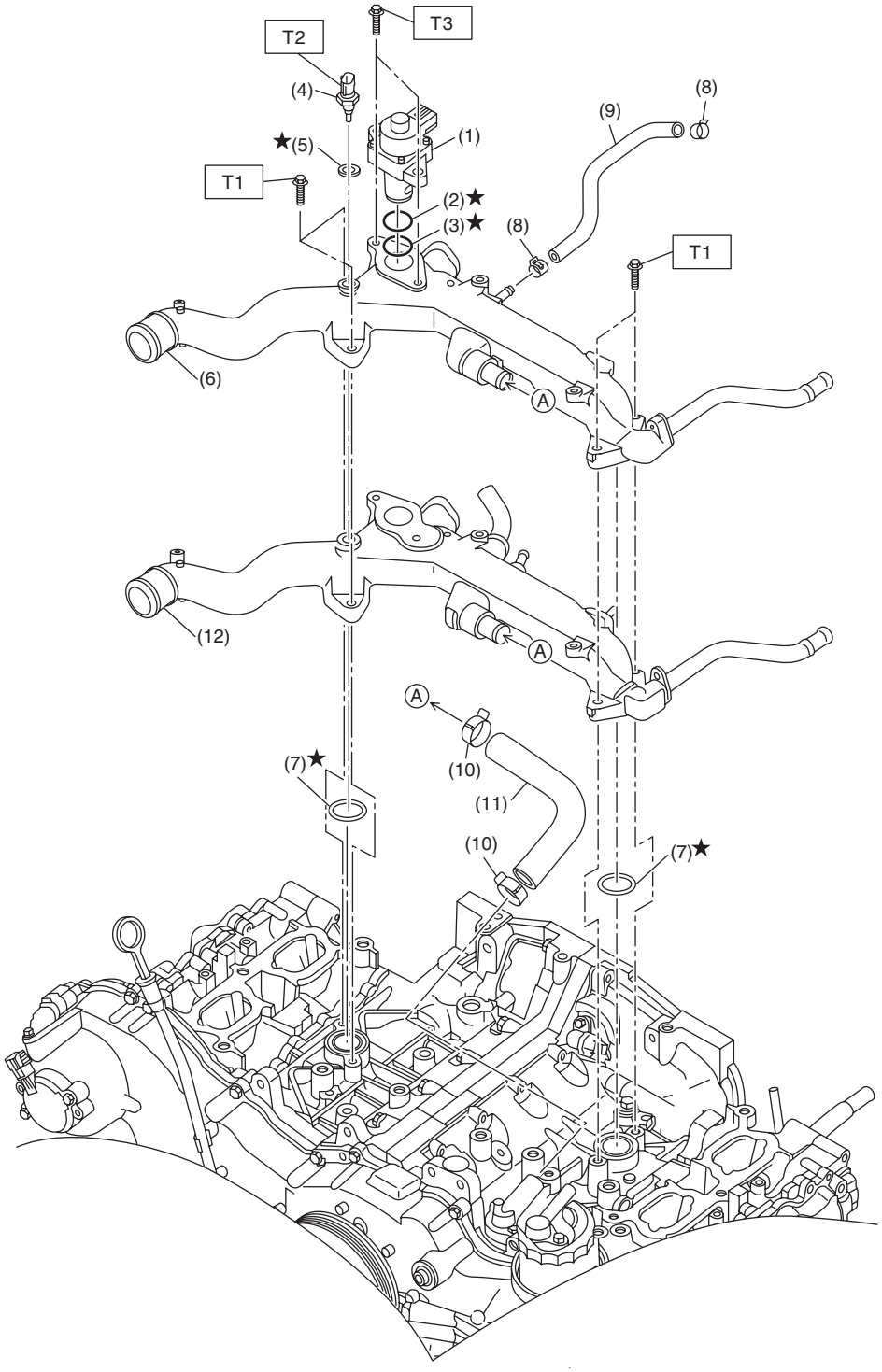
1. General Description

A: COMPONENT

1. CANISTER, LEAK CHECK VALVE ASSEMBLY AND DRAIN SEPARATOR

For structures of the canister, leak check valve assembly and drain separator, refer to “FU (H4DO (w/o HEV))”. <Ref. to FU(H4DO(w/o HEV))-3, COMPONENT, General Description.>

2. EGR SYSTEM 1

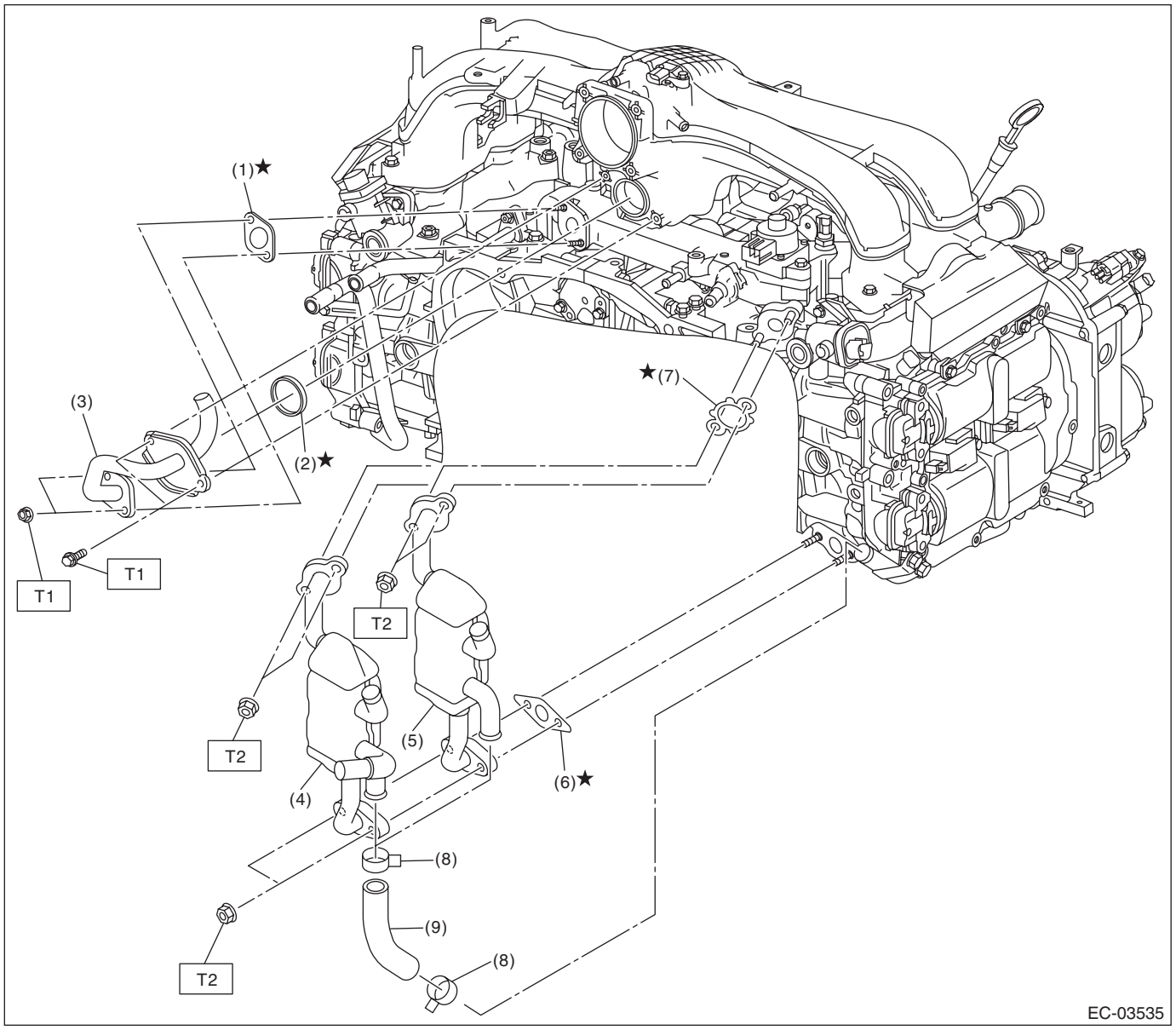


EC-03534

(1)	EGR control valve	(7)	O-ring
(2)	O-ring	(8)	Clip
(3)	Gasket	(9)	Preheater hose A
(4)	Engine coolant temperature sensor	(10)	Clip
(5)	Gasket	(11)	Preheater hose B
(6)	Water pipe ASSY (MT model)	(12)	Water pipe ASSY (CVT model)

Tightening torque: N·m (kgf-m, ft-lb)
T1: 6.4 (0.7, 4.7)
T2: 18 (1.8, 13.3)
T3: 22 (2.2, 16.2)

3. EGR SYSTEM 2



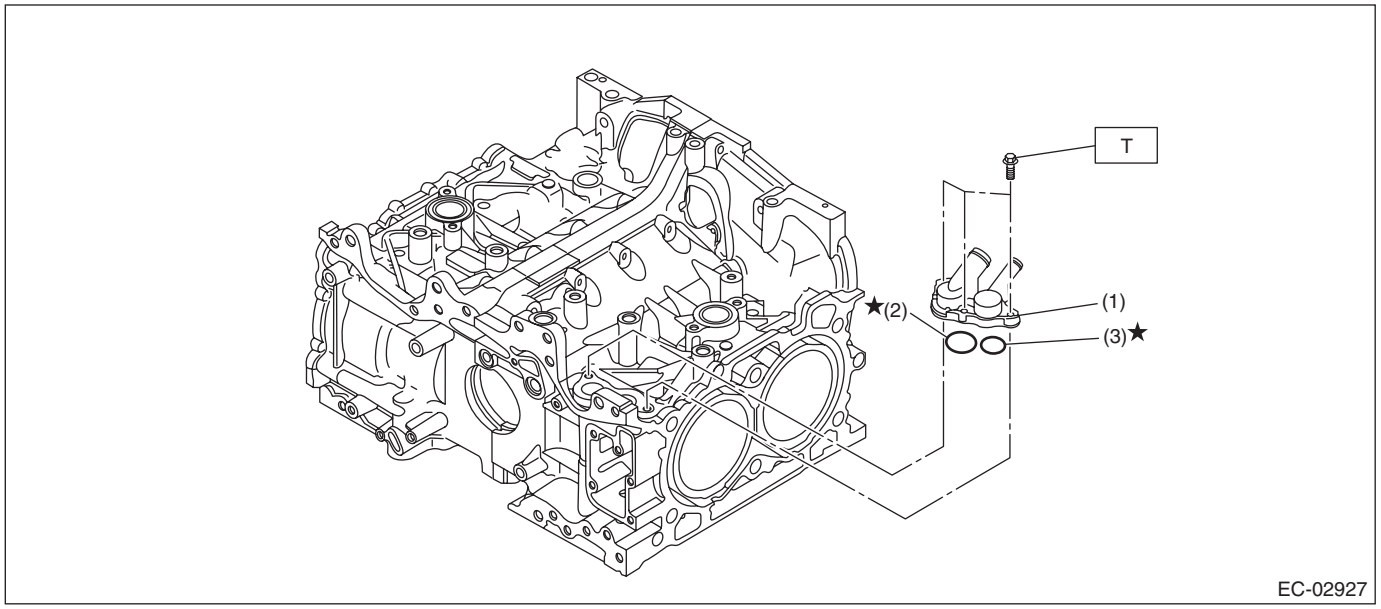
(1) Gasket
(2) Gasket
(3) EGR pipe
(4) EGR cooler (CVT model)
(5) EGR cooler (MT model)
(6) Gasket
(7) Gasket
(8) Clip
(9) Engine coolant hose

Tightening torque: N·m (kgf-m, ft-lb)

T1: <Ref. to EC(H4DO(w/o HEV))-30, INSTALLATION, EGR Pipe.>

T2: <Ref. to EC(H4DO(w/o HEV))-36, INSTALLATION, EGR Cooler.>

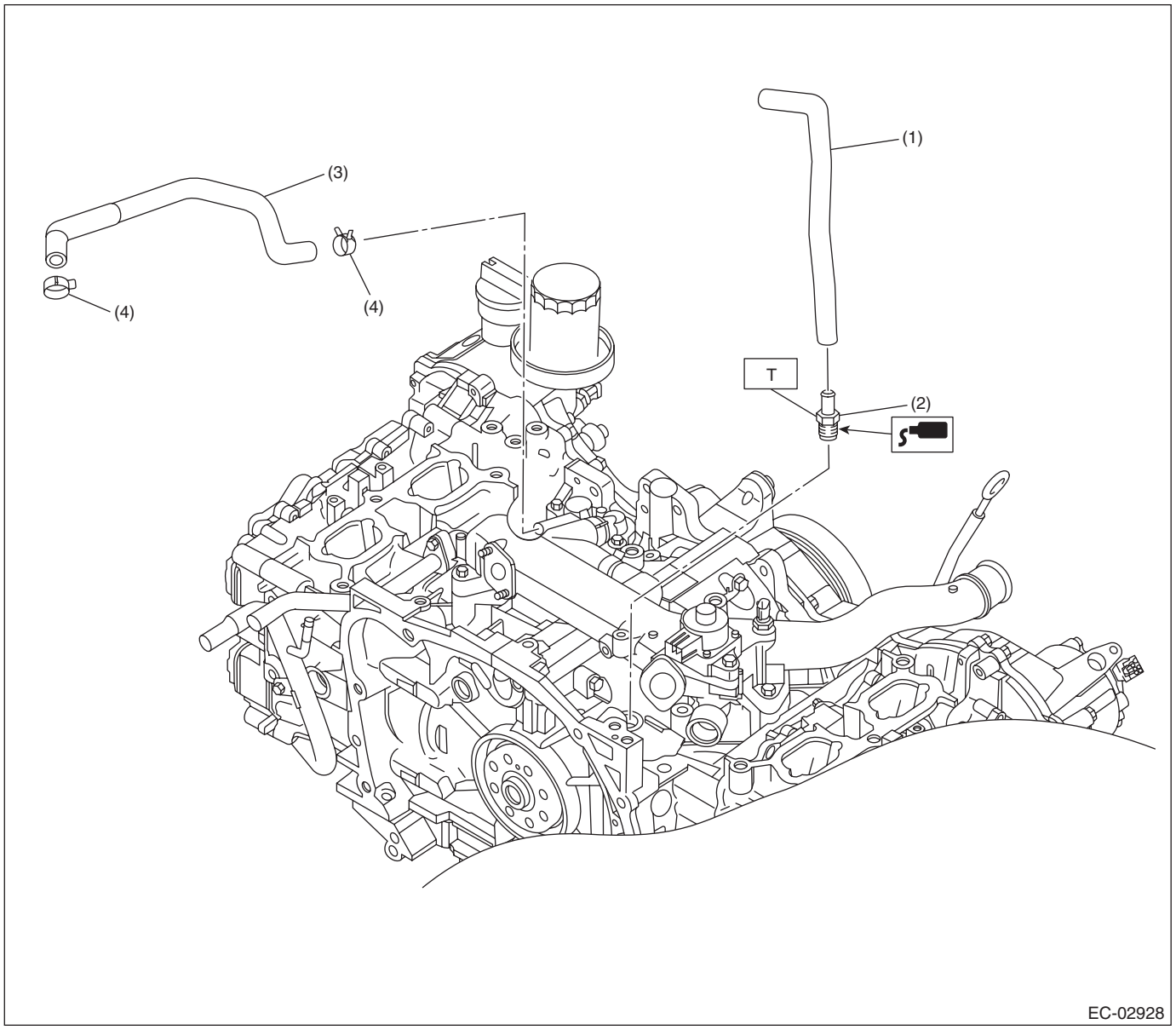
4. PCV SYSTEM 1



(1) PCV connector
(2) O-ring
(3) O-ring

Tightening torque: N·m (kgf-m, ft-lb)
T: 6.4 (0.7, 4.7)

5. PCV SYSTEM 2



(1) PCV hose A
(2) PCV valve
(3) PCV hose B
(4) Clip

Tightening torque: N·m (kgf-m, ft-lb)
T: 23 (2.3, 17.0)

B: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a work cap, and protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.

C: PREPARATION TOOL

1. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance and voltage.

2. Front Catalytic Converter

A: REMOVAL

The front catalytic converter is integrated into the front exhaust pipe; therefore, refer to “Front Exhaust Pipe” for the removal procedure. <Ref. to EX(H4DO(w/o HEV))-6, REMOVAL, Front Exhaust Pipe.>

B: INSTALLATION

The front catalytic converter is integrated into the front exhaust pipe; therefore, refer to “Front Exhaust Pipe” for the installation procedure. <Ref. to EX(H4DO(w/o HEV))-8, INSTALLATION, Front Exhaust Pipe.>

C: INSPECTION

1) Check the connections and welded parts for exhaust leaks.
2) Make sure there are no holes or rusting.

3. Rear Catalytic Converter

A: REMOVAL

The rear catalytic converter is integrated into the center exhaust pipe; therefore, refer to “Center Exhaust Pipe” for the removal procedure. <Ref. to EX(H4DO(w/o HEV))-14, REMOVAL, Center Exhaust Pipe.>

B: INSTALLATION

The rear catalytic converter is integrated into the center exhaust pipe; therefore, refer to “Center Exhaust Pipe” for the installation procedure. <Ref. to EX(H4DO(w/o HEV))-15, INSTALLATION, Center Exhaust Pipe.>

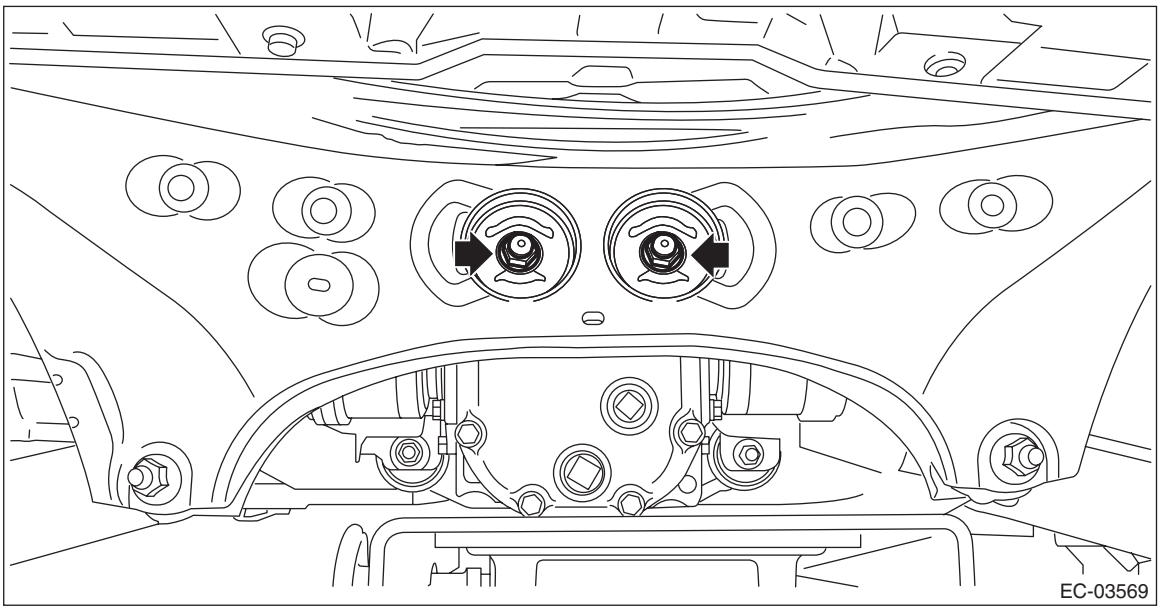
C: INSPECTION

1) Check the connections and welded parts for exhaust leaks.
2) Make sure there are no holes or rusting.

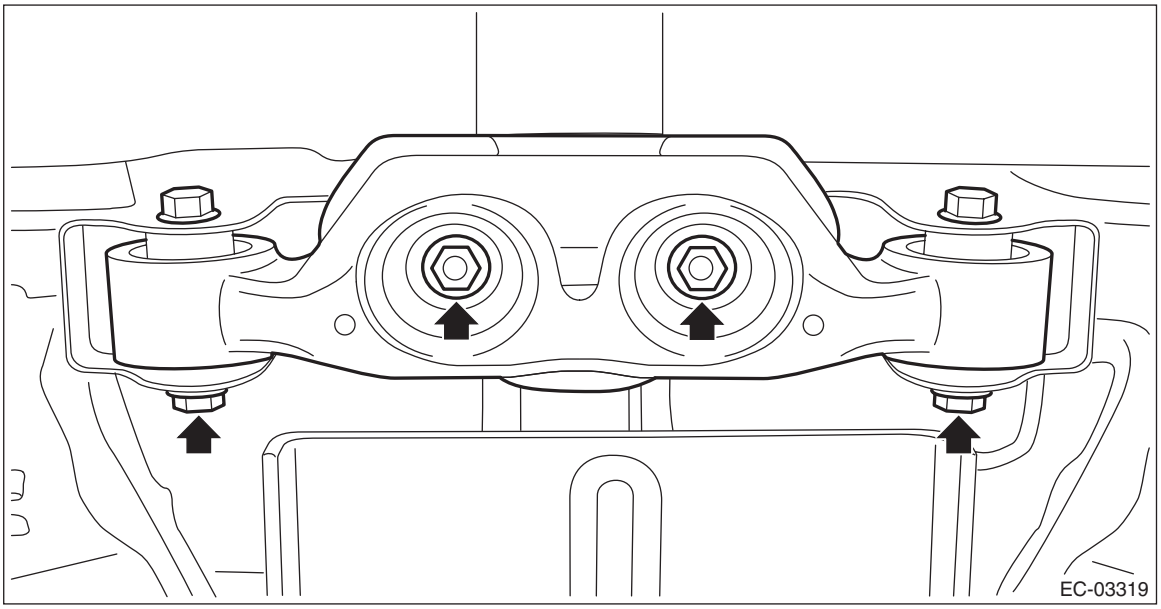
4. Canister

A: REMOVAL

1) Lift up the vehicle.
2) Remove the rear exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-18, REMOVAL, Rear Exhaust Pipe.>
3) Remove the propeller shaft. <Ref. to DS-12, REMOVAL, Propeller Shaft.>
4) Support the rear differential with the transmission jack.
5) Remove the self-locking nuts which hold the rear differential to the rear sub frame assembly.



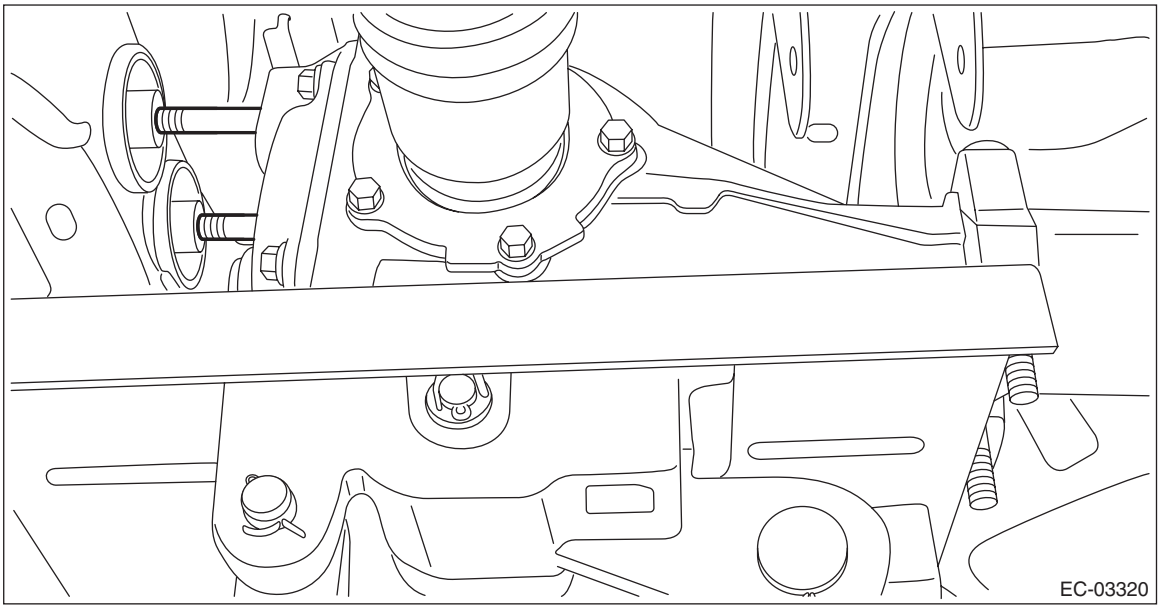
6) Remove the rear differential member from the rear sub frame assembly and the rear differential.



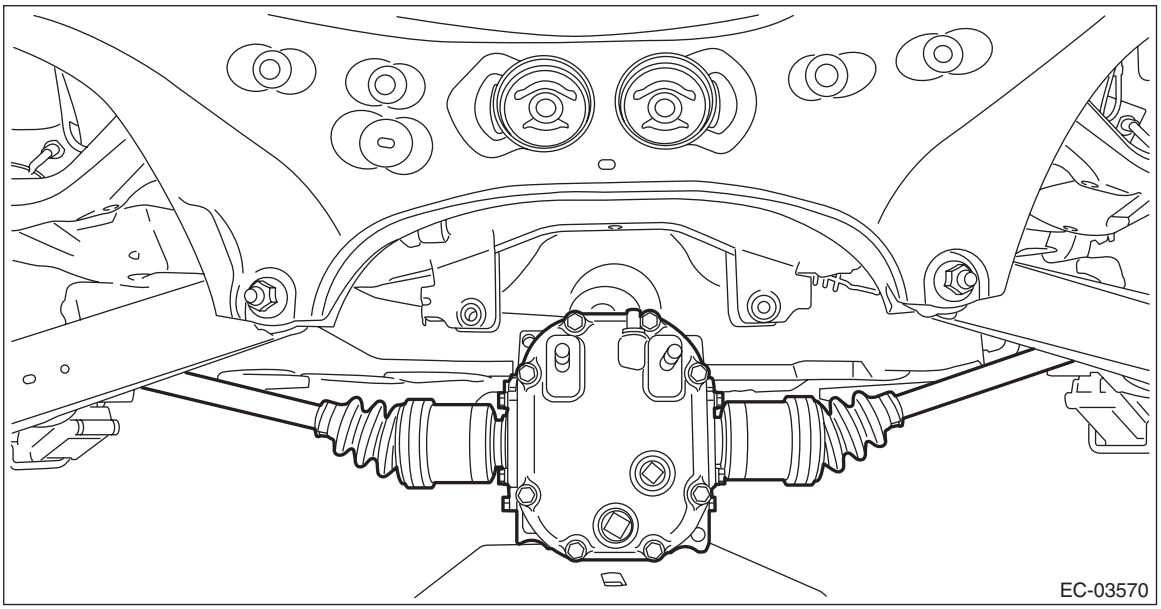
7) Lower the transmission jack gradually until the rear differential is at the position shown in the figure.

NOTE:

• When pulling out the stud bolt from the bushing portion of the rear sub frame assembly, adjust the angle and location of transmission jack and jack stand.

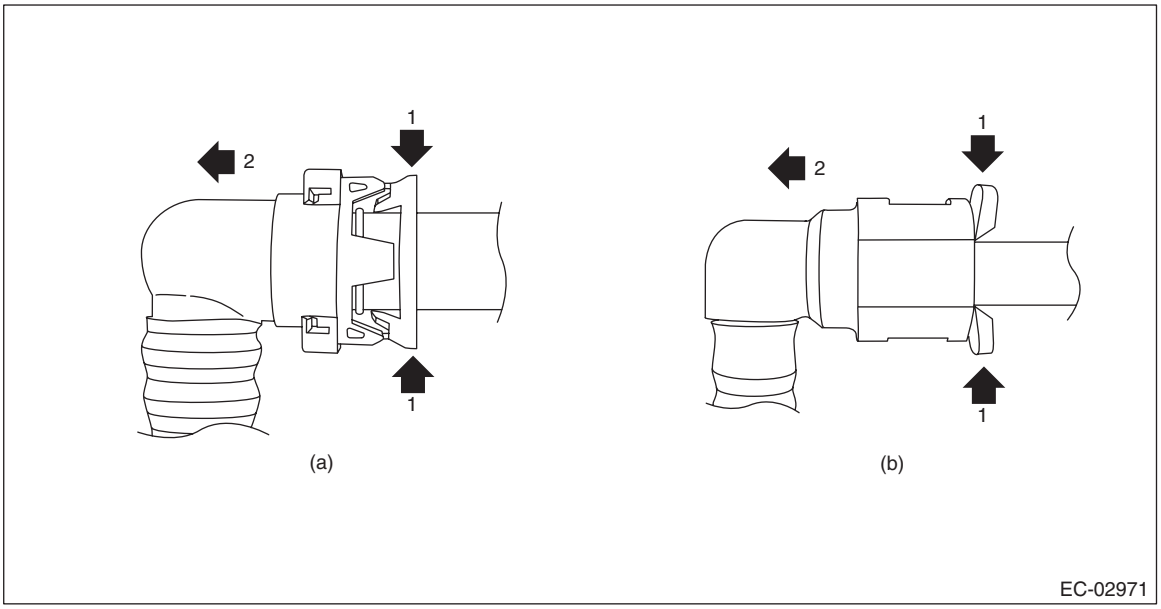


• Do not lower the rear differential excessively. Doing so may add extra load to the drive shaft or cause the falling-off of the drive shaft.

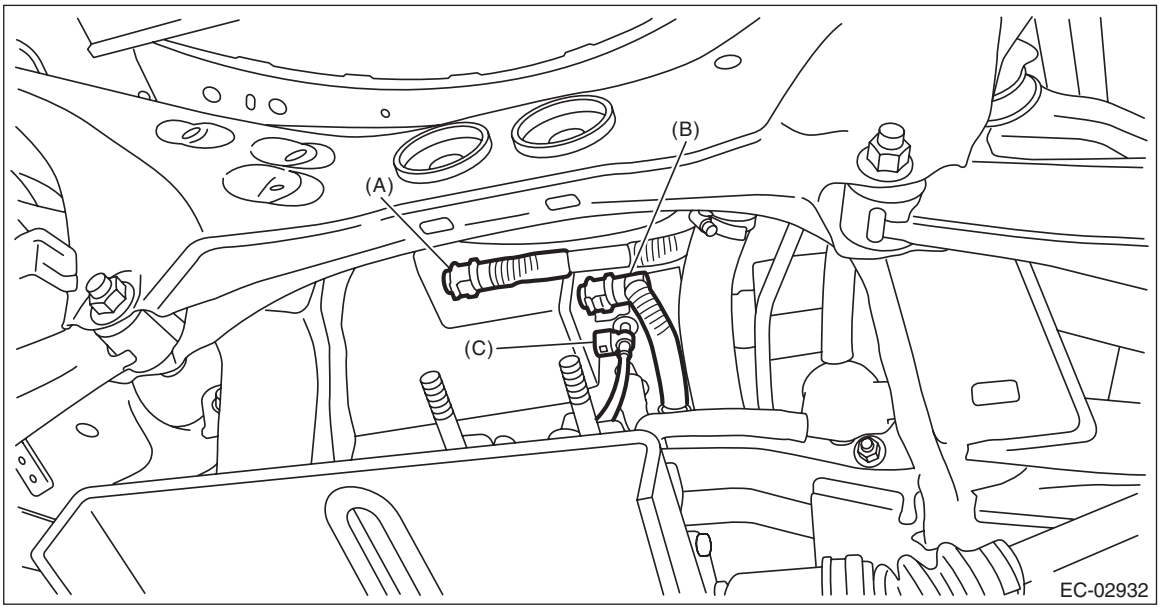


8) Disconnect the drain tube (A), vent tube (B) and purge tube (C) from the canister.

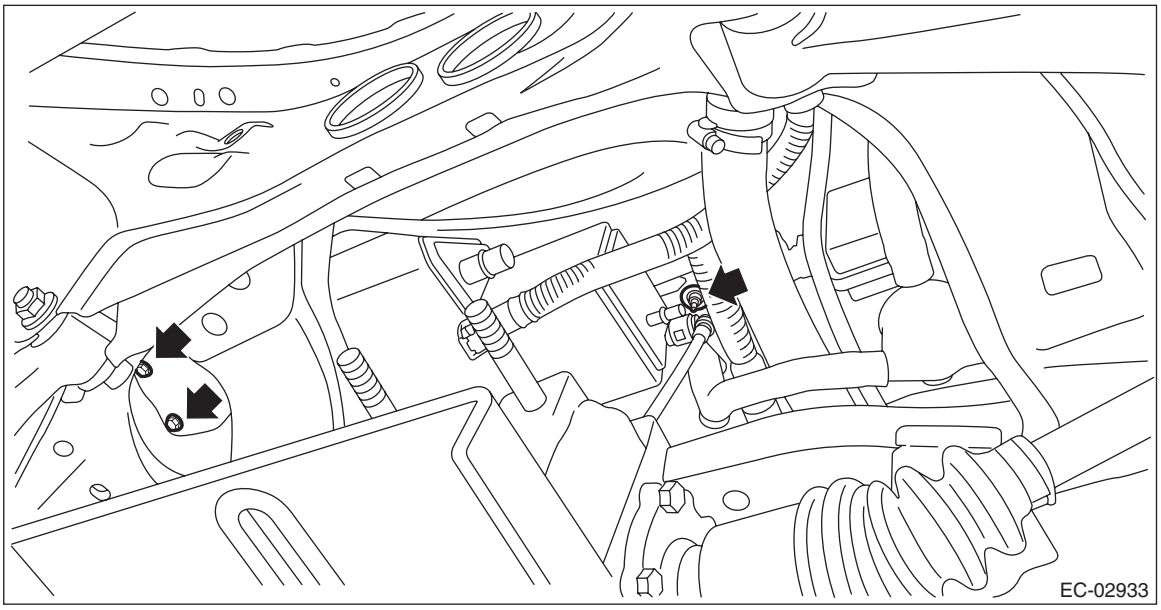
NOTE:
Disconnect the quick connector as shown in the figure.



(a) Drain tube and vent tube (b) Purge tube



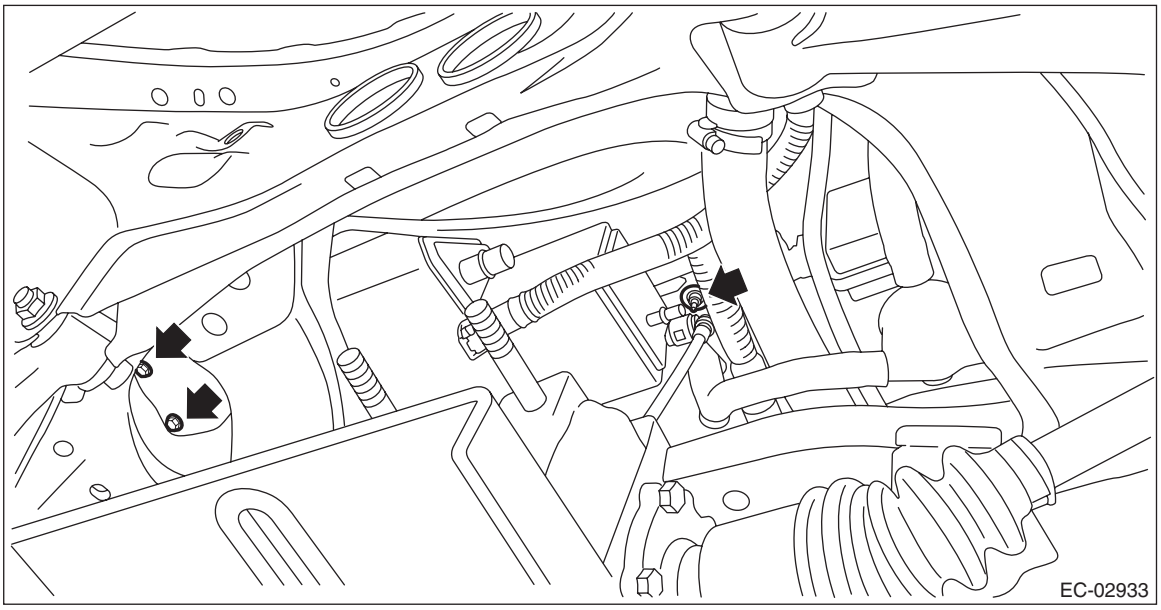
9) Remove the bolts and nuts securing the canister to the vehicle, and remove the canister.



B: INSTALLATION

1) Install the canister to the vehicle using bolts and nuts.

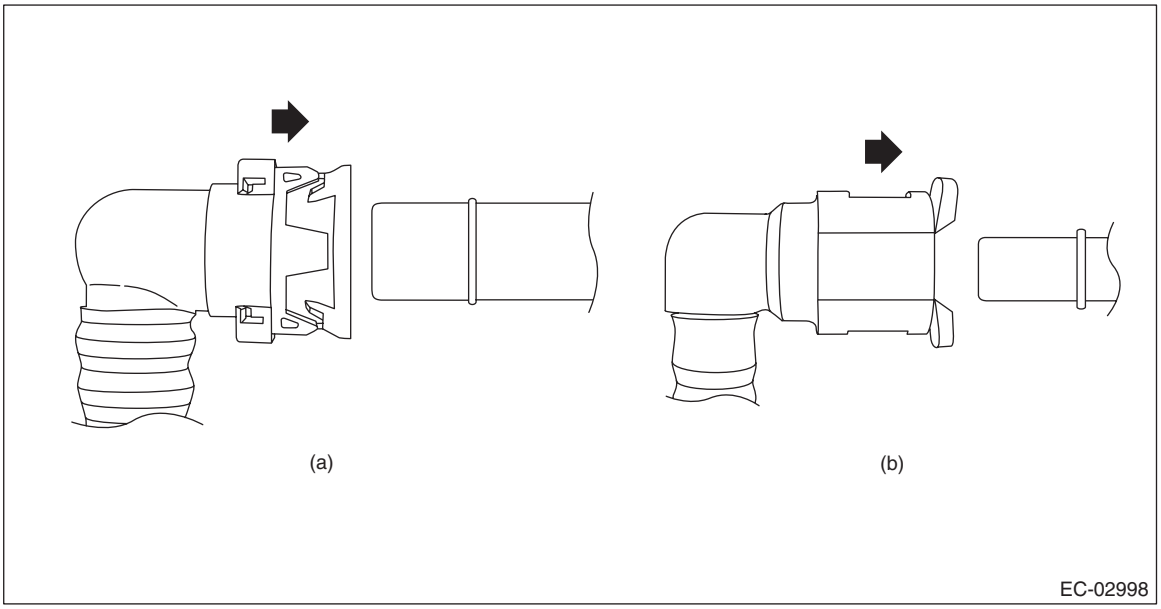
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



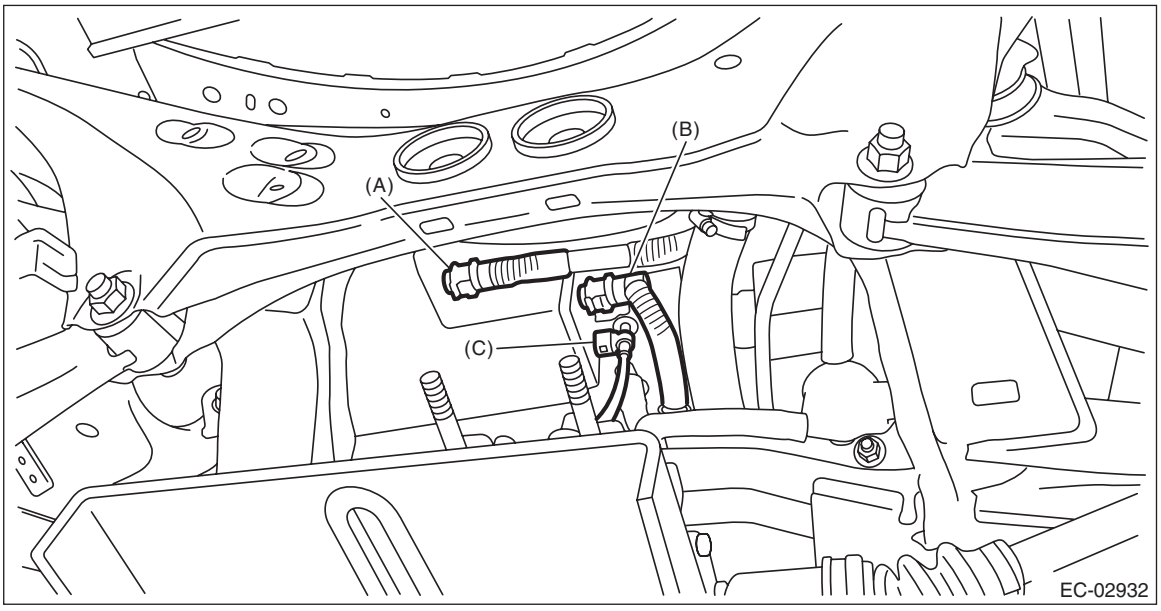
2) Install the drain tube (A), vent tube (B) and purge tube (C) to the canister.

CAUTION:
- **Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.**
- **Make sure that the quick connector is securely connected.**

NOTE:
Install the quick connector as shown in the figure.

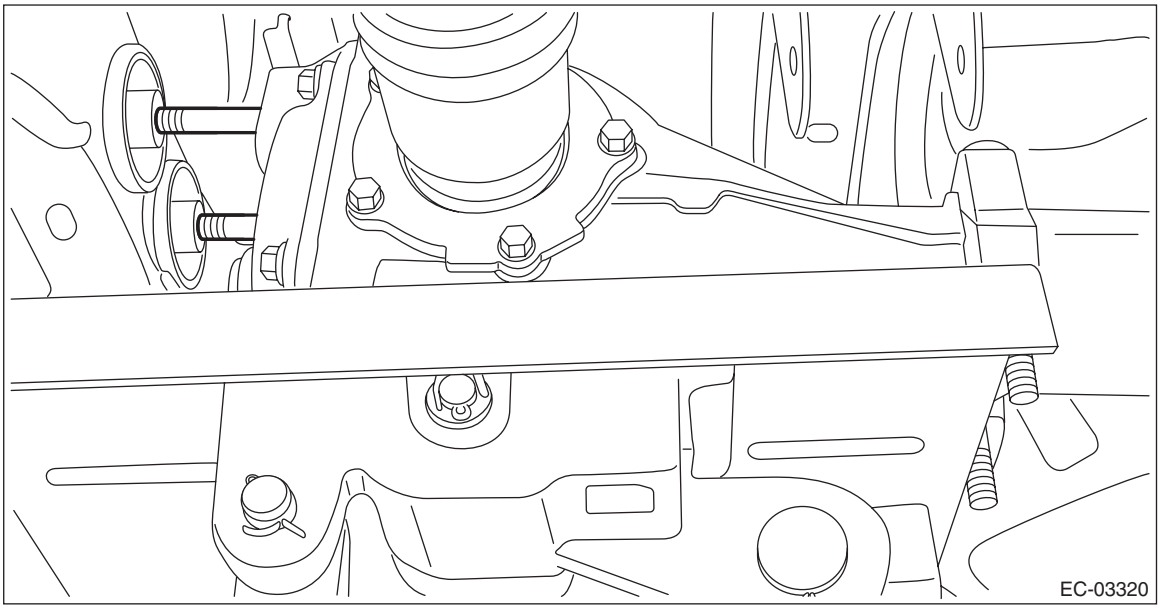


(a) Drain tube and vent tube (b) Purge tube



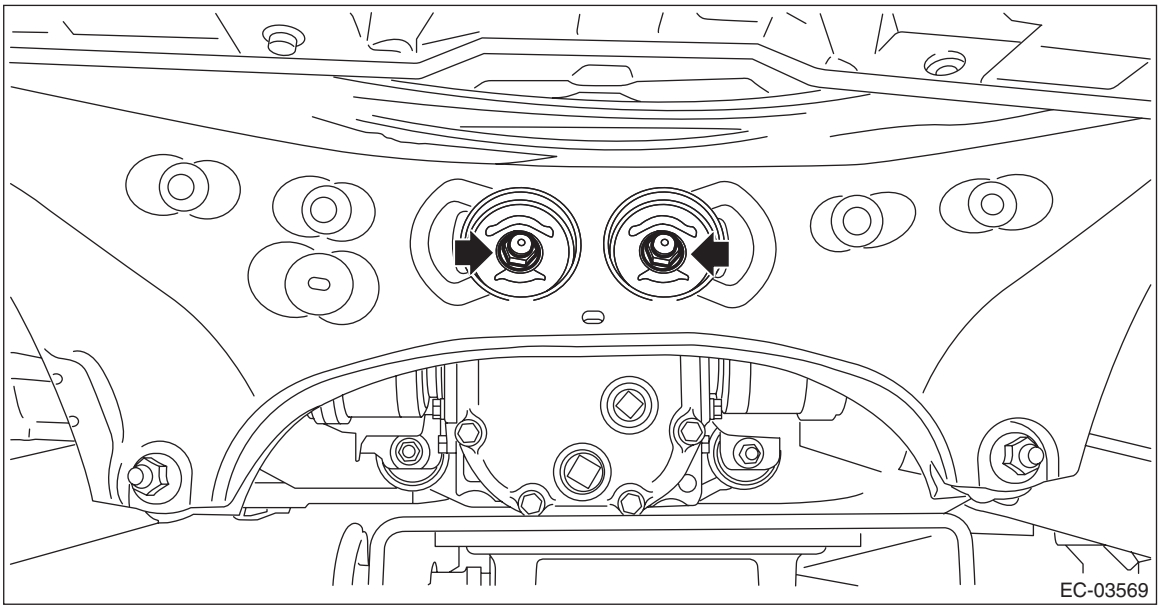
3) Lift up the transmission jack gradually, and set the rear differential to the rear sub frame assembly.

NOTE:
When inserting the stud bolt into the bushing portion of the rear sub frame assembly, adjust the angle and location of transmission jack and jack stand.



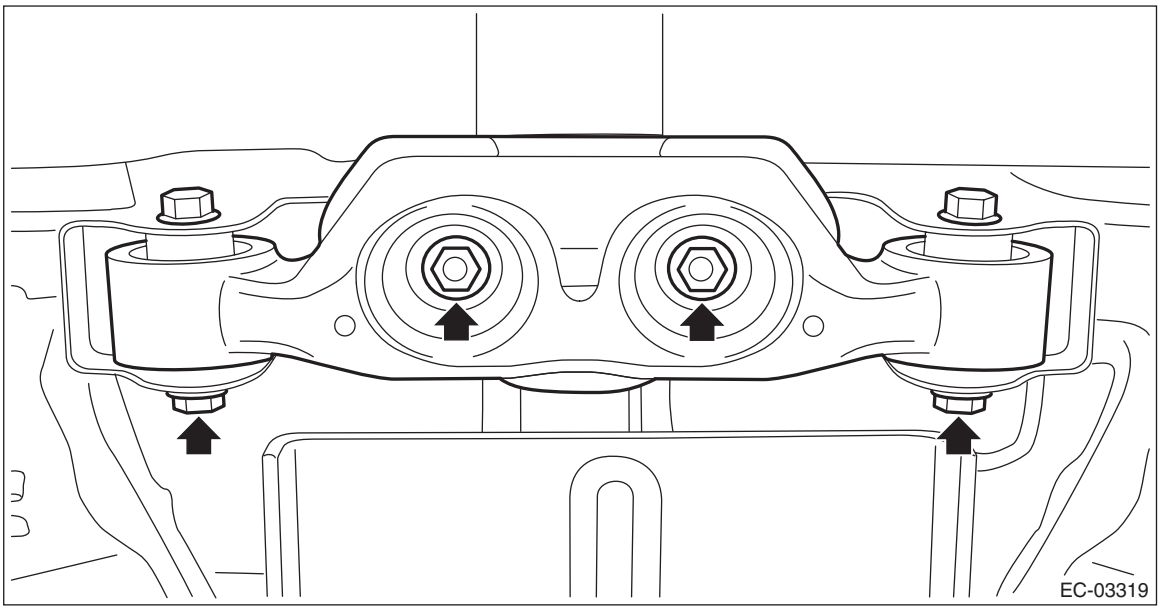
4) Temporarily tighten the self-locking nuts which hold the rear differential to the rear sub frame assembly.

NOTE:
Use a new self-locking nut.



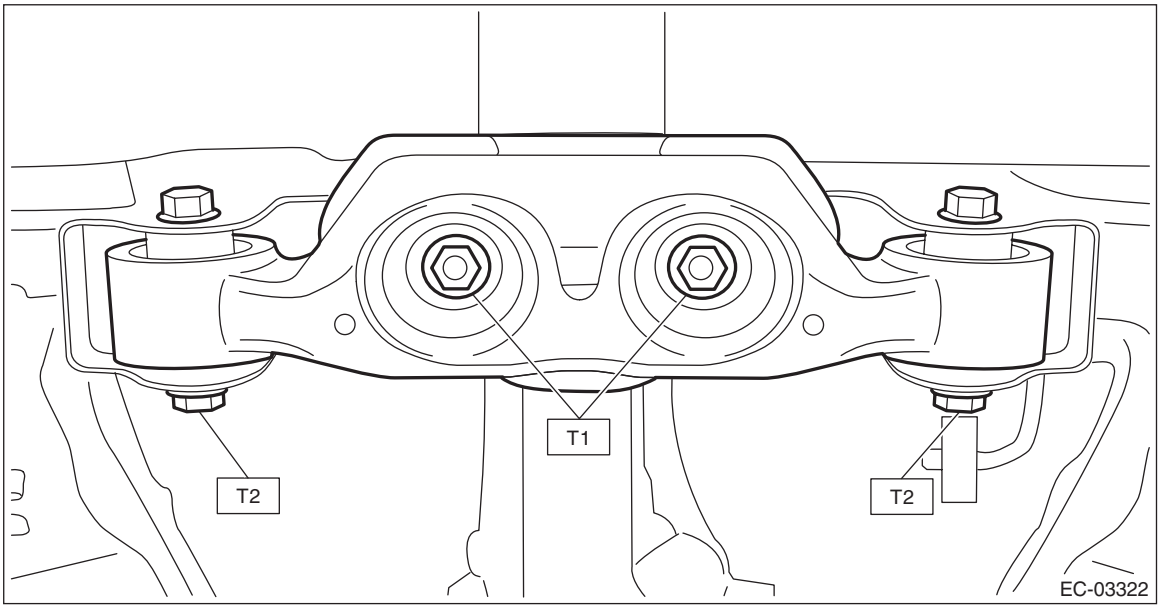
5) Set the rear differential member to the rear sub frame assembly and rear differential, and temporarily tighten the self-lock nuts which secure the rear differential member to the rear sub frame assembly and rear differential.

NOTE:
Use a new self-locking nut.



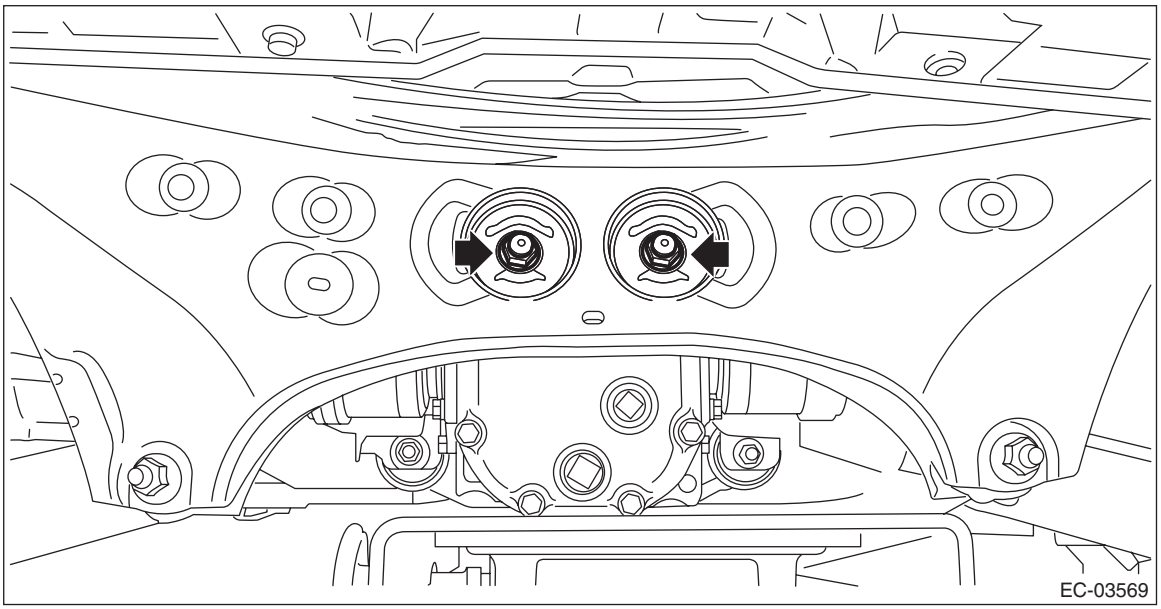
6) Remove the transmission jack from the rear differential.
7) Tighten the self-locking nuts which secure the rear differential member to the rear sub frame assembly and rear differential.

Tightening torque:
T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)
T2: 110 N·m (11.2 kgf-m, 81.1 ft-lb)



8) Tighten the self-locking nuts which secure the rear differential to the rear sub frame assembly.

Tightening torque:
70 N·m (7.1 kgf-m, 51.6 ft-lb)



9) Install the propeller shaft. <Ref. to DS-13, INSTALLATION, Propeller Shaft.>
10) Install the rear exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-20, INSTALLATION, Rear Exhaust Pipe.>
11) Lower the vehicle.

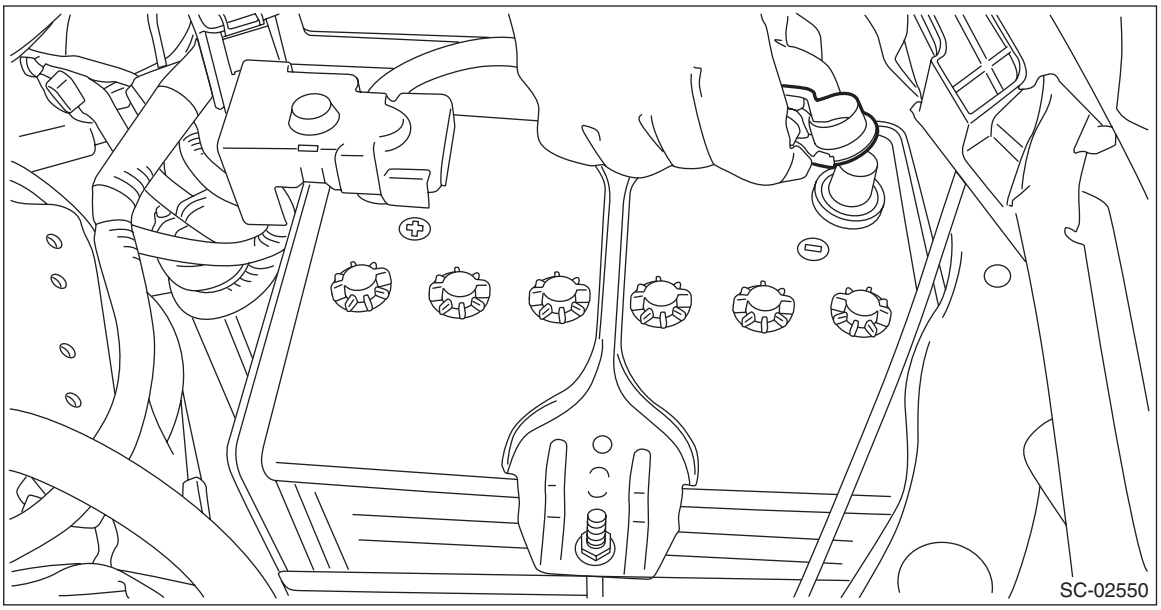
C: INSPECTION

1) Check that the canister has no deformation, cracks or other damages.
2) Check that the tube has no cracks, damage or loose part.

5. Purge Control Solenoid Valve

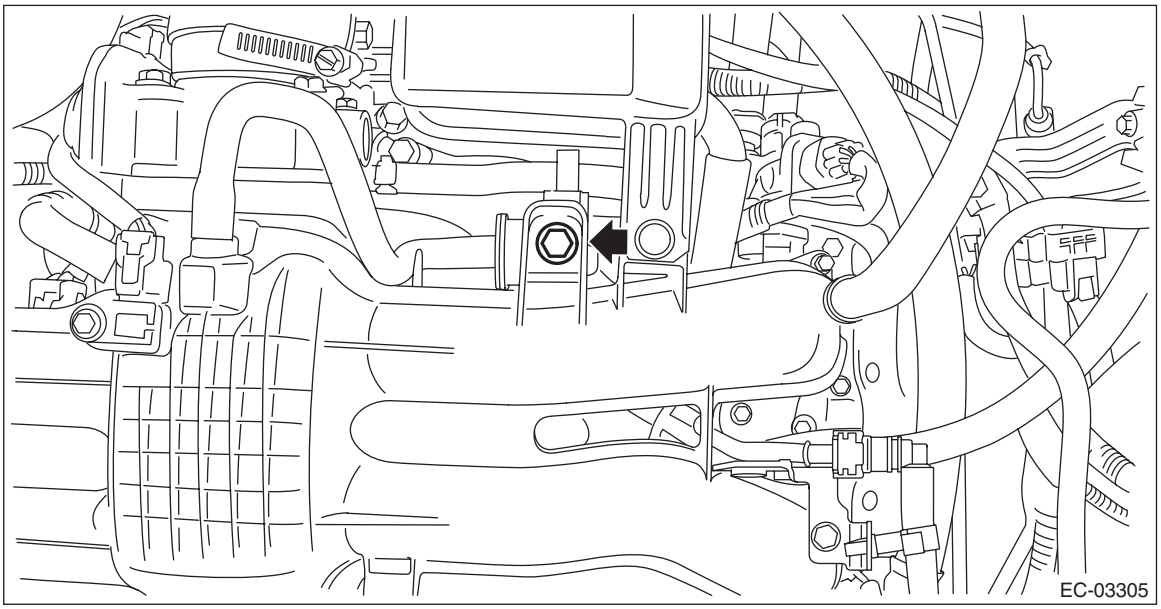
A: REMOVAL

1) Disconnect the ground cable from battery.

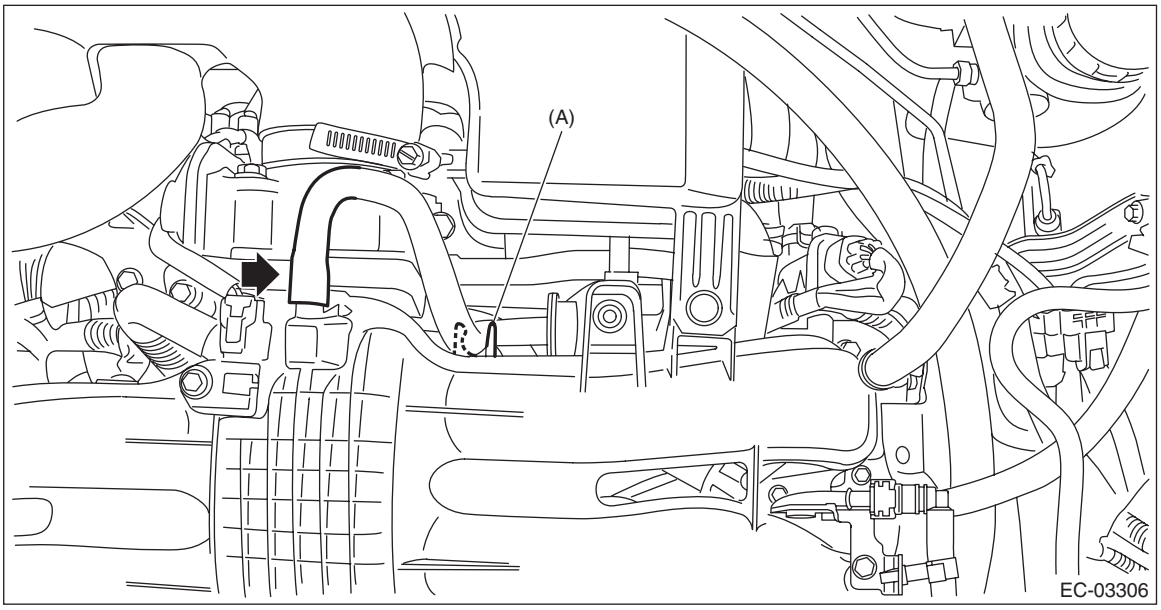


2) Remove the bolt which holds the purge control solenoid valve onto intake manifold.

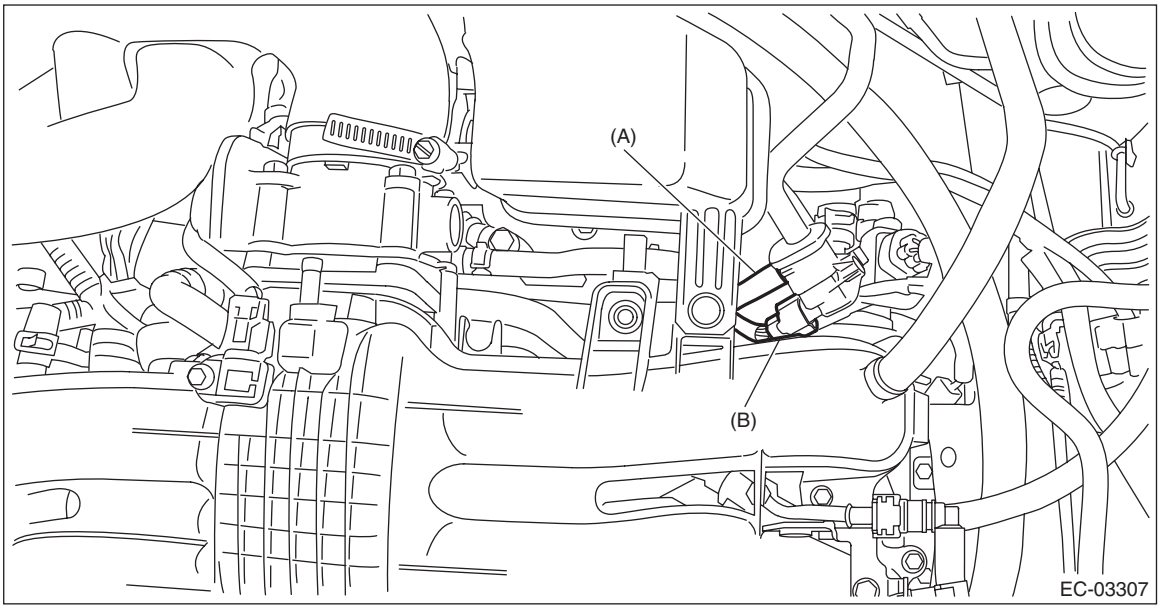
NOTE:
Hold the purge control solenoid valve unit by hand to prevent it from rotating together.



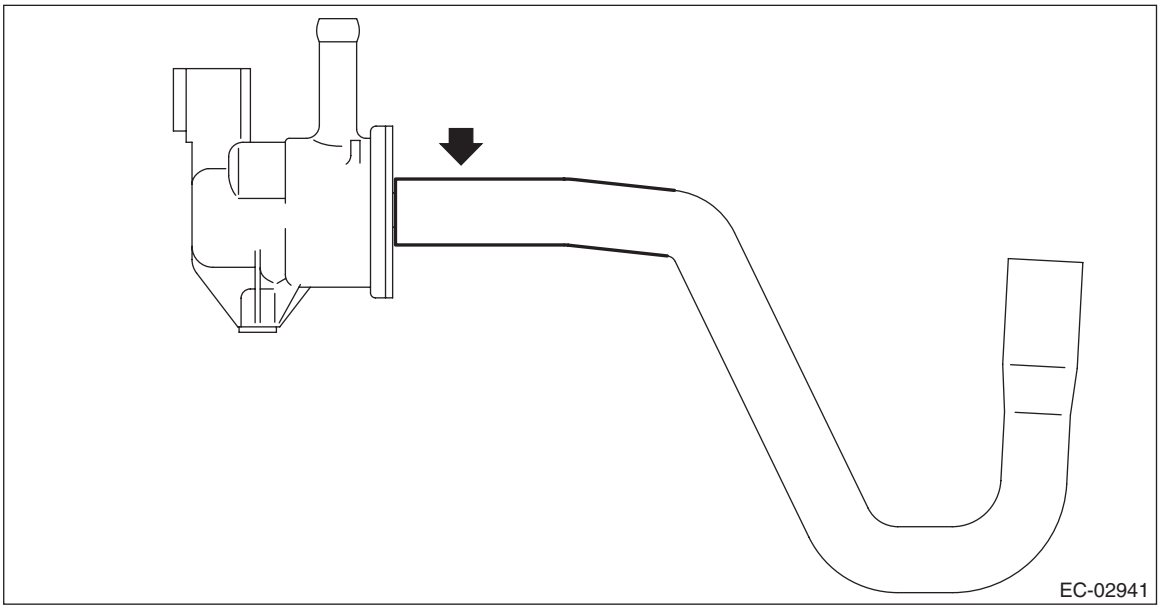
3) Disconnect the vacuum hose from the intake manifold and intake manifold clip (A).



4) Disconnect the vacuum hose (A) and connector (B) from the purge control solenoid valve, and remove the purge control solenoid valve.



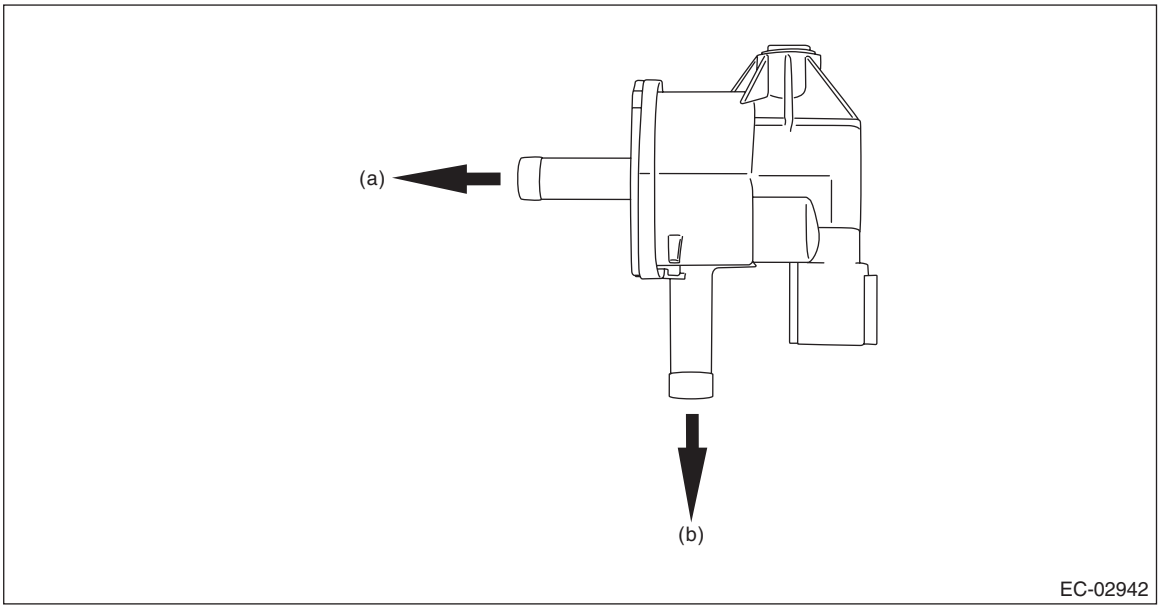
5) Remove the vacuum hose from the purge control solenoid valve.



B: INSTALLATION

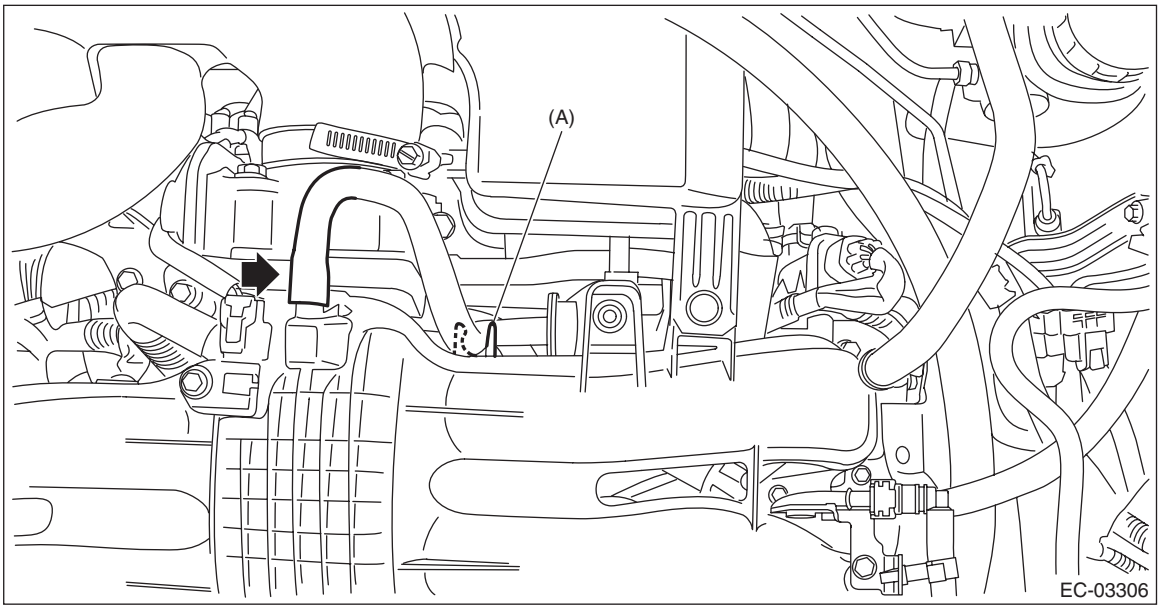
Install in the reverse order of removal.

NOTE:
- Hold the purge control solenoid valve unit by hand to prevent it from rotating together.
- Connect the vacuum hose as shown in the figure.



(a) To intake manifold (b) To fuel pipe

- Check that the vacuum hose is securely held to the intake manifold and intake manifold clip (A).

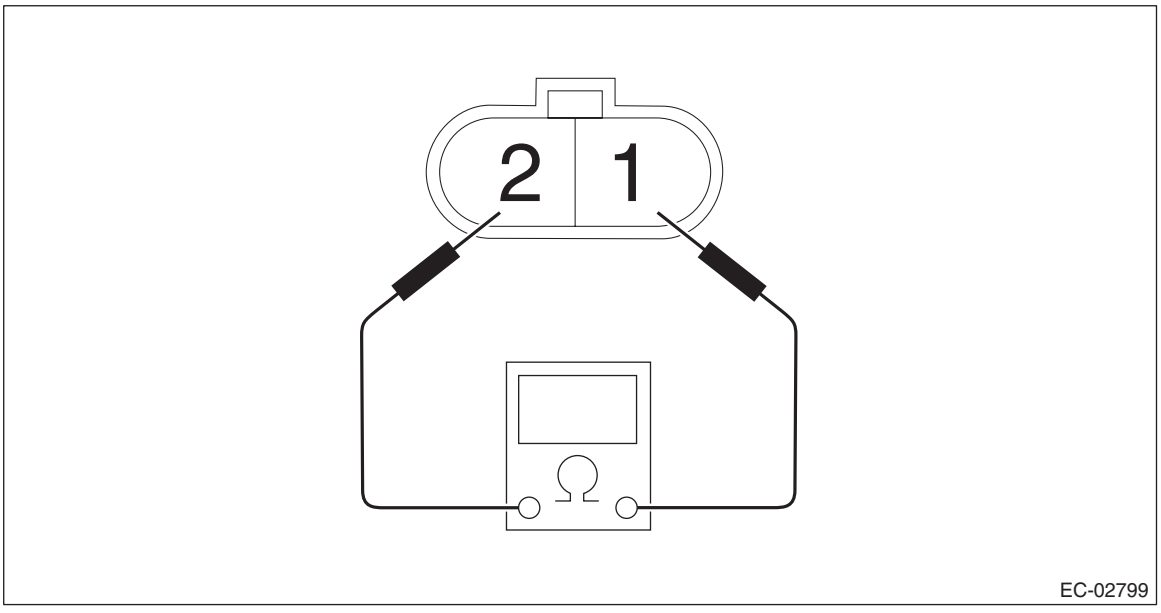


Tightening torque:
3.4 N·m (0.3 kgf-m, 2.5 ft-lb)

C: INSPECTION

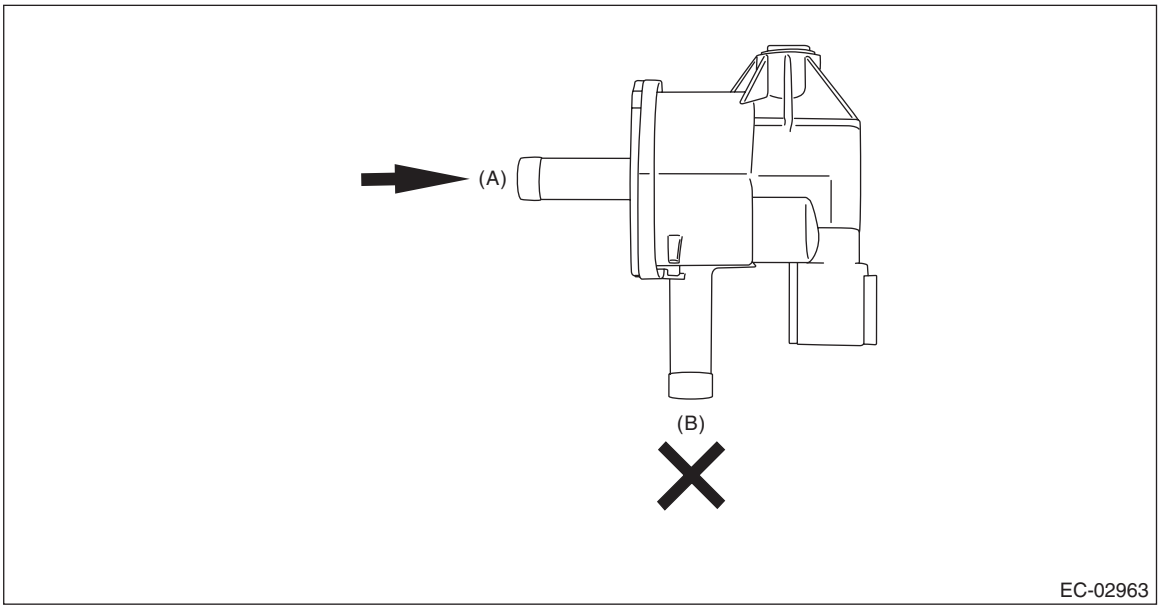
1. PURGE CONTROL SOLENOID VALVE

1) Check that the purge control solenoid valve has no deformation, cracks or other damages.
2) Measure the resistance between the purge control solenoid valve terminals.

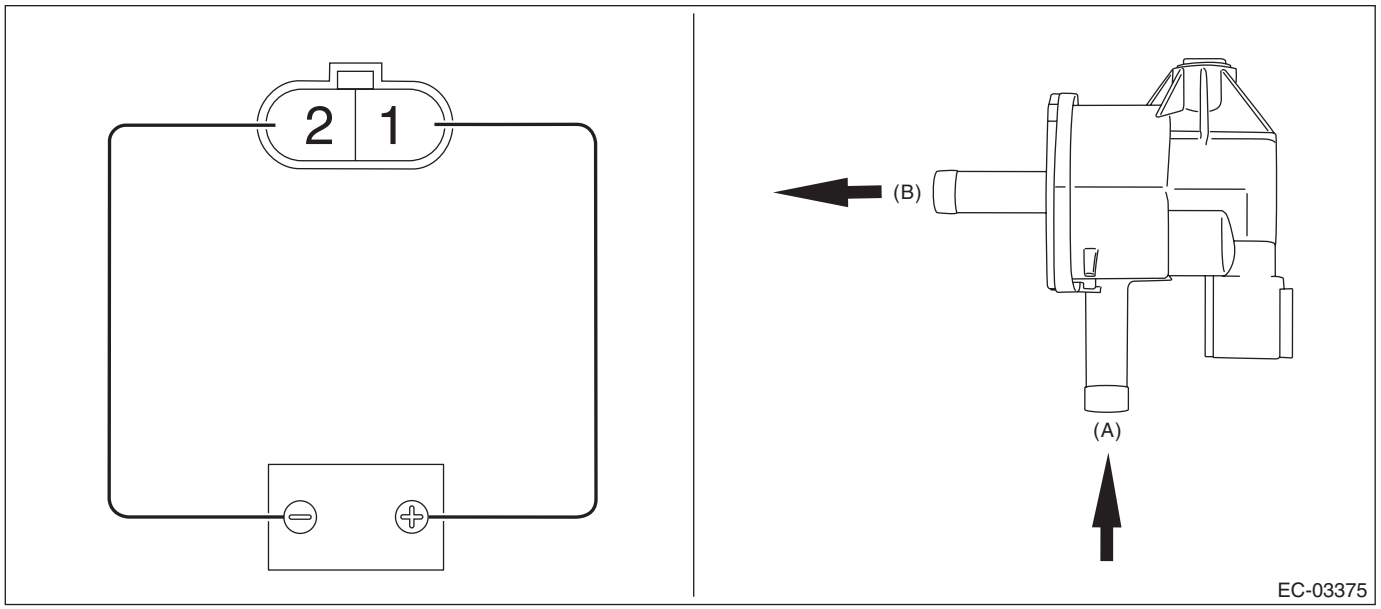


Terminal No.	Standard
1 and 2	24.5±1.5 Ω (20°C (68°F))

3) Check that air does not come out from (B) when air is blown into (A).



4) Connect the battery positive terminal to the terminal No. 1 and the battery negative terminal to the terminal No. 2. Check that air is discharged from (B), when supplying air to (A).



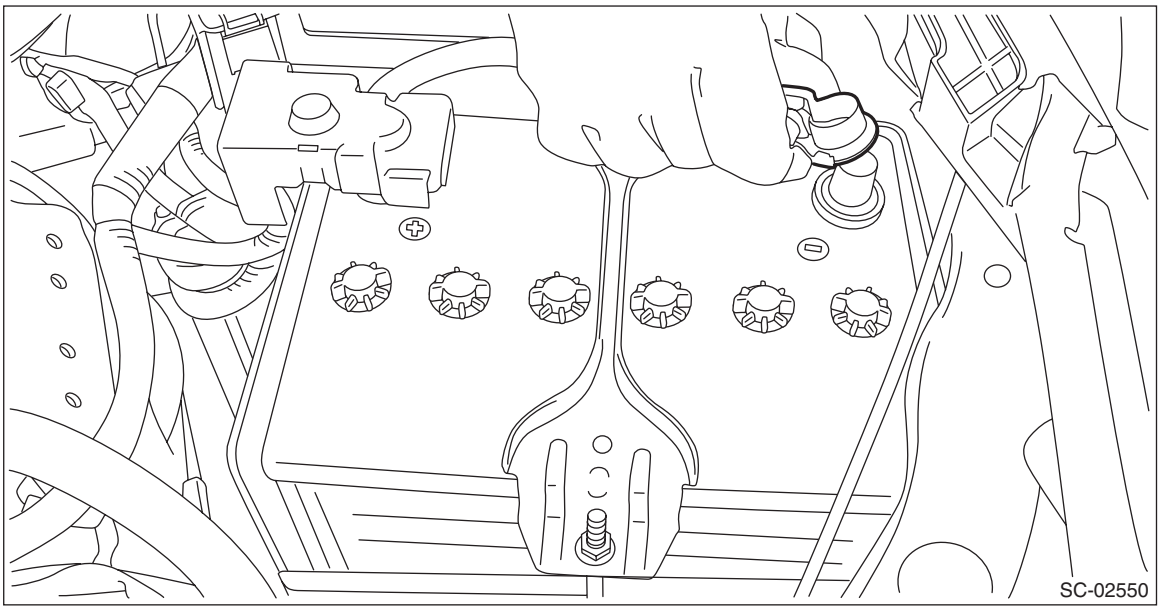
2. OTHER INSPECTIONS

Check the vacuum hose for cracks, damage or looseness.

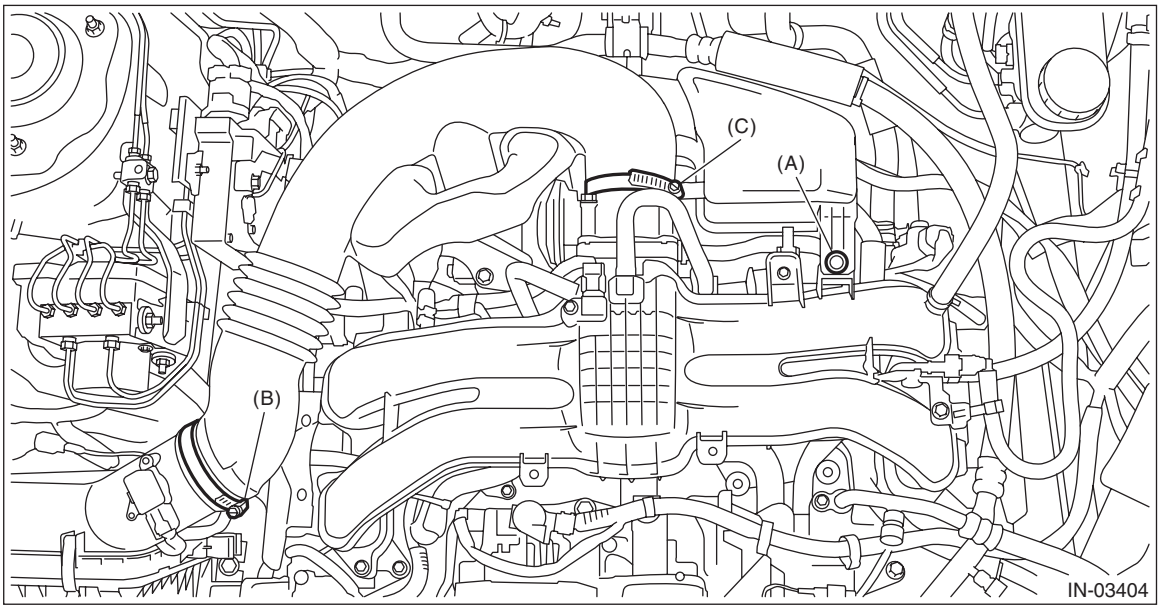
6. EGR Control Valve

A: REMOVAL

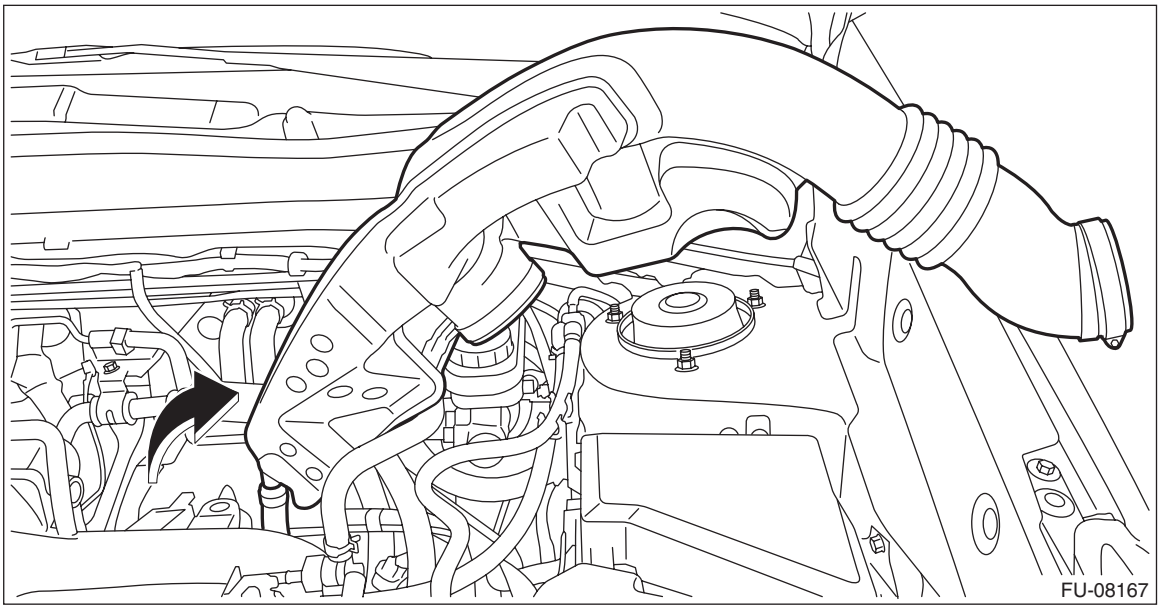
1) Disconnect the ground cable from battery.



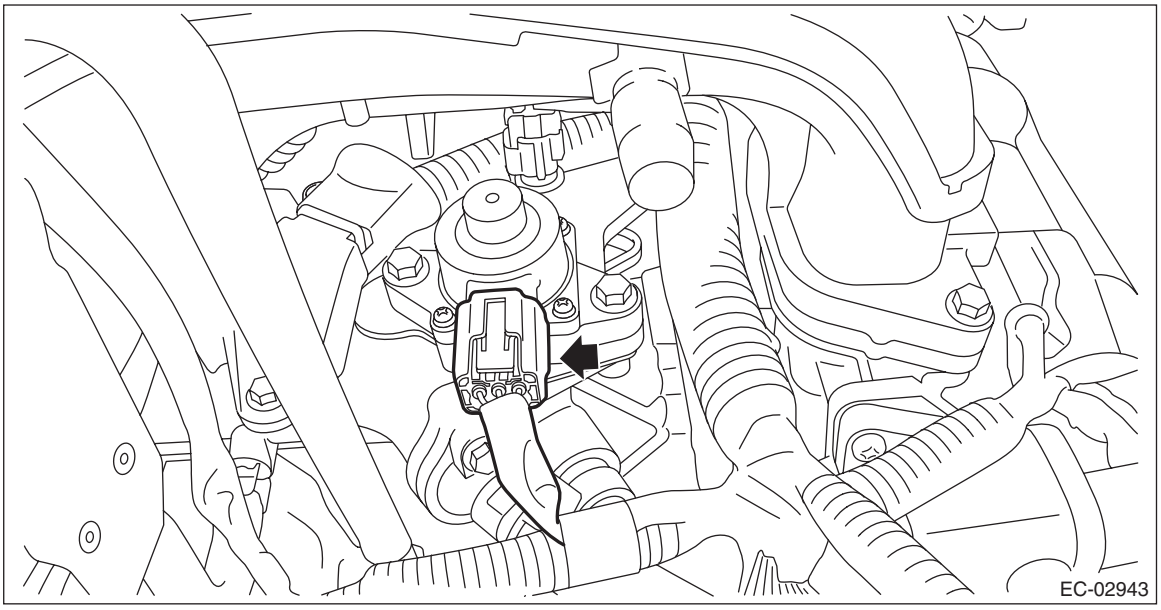
2) Remove the clip (A) from the air intake boot.
3) Loosen the clamp (B) connecting the air intake boot and air cleaner case (rear).
4) Loosen the clamp (C) which connects the air intake boot and throttle body.



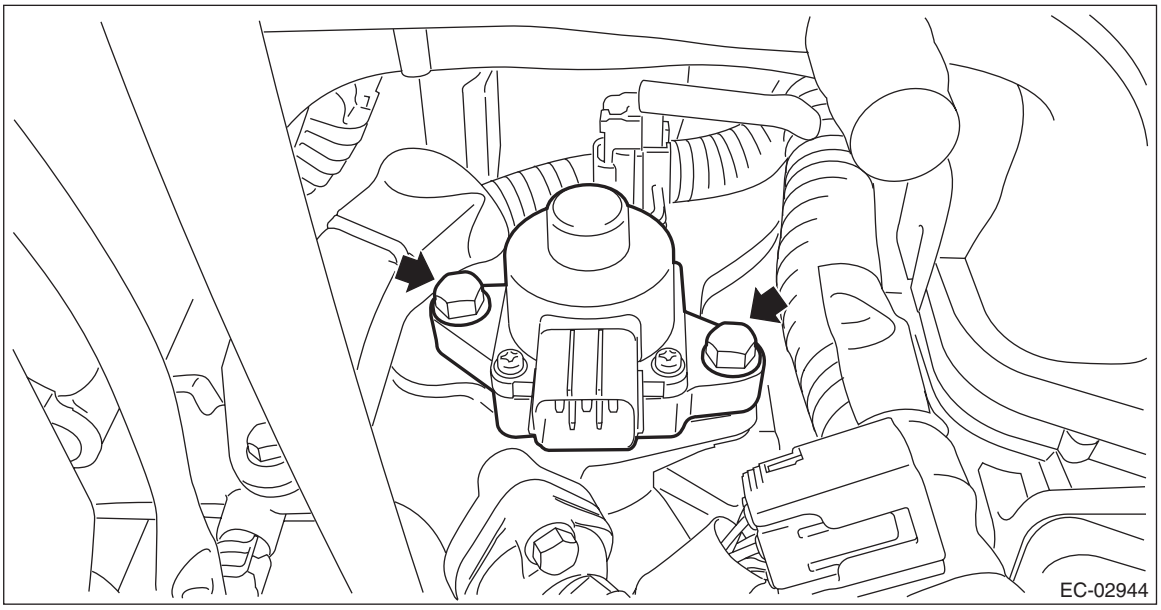
5) Remove the air intake boot from the throttle body, and move the air intake boot to the left side wheel apron.



6) Disconnect the connector from the EGR control valve.



7) Remove the EGR control valve from the water pipe assembly.

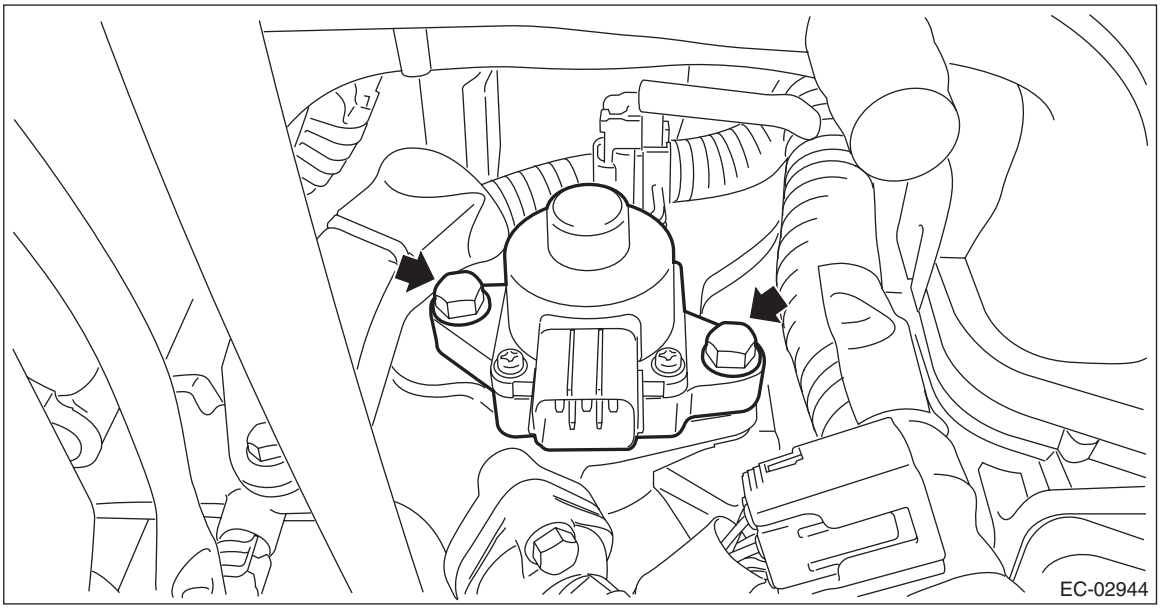


B: INSTALLATION

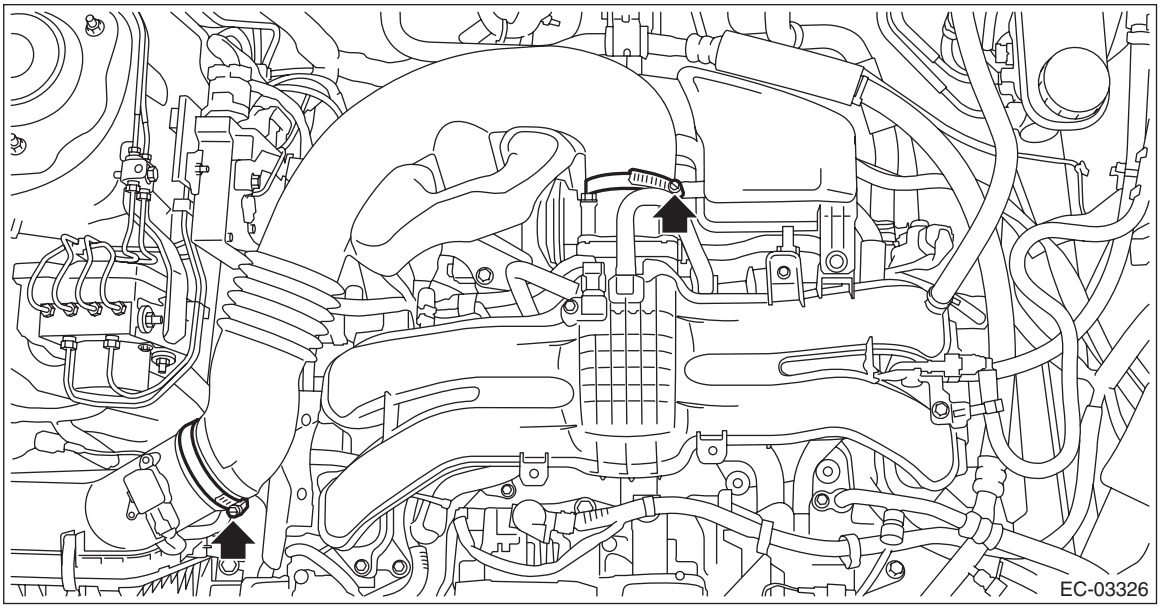
Install in the reverse order of removal.

NOTE:
Use new O-rings and gaskets.

Tightening torque:
22 N·m (2.2 kgf-m, 16.2 ft-lb)

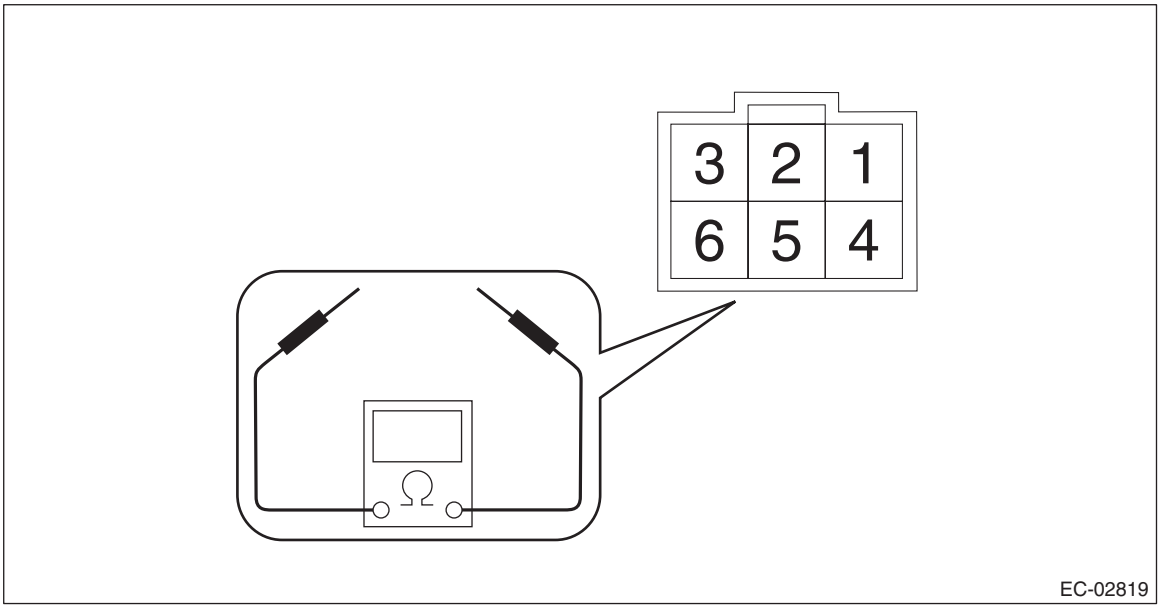


Tightening torque:
3 N·m (0.3 kgf-m, 2.2 ft-lb)



C: INSPECTION

1) Check that the EGR control valve has no deformation, cracks or other damages.
2) Measure the resistance between EGR control valve terminals.

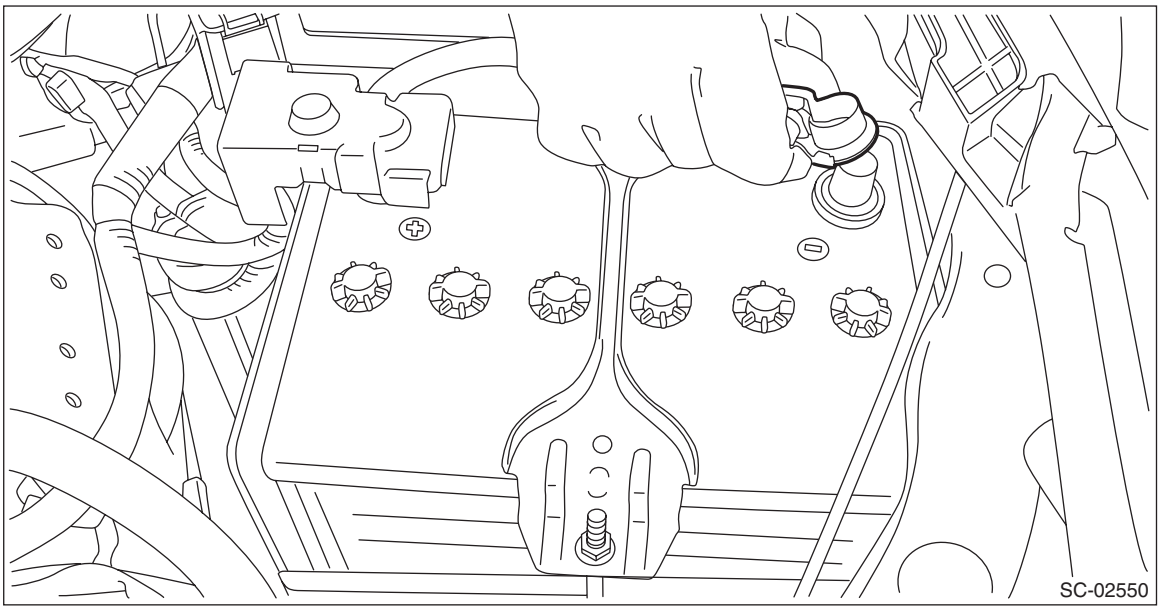


Terminal No.	Standard
2 and 1	22±2 Ω
2 and 3	22±2 Ω
5 and 4	22±2 Ω
5 and 6	22±2 Ω

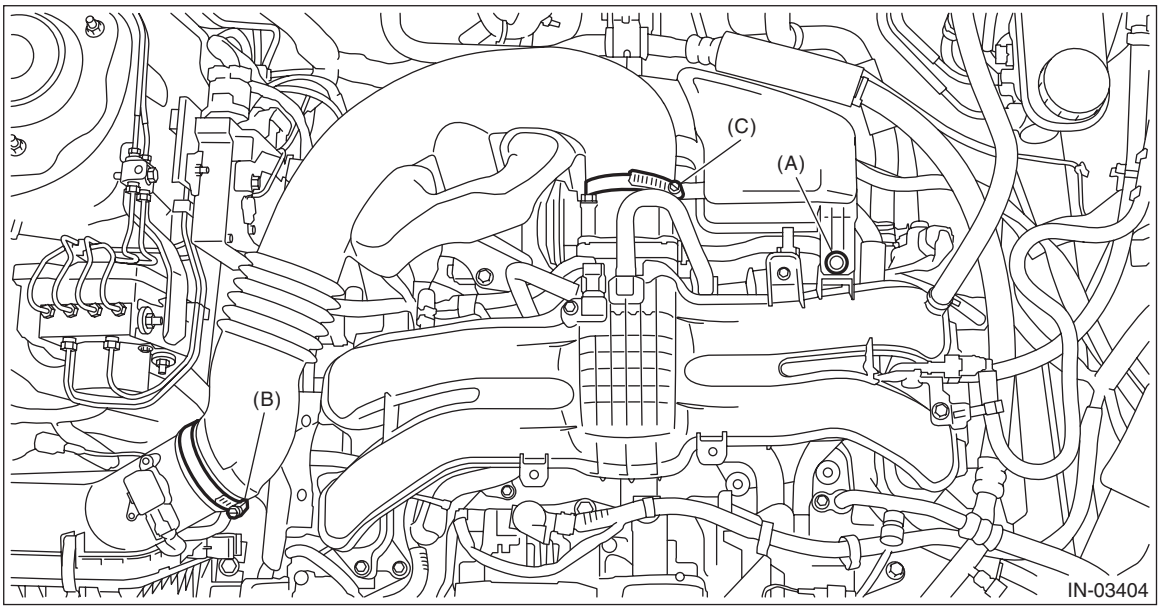
7. EGR Pipe

A: REMOVAL

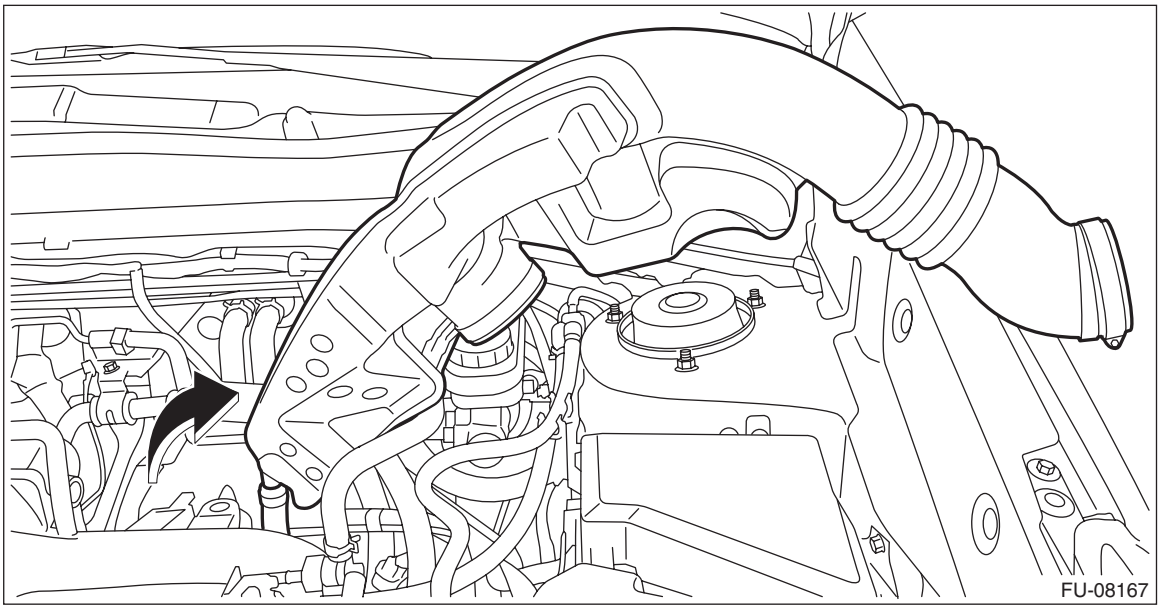
1) Disconnect the ground cable from battery.



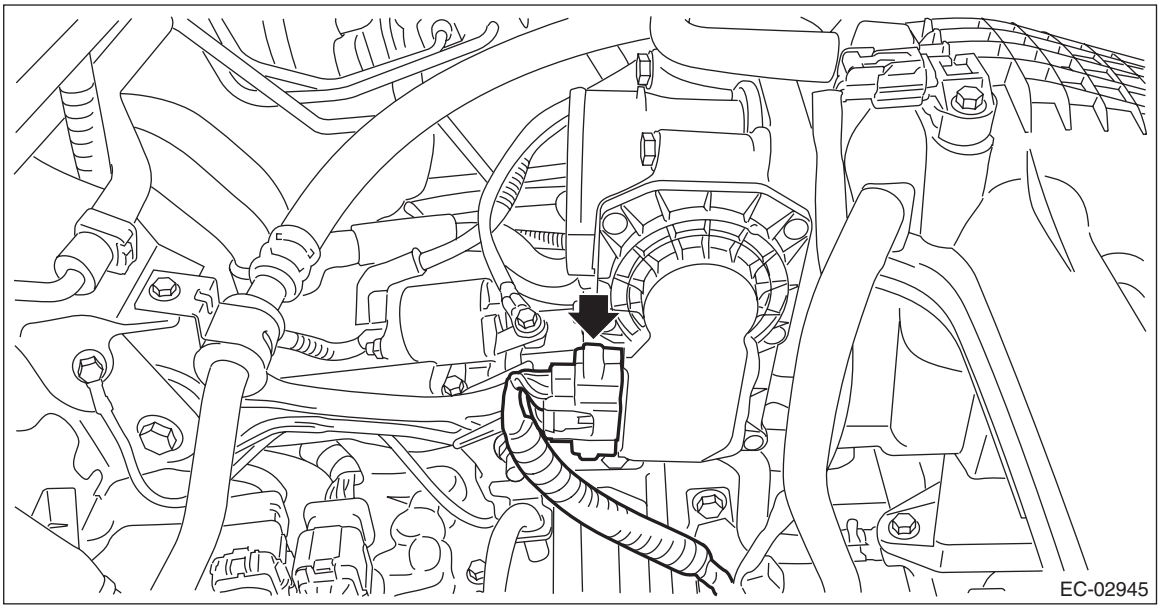
2) Remove the clip (A), and loosen the clamps (B) and (C) securing the air intake boot.



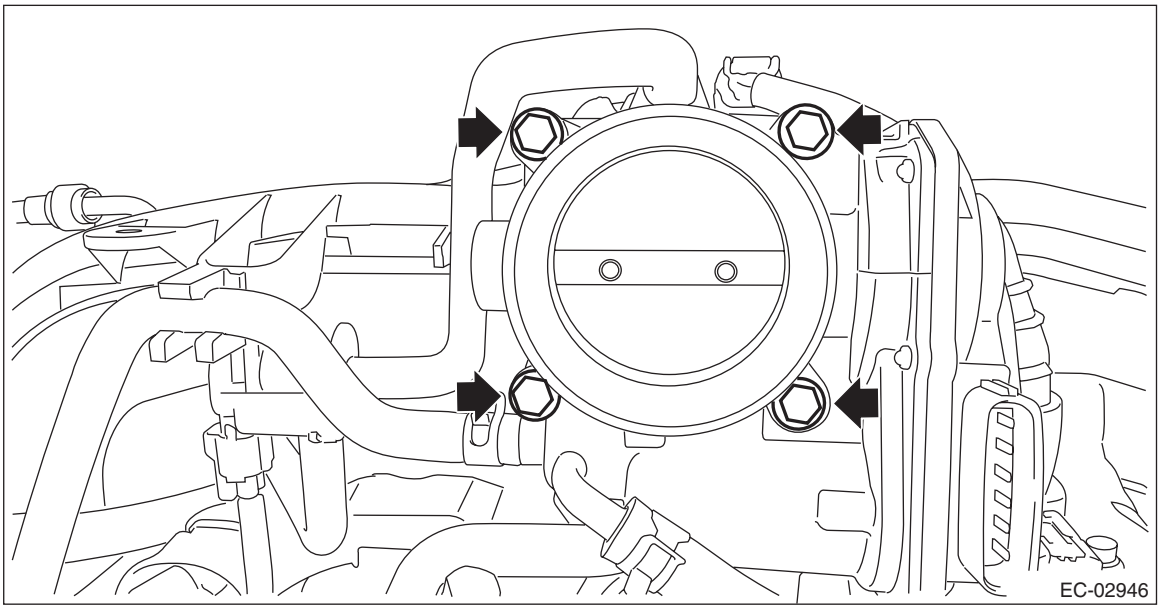
3) Remove the air intake boot from the air cleaner case (rear) and throttle body, and move it to the left side wheel apron.



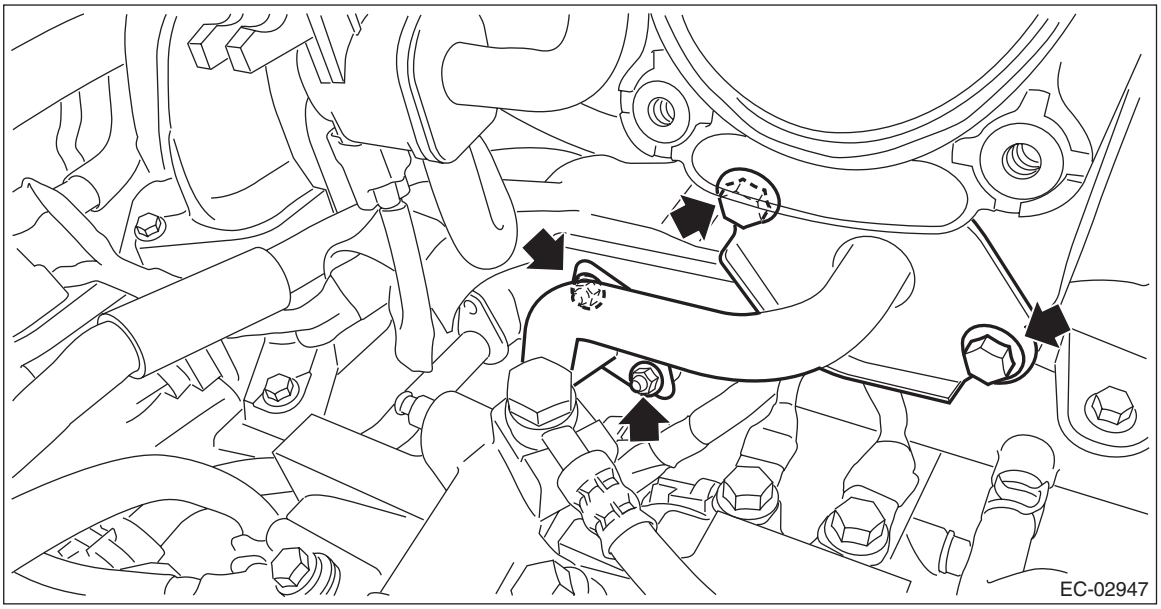
4) Disconnect the connector from the throttle body.



5) Remove the bolts which secure the throttle body to the intake manifold, and tilt the throttle body to the rear side of vehicle.



6) Remove the bolts and nuts that hold the EGR pipe to the intake manifold and the water pipe assembly, and remove the EGR pipe.

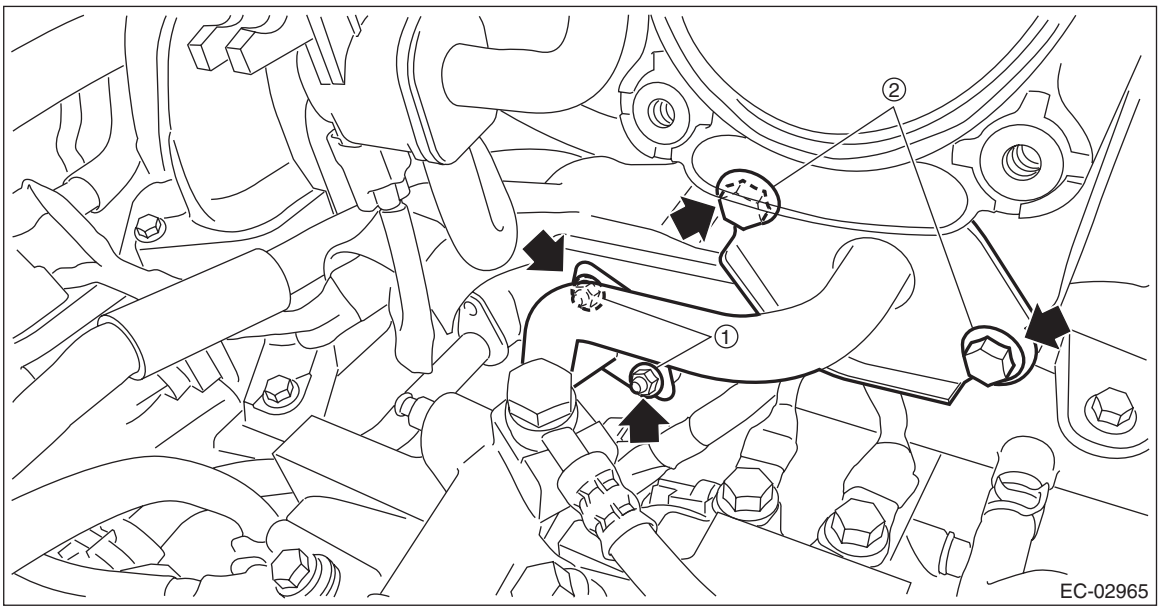


B: INSTALLATION

1) Temporarily install the EGR pipe to the intake manifold and water pipe assembly, and tighten the EGR pipe in numerical order as shown in the figure.

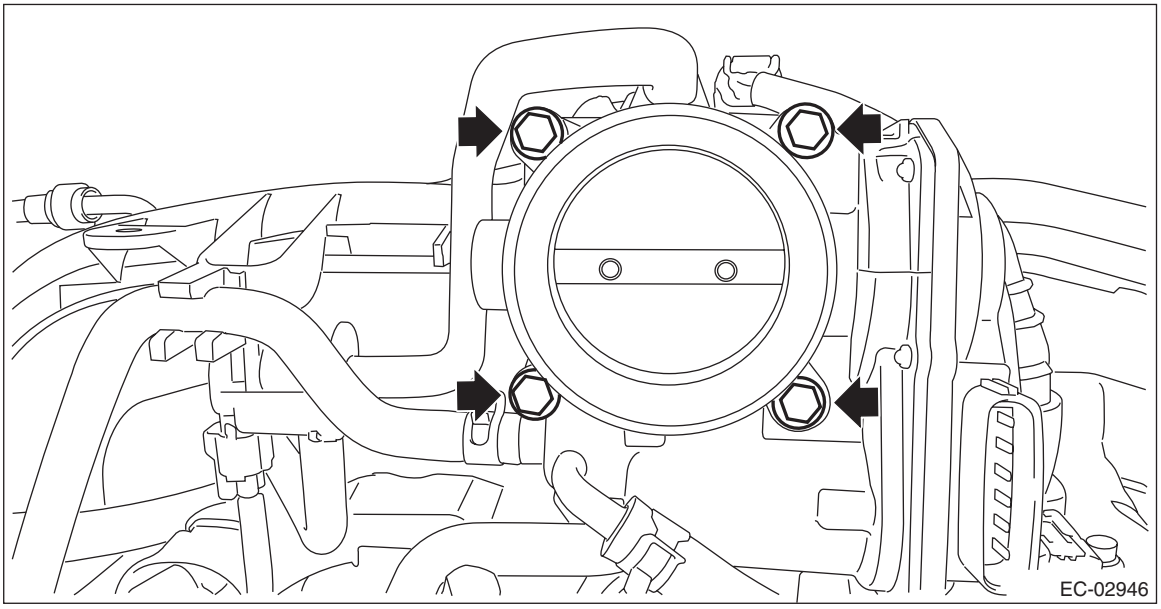
NOTE:
Use a new gasket.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

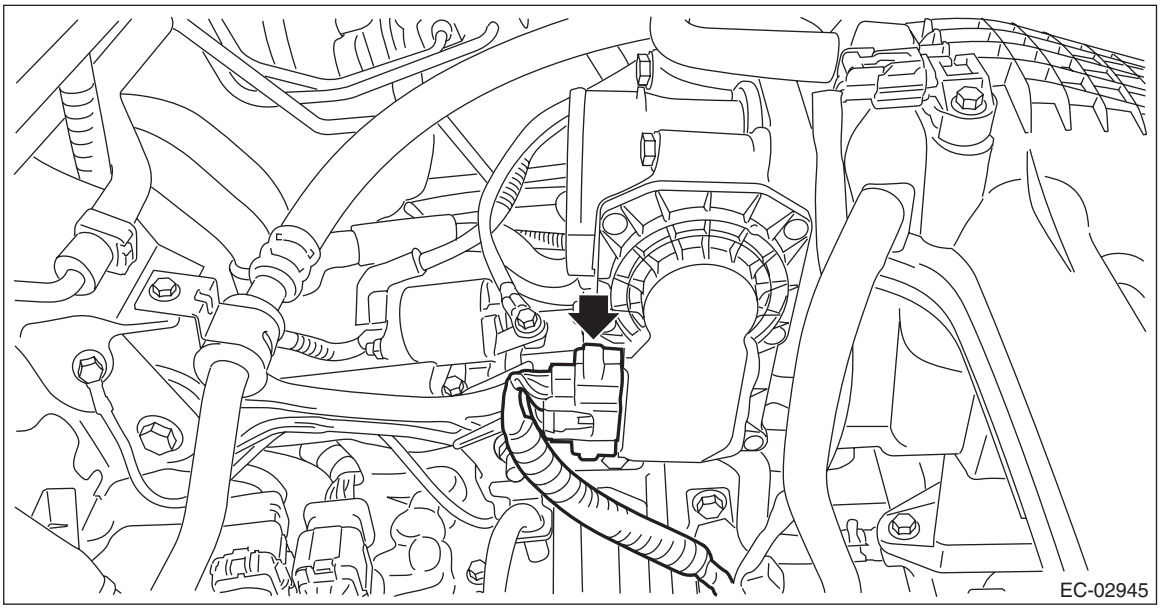


2) Install the throttle body to the intake manifold.

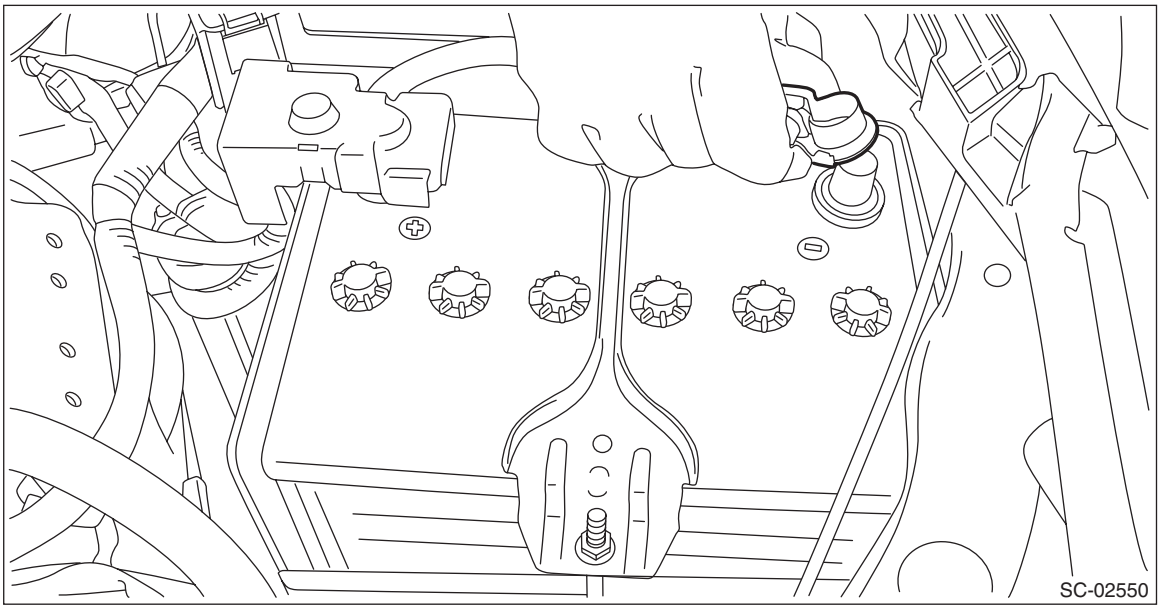
Tightening torque:
8.0 N·m (0.8 kgf-m, 5.9 ft-lb)



3) Connect the connector to the throttle body.



4) Install the air intake boot. <Ref. to IN(H4DO(w/o HEV))-12, INSTALLATION, Air Intake Boot.>
5) Connect the battery ground terminal.



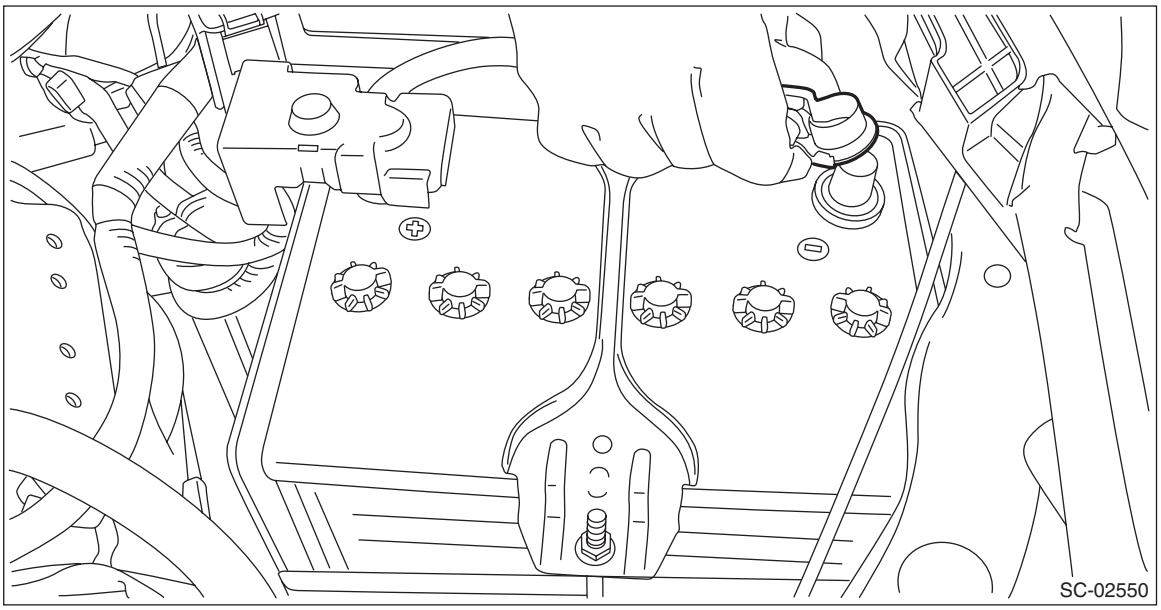
C: INSPECTION

Check that the EGR pipe has no deformation, cracks or other damages.

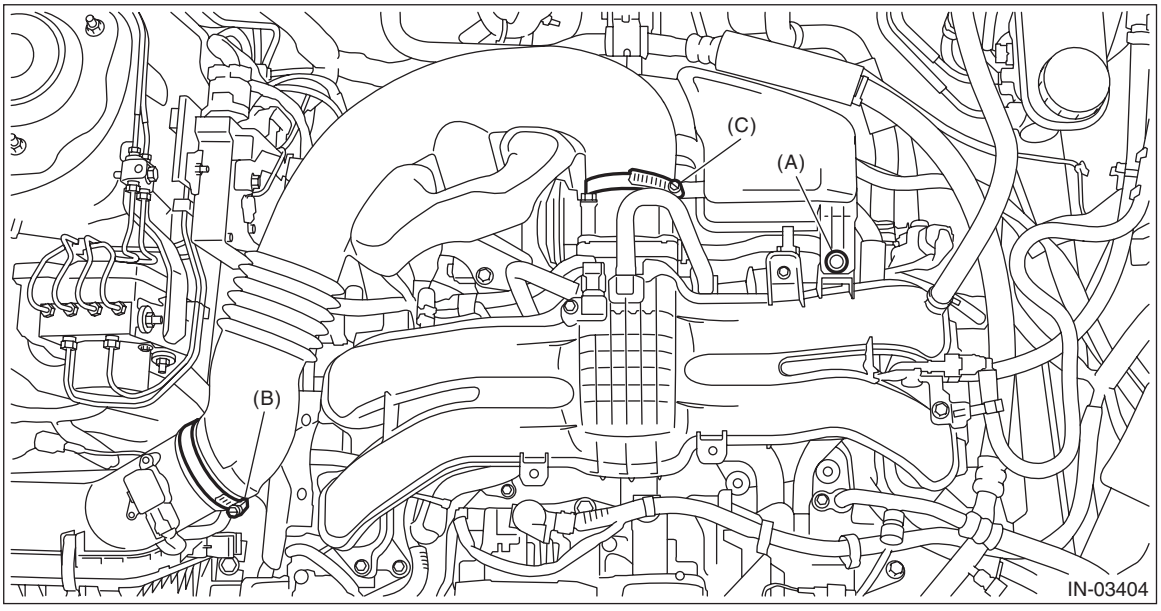
8. EGR Cooler

A: REMOVAL

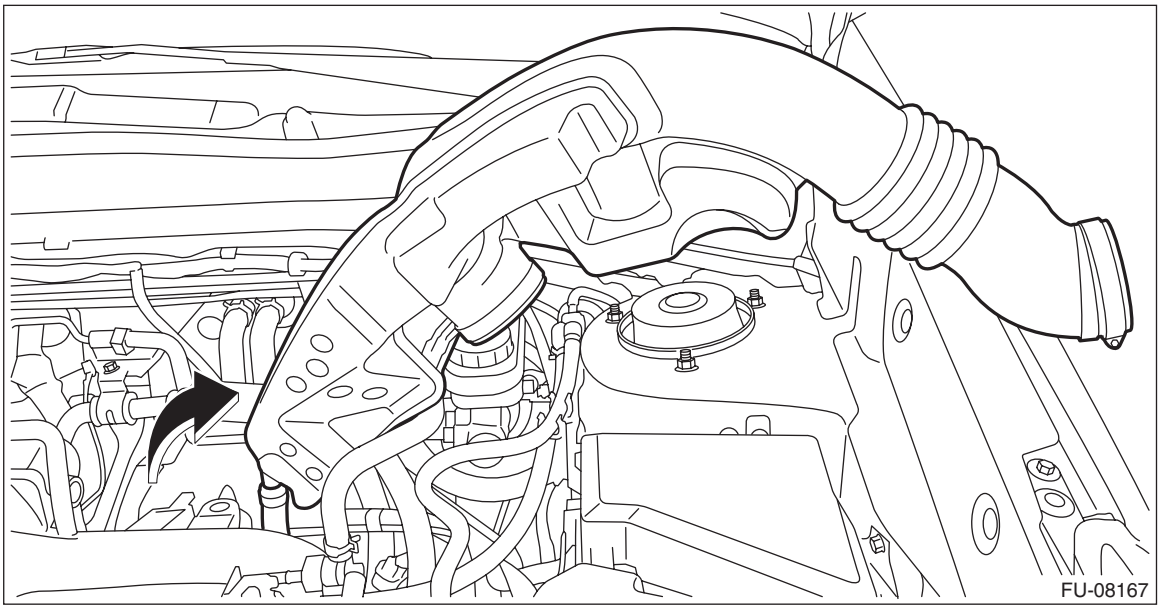
1) Disconnect the ground cable from battery.



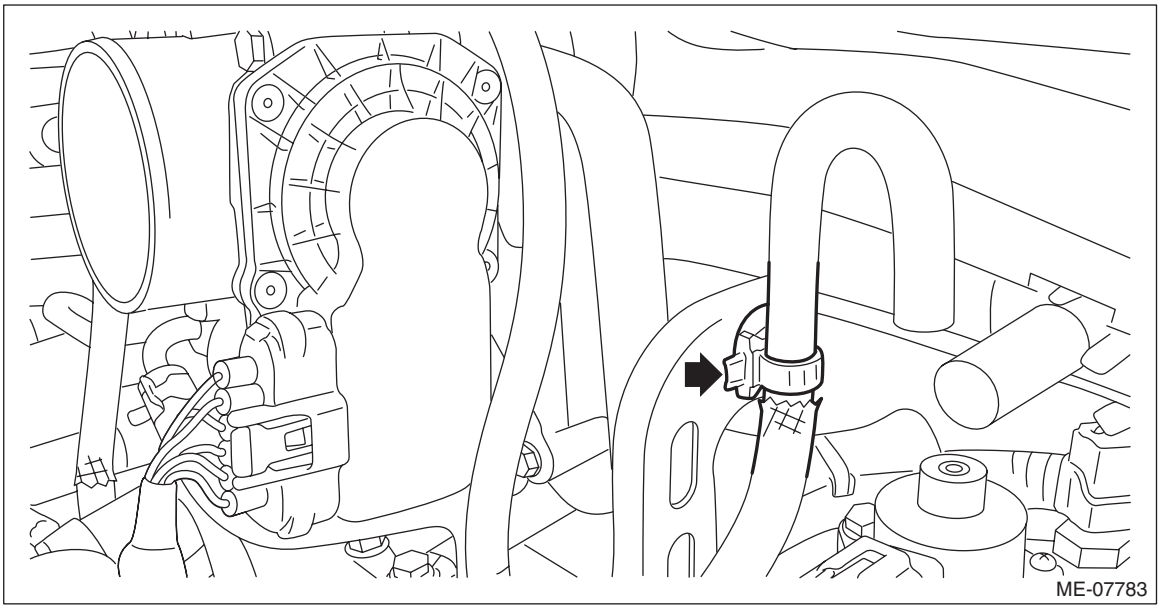
2) Drain engine coolant. <Ref. to CO(H4DO(w/o HEV))-16, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
3) Remove the center exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-14, REMOVAL, Center Exhaust Pipe.>
4) Lower the vehicle.
5) Remove the clip (A), and loosen the clamps (B) and (C) securing the air intake boot.



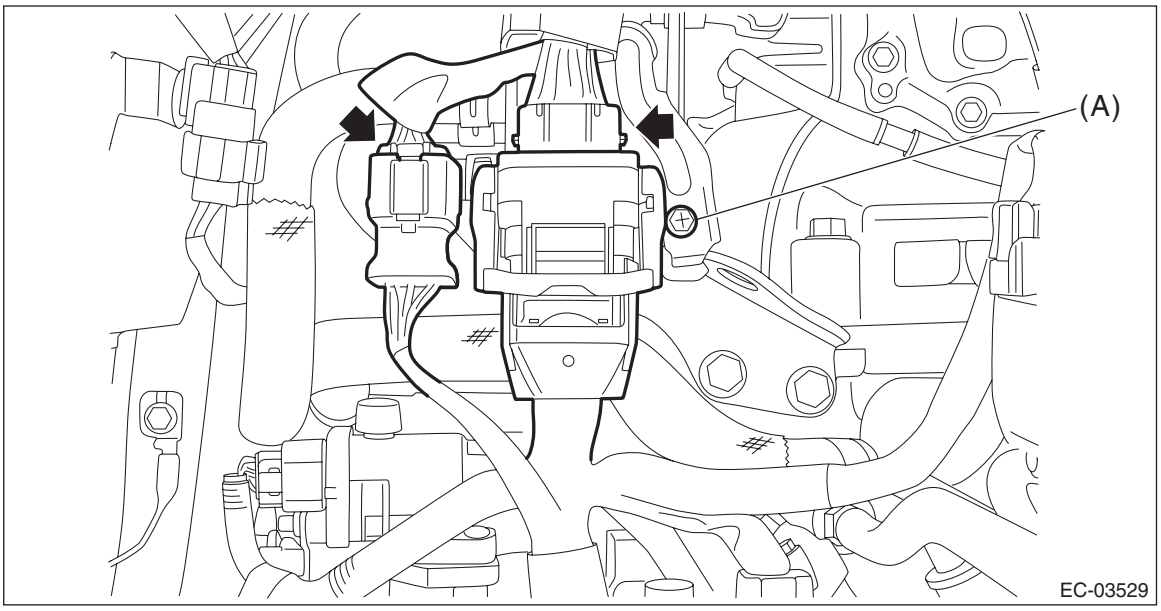
6) Remove the air intake boot from the air cleaner case (rear) and throttle body, and move it to the left side wheel apron.



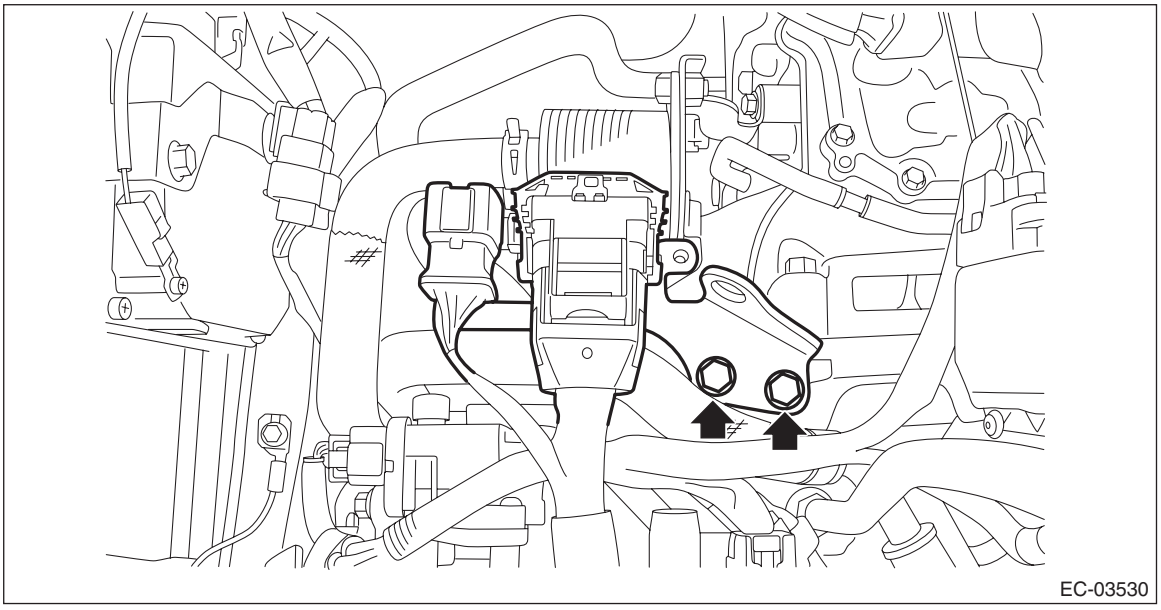
7) Remove the clip holding the air breather hose to the engine rear hanger. (MT model)



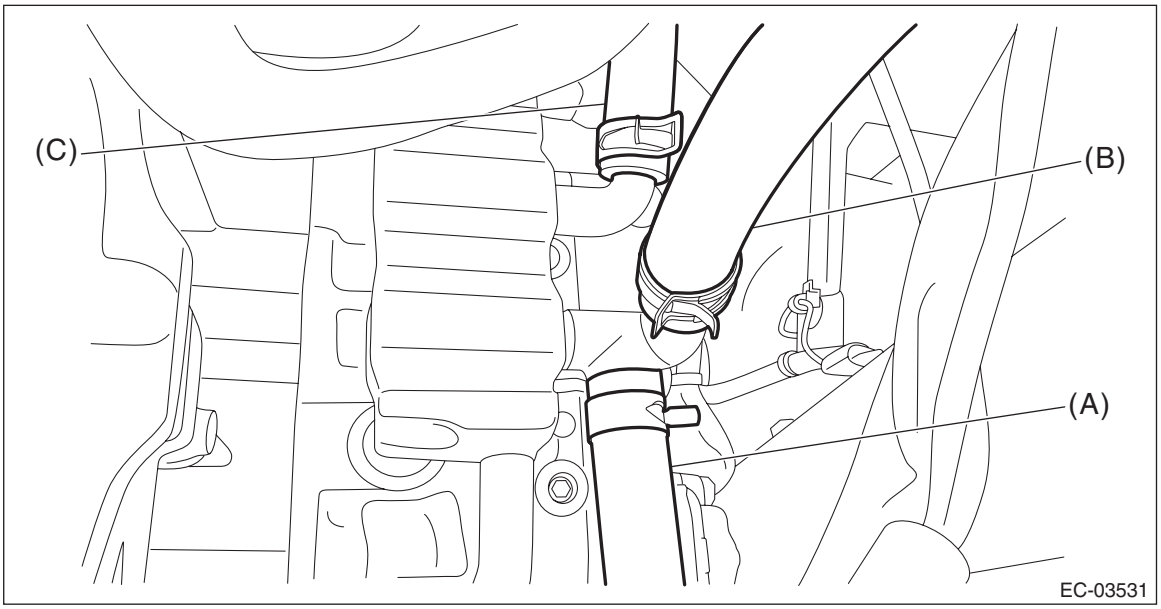
8) Disconnect the engine harness connector.
(1) Remove the bolt (A) securing the bulkhead harness connector bracket.
(2) Disconnect the bulkhead harness connector from the engine harness connector (black) and engine harness connector (brown).



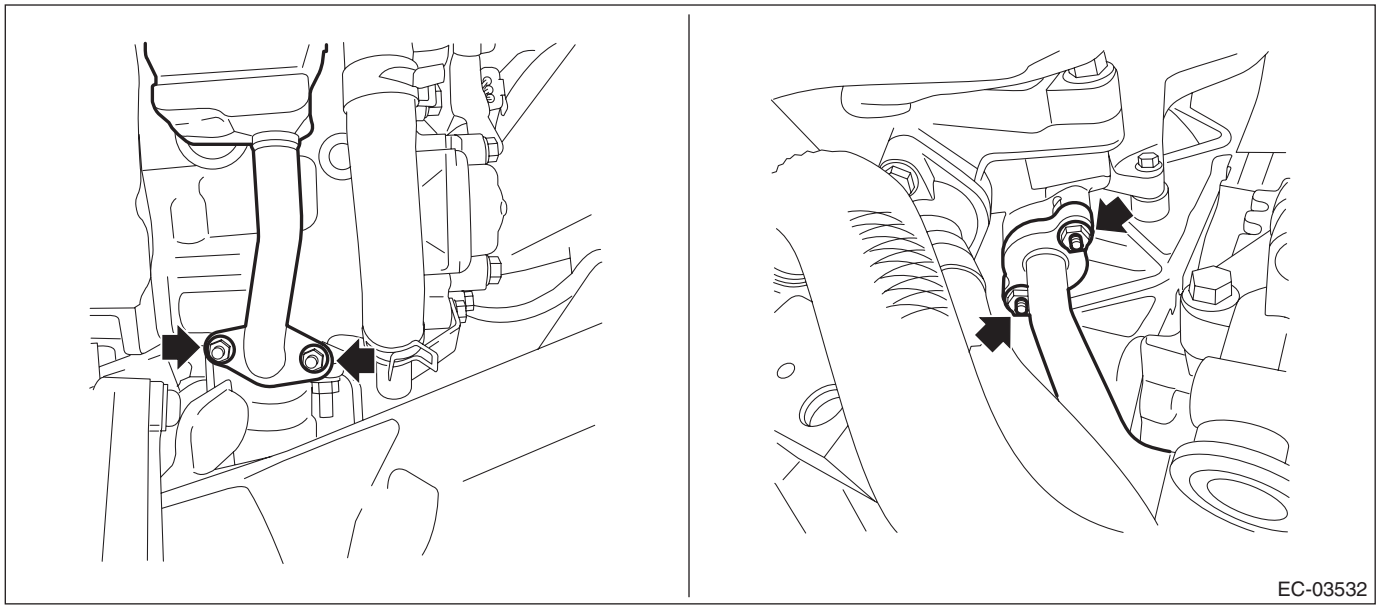
9) Remove the engine rear hanger.



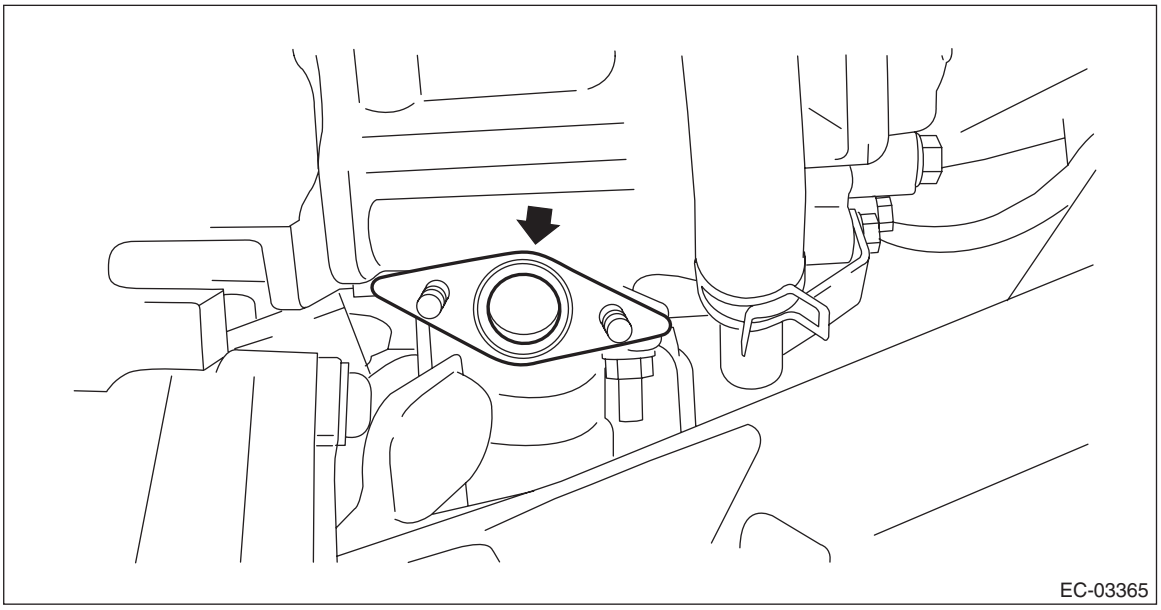
10) Disconnect the engine coolant hose (A), engine coolant hose (B) (CVT model) and engine coolant hose (C) from the EGR cooler.



11) Remove the nut which secures the EGR cooler to the cylinder head RH.
12) Remove the nuts securing the EGR cooler to the EGR control valve.



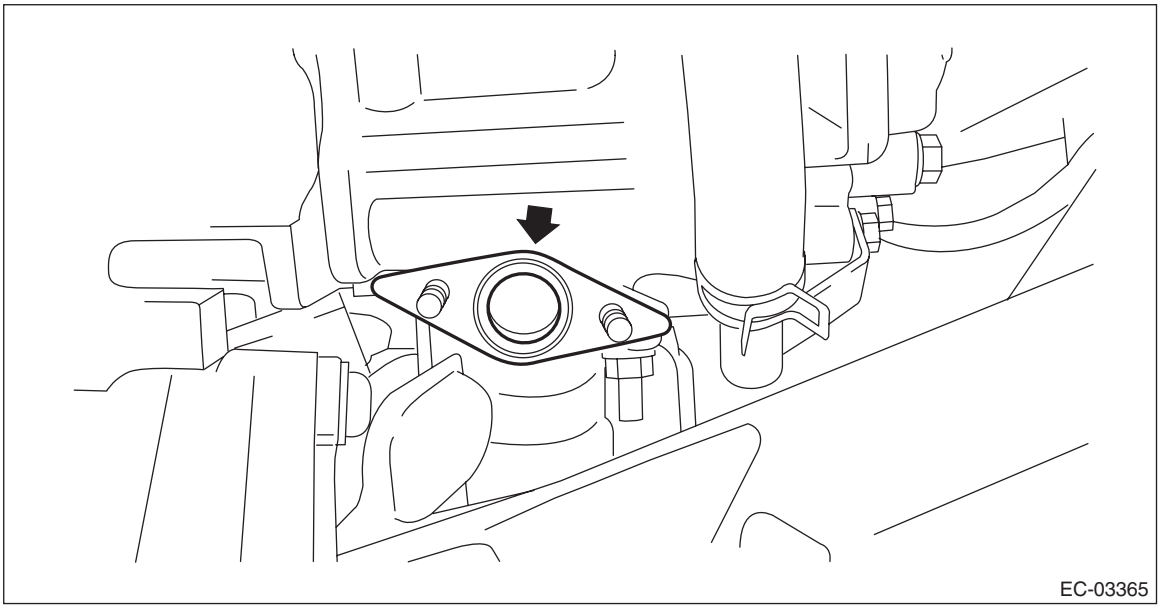
13) Remove the gasket from the stud bolt.



B: INSTALLATION

1) Set the gasket to the stud bolt.

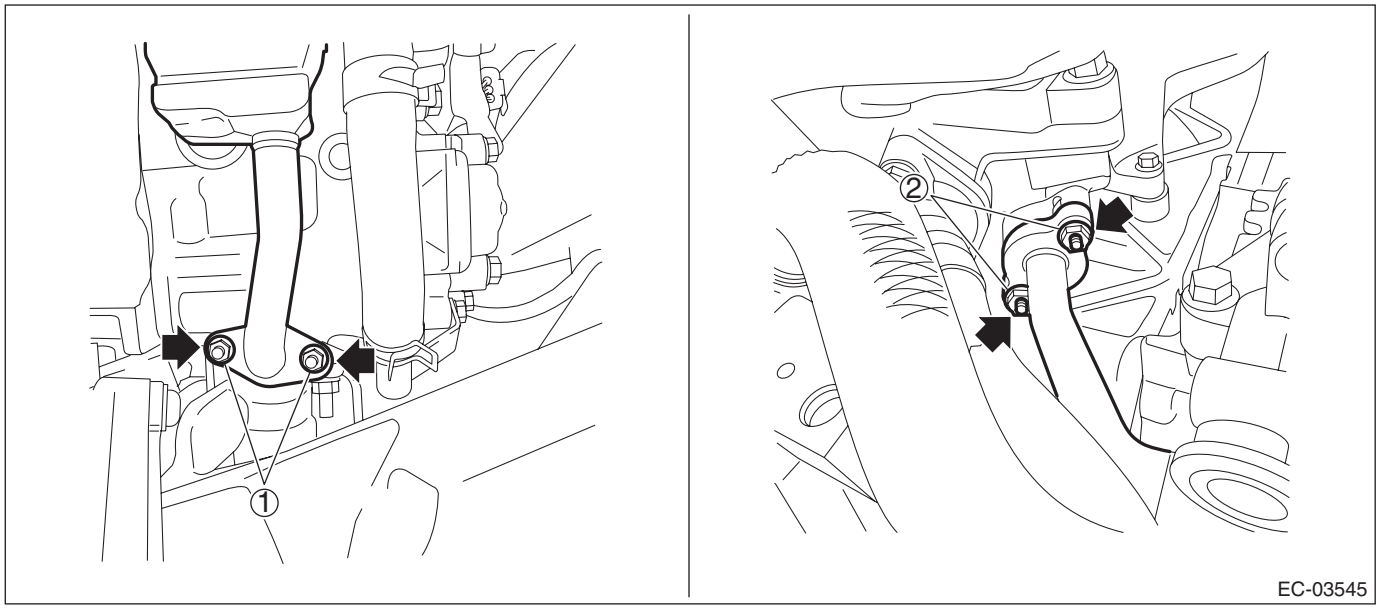
NOTE:
Use a new gasket.



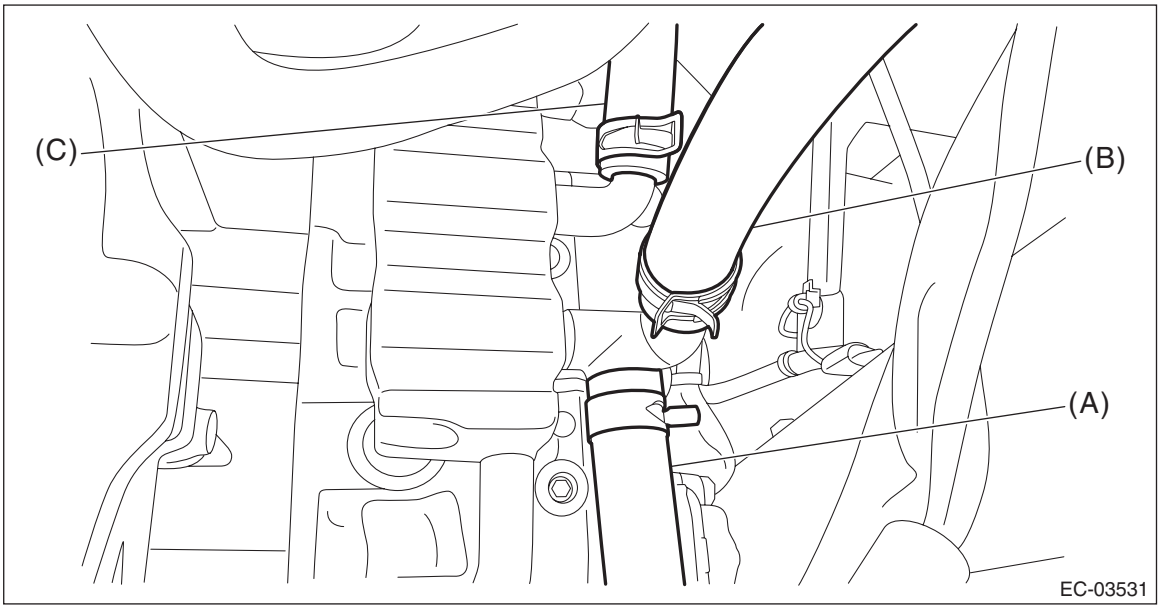
2) Temporarily install the EGR cooler to the EGR control valve and the cylinder head RH and tighten in the numerical order.

NOTE:
Use a new gasket.

Tightening torque:
9 N·m (0.9 kgf-m, 6.6 ft-lb)

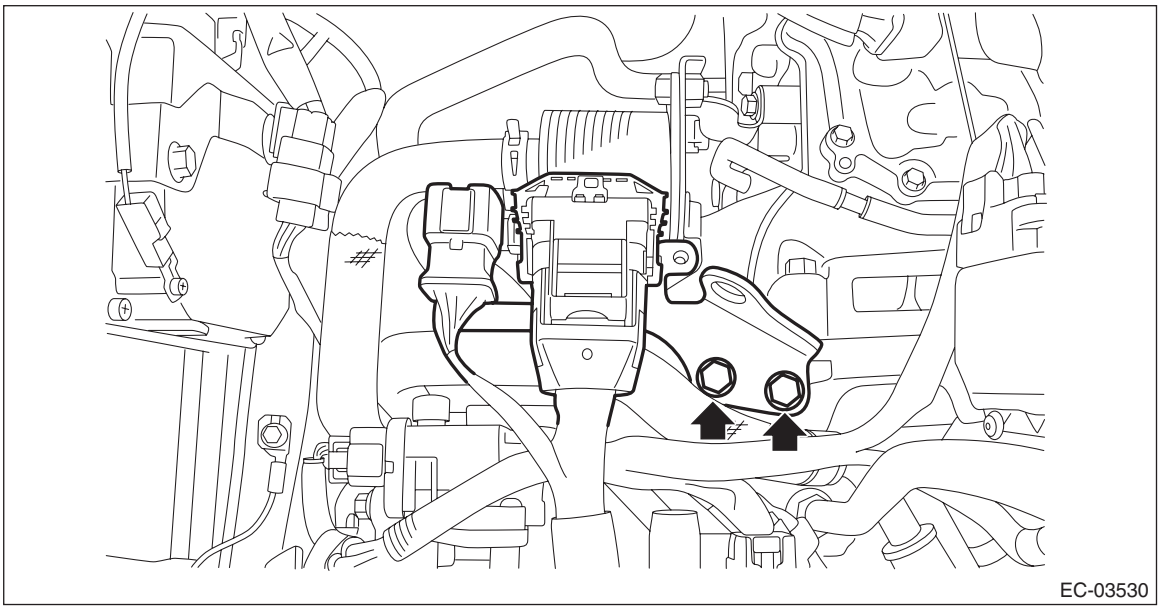


3) Connect the engine coolant hose (A), engine coolant hose (B) (CVT model) and engine coolant hose (C) to the EGR cooler.



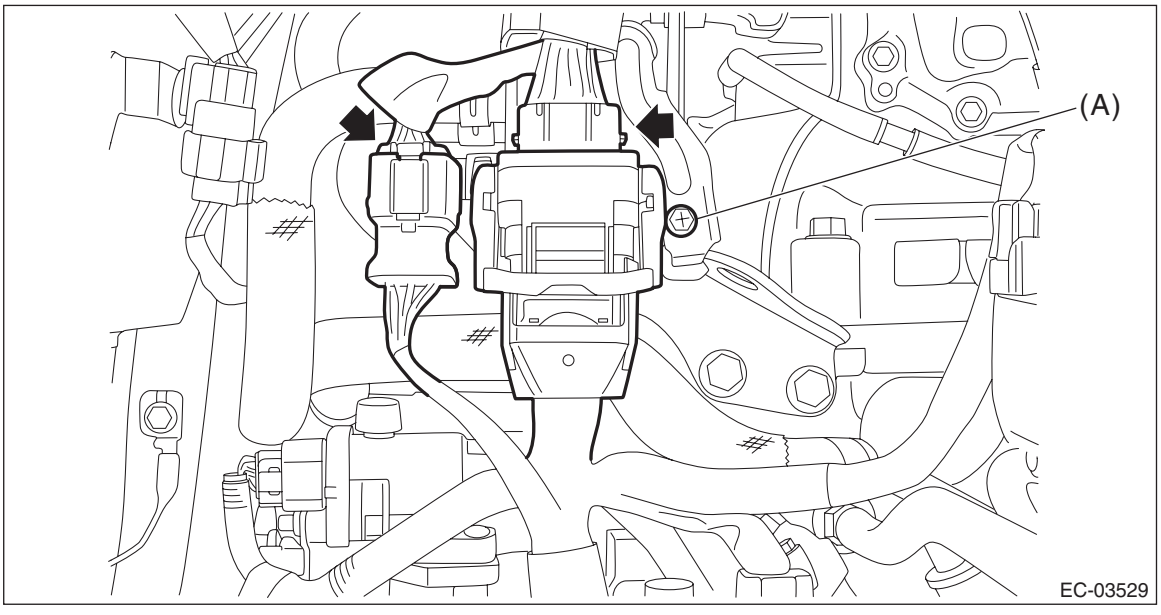
4) Install the engine rear hanger.

Tightening torque:
21 N·m (2.1 kgf-m, 15.5 ft-lb)

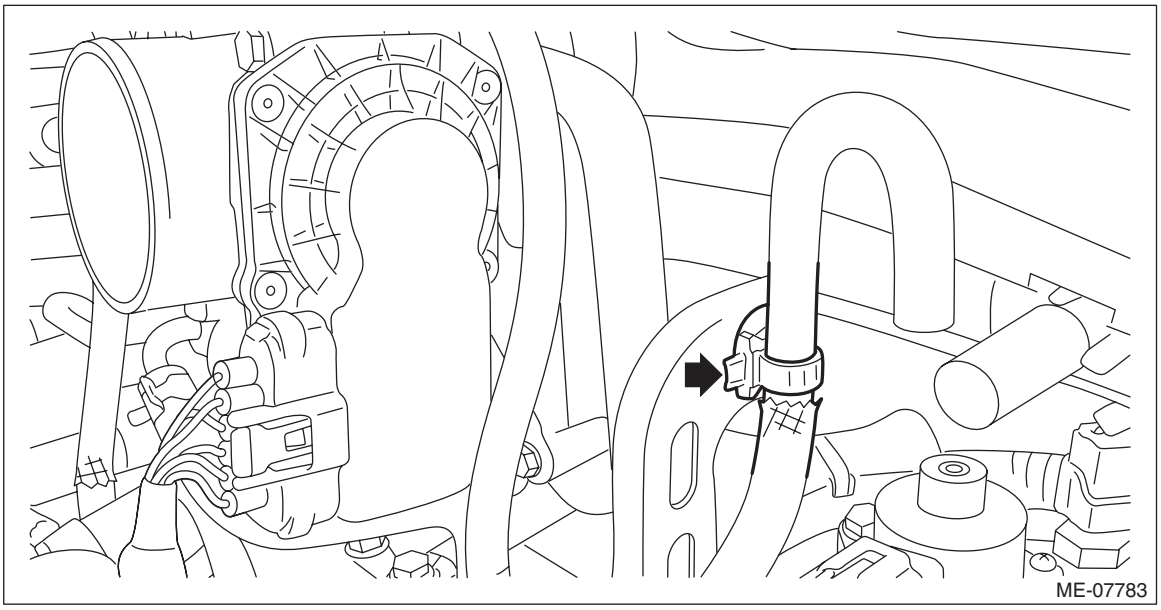


5) Connect the engine harness connector.
(1) Connect the bulkhead harness connector to the engine harness connector (black) and engine harness connector (brown).
(2) Install the bolt (A) which secures the bulkhead harness connector bracket.

Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



6) Secure the air breather hose to the engine rear hanger using clip. (MT model)



7) Install the air intake boot. <Ref. to IN(H4DO(w/o HEV))-12, INSTALLATION, Air Intake Boot.>
8) Install the center exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-15, INSTALLATION, Center Exhaust Pipe.>
9) Lower the vehicle.
10) Install the collector cover.
11) Connect the battery ground terminal. <Ref. to NT-5, BATTERY, NOTE, Note.>
12) Fill engine coolant. <Ref. to CO(H4DO(w/o HEV))-16, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

C: INSPECTION

1) Check that the EGR cooler has no deformation, cracks or other damages.
2) Check that the hose has no cracks, damage or loose part.

9. Fuel Level Sensor

A: REMOVAL

For removal procedures, refer to the “FU (H4DO (w/o HEV))” section. <Ref. to FU(H4DO(w/o HEV))-143, REMOVAL, Fuel Level Sensor.>

B: INSTALLATION

For installation procedures, refer to the “FU (H4DO (w/o HEV))” section. <Ref. to FU(H4DO(w/o HEV))-144, INSTALLATION, Fuel Level Sensor.>

C: INSPECTION

For inspection procedures, refer to the “FU (H4DO (w/o HEV))” section. <Ref. to FU(H4DO(w/o HEV))-145, INSPECTION, Fuel Level Sensor.>

10.Fuel Sub Level Sensor

A: REMOVAL

For removal procedures, refer to the “FU (H4DO (w/o HEV))” section. <Ref. to FU(H4DO(w/o HEV))-146, REMOVAL, Fuel Sub Level Sensor.>

B: INSTALLATION

For installation procedures, refer to the “FU (H4DO (w/o HEV))” section. <Ref. to FU(H4DO(w/o HEV))-150, INSTALLATION, Fuel Sub Level Sensor.>

C: INSPECTION

For inspection procedures, refer to the “FU (H4DO (w/o HEV))” section. <Ref. to FU(H4DO(w/o HEV))-152, INSPECTION, Fuel Sub Level Sensor.>

11.Drain Filter

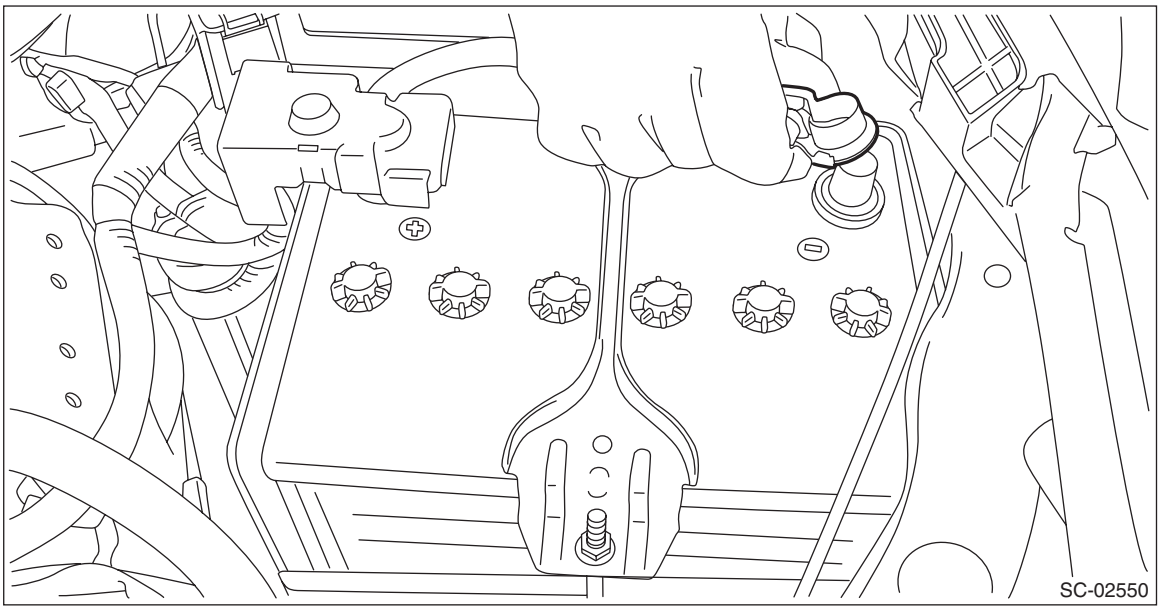
A: SPECIFICATION

The leak check valve assembly is a non-disassembled part. Do not remove the drain filter from the leak check valve assembly. Refer to “Leak Check Valve Assembly” for removal and installation procedures. <Ref. to EC(H4DO(w/o HEV))-43, REMOVAL, Leak Check Valve Assembly.> <Ref. to EC(H4DO(w/o HEV))-49, INSTALLATION, Leak Check Valve Assembly.>

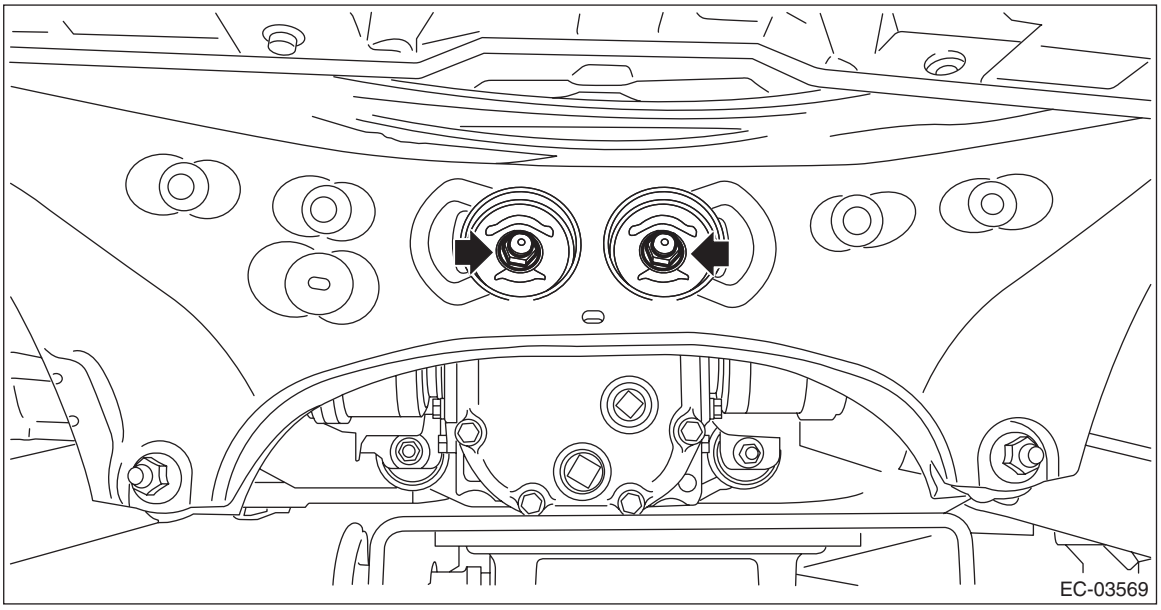
12.Leak Check Valve Assembly

A: REMOVAL

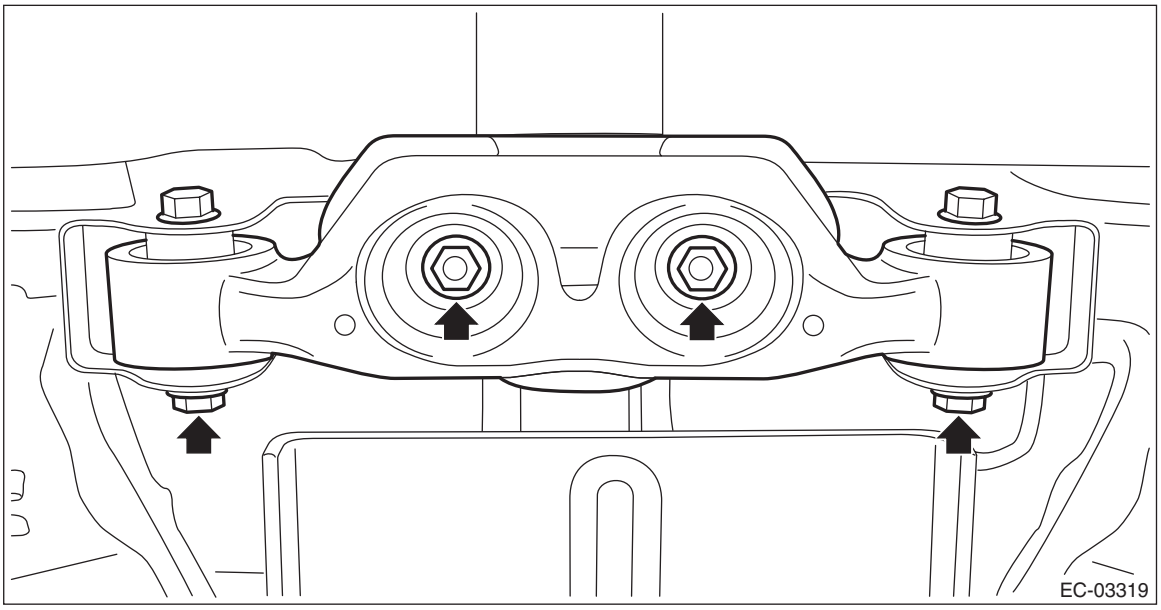
1) Disconnect the ground cable from battery.



2) Lift up the vehicle.
3) Remove the rear exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-18, REMOVAL, Rear Exhaust Pipe.>
4) Remove the propeller shaft. <Ref. to DS-12, REMOVAL, Propeller Shaft.>
5) Support the rear differential with the transmission jack.
6) Remove the self-locking nuts which hold the rear differential to the rear sub frame assembly.



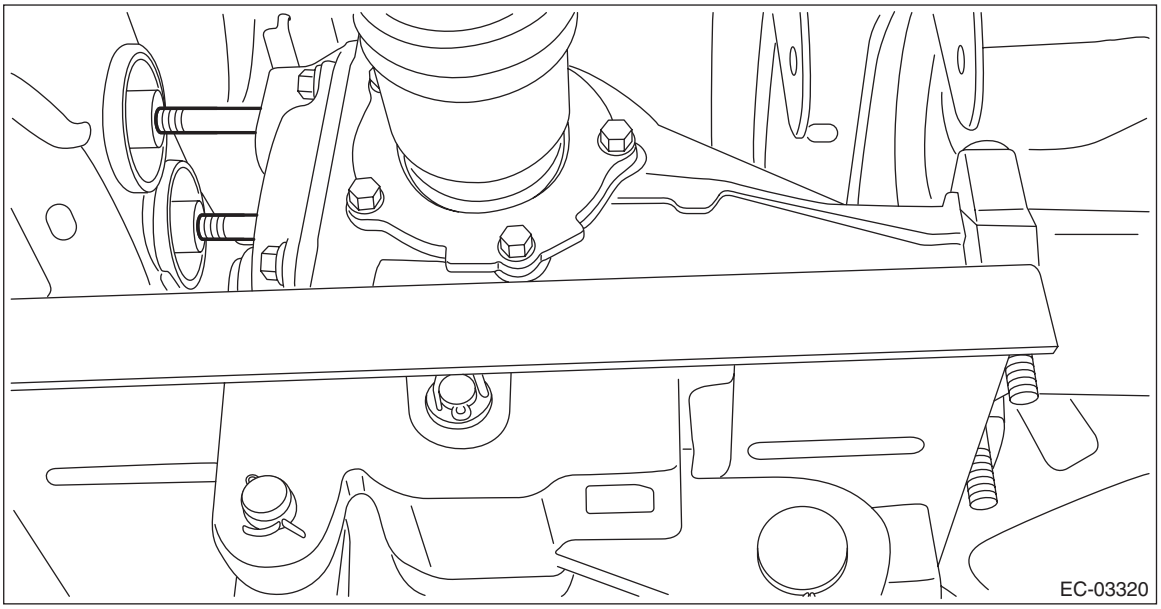
7) Remove the rear differential member from the rear sub frame assembly and the rear differential.



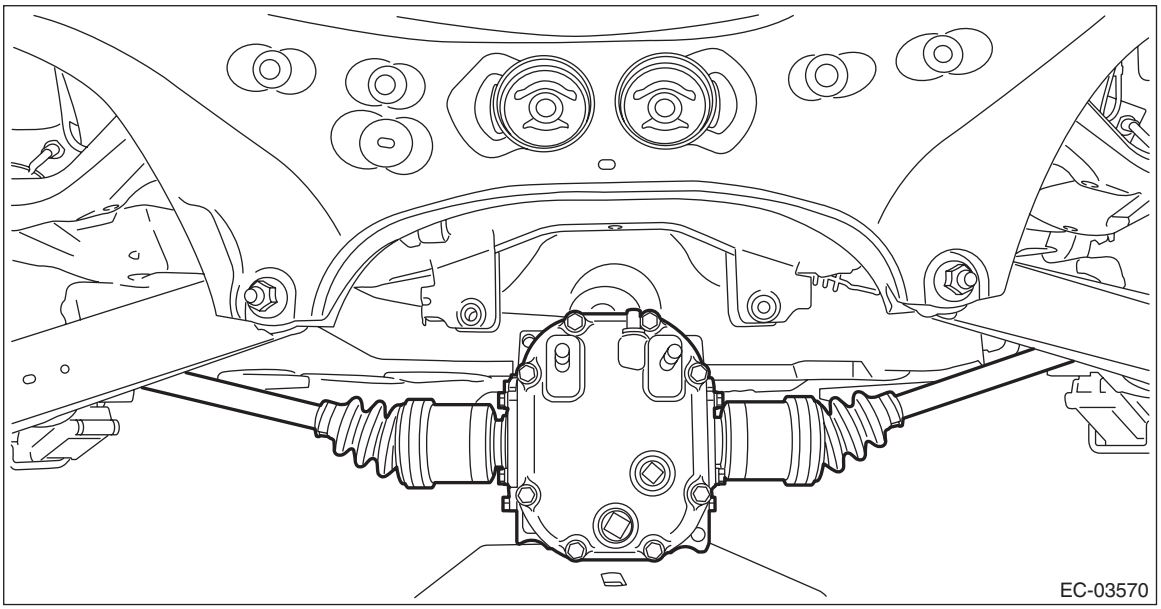
8) Lower the transmission jack gradually until the rear differential is at the position shown in the figure.

NOTE:

• When pulling out the stud bolt from the bushing portion of the rear sub frame assembly, adjust the angle and location of transmission jack and jack stand.

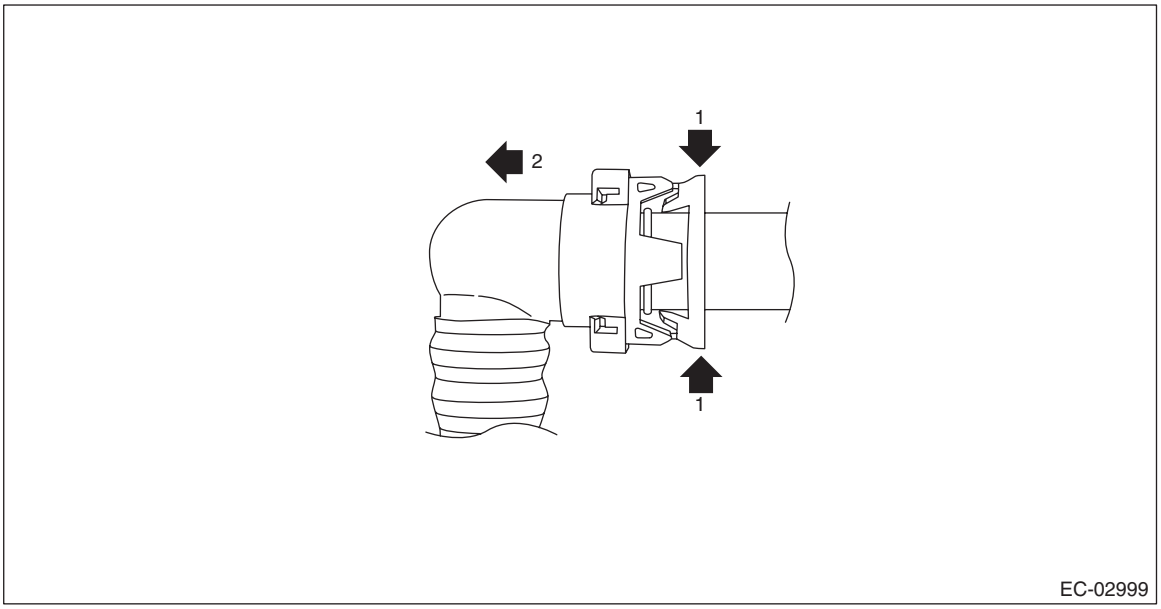


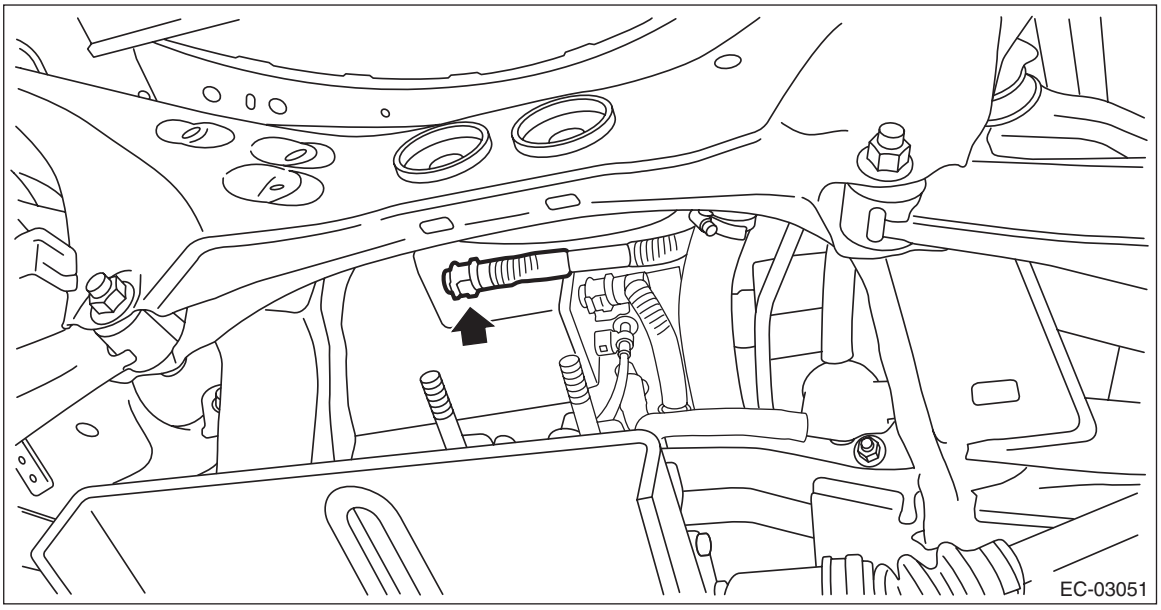
• Do not lower the rear differential excessively. Doing so may add extra load to the drive shaft or cause the falling-off of the drive shaft.



9) Disconnect the drain tube from the canister.

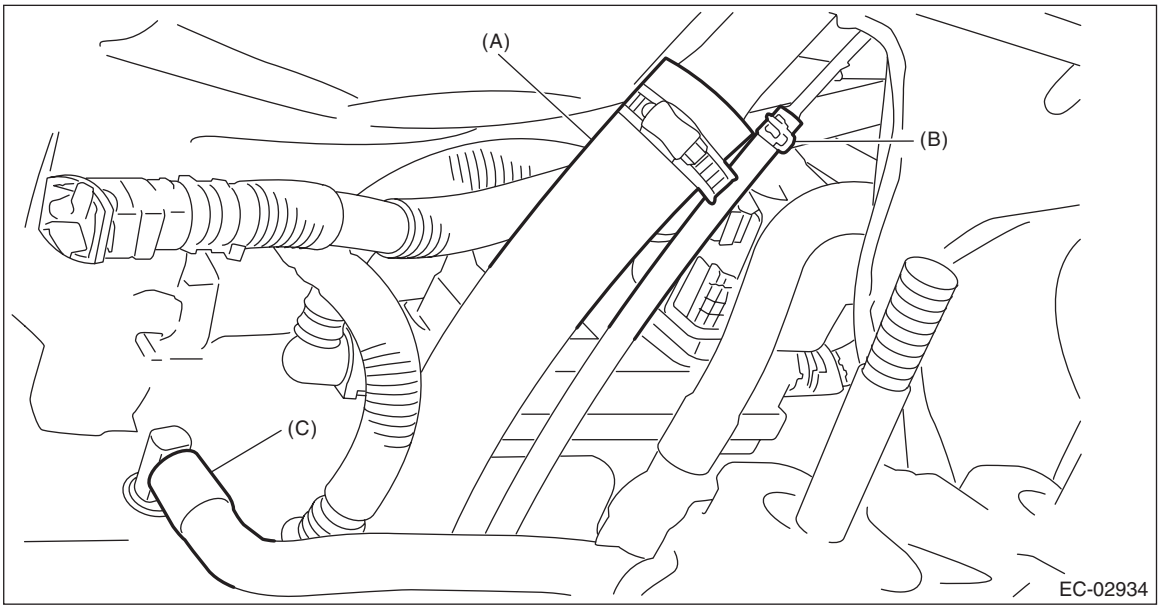
NOTE:
Disconnect the quick connector as shown in the figure.



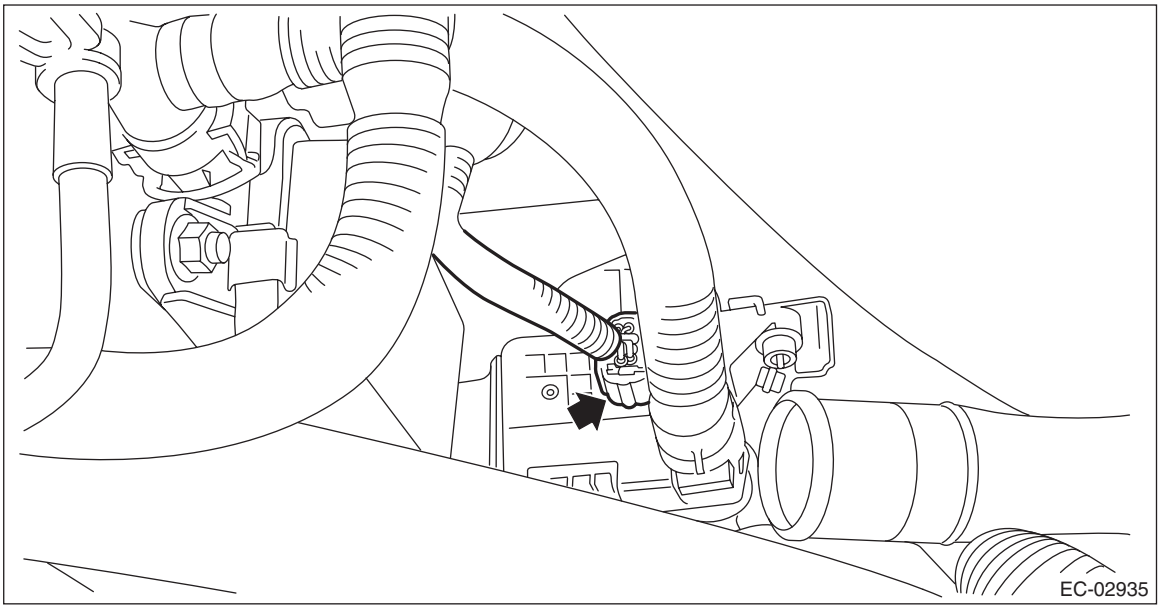


10) Disconnect the fuel filler hose (A) and evaporation hose (B).

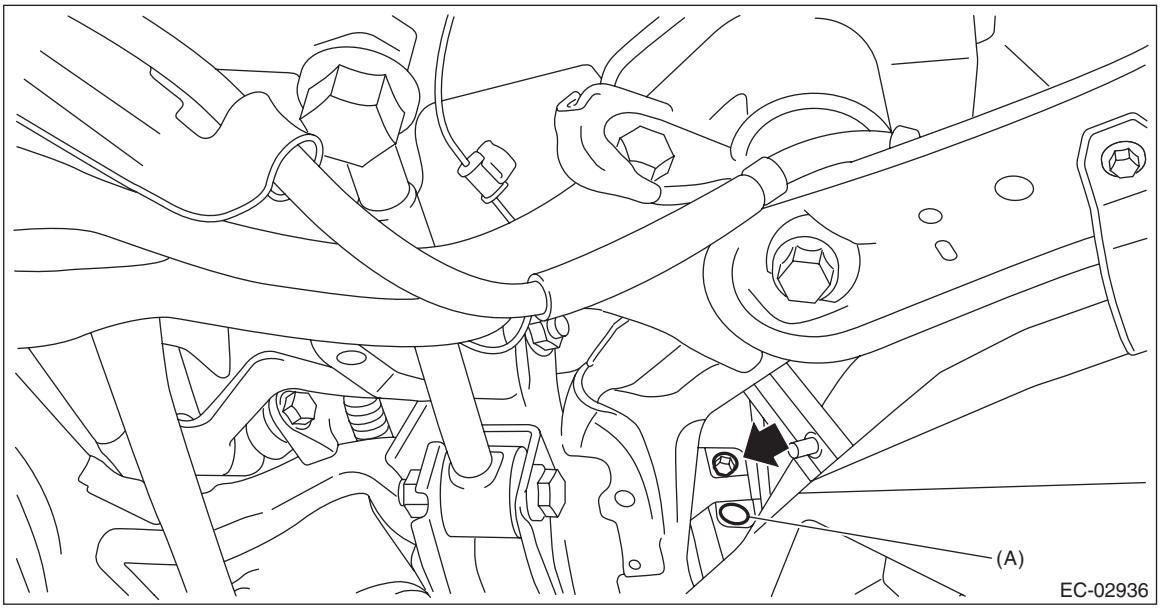
11) Disconnect the intake hose (C) from the connector.

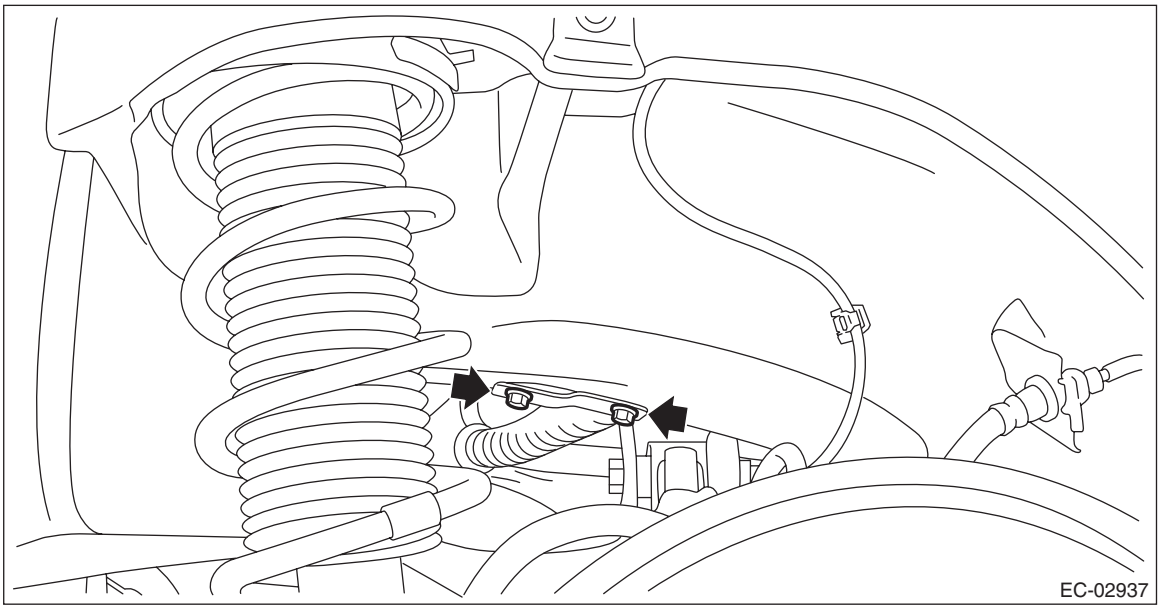


12) Disconnect the connector from the leak check valve assembly.



13) Remove the bolt and clip (A) which secure the leak check valve assembly to the vehicle, and remove the leak check valve assembly.

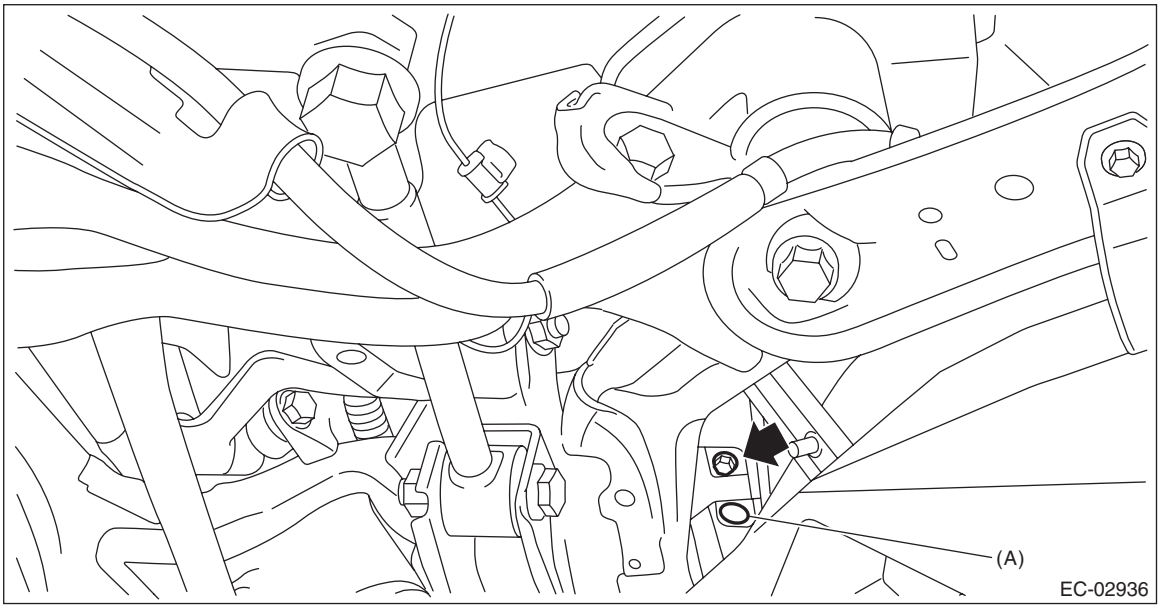


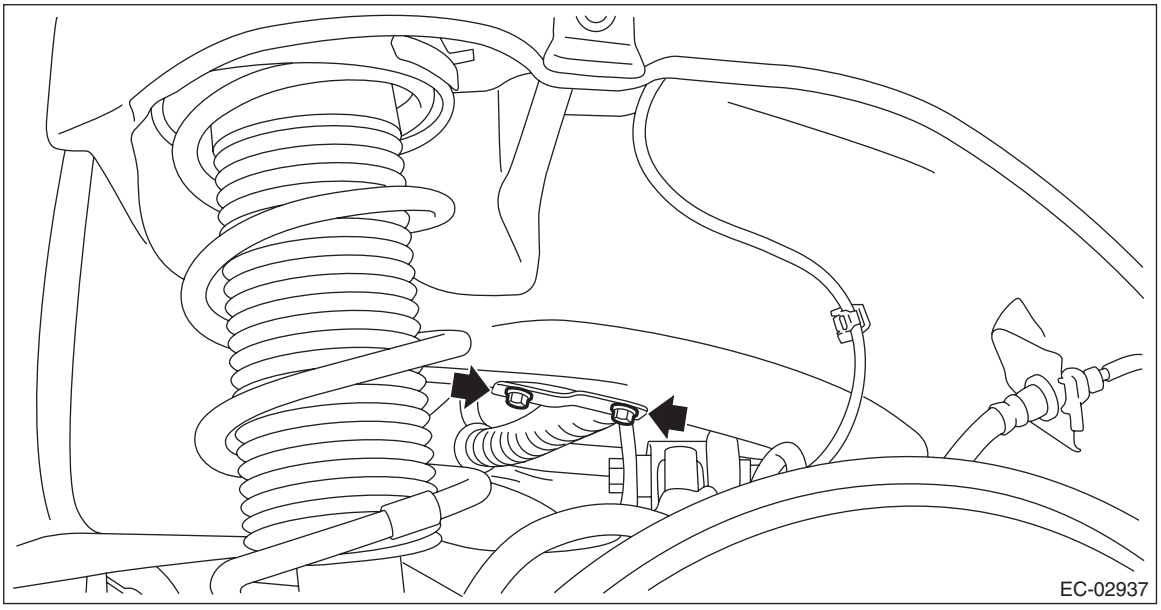


B: INSTALLATION

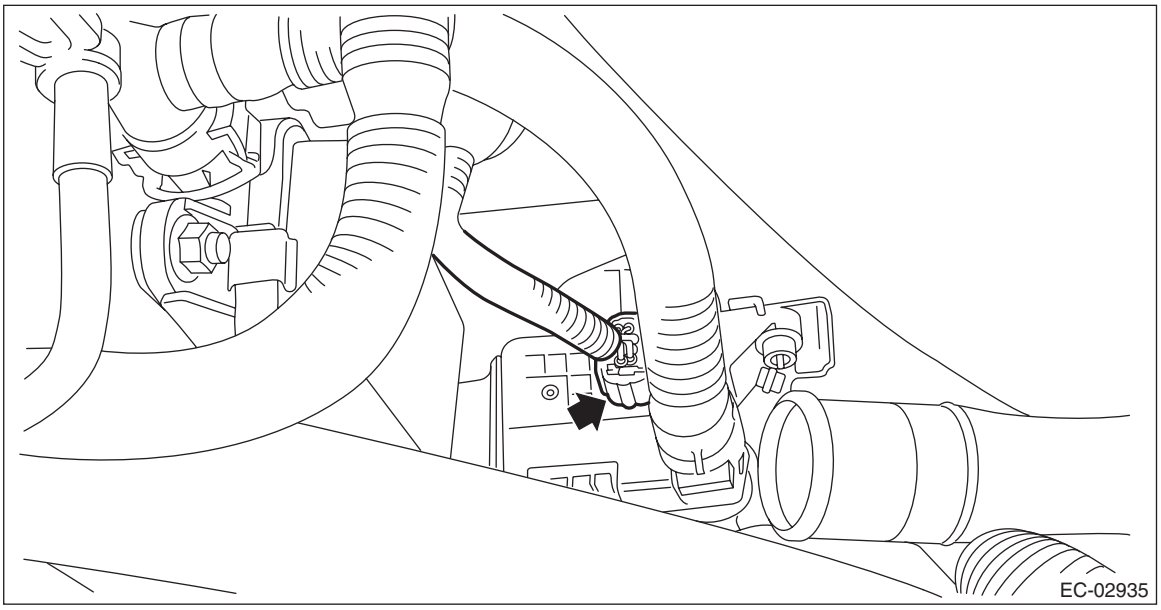
1) Install the leak check valve assembly to the vehicle with the bolt and clip (A).

Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)





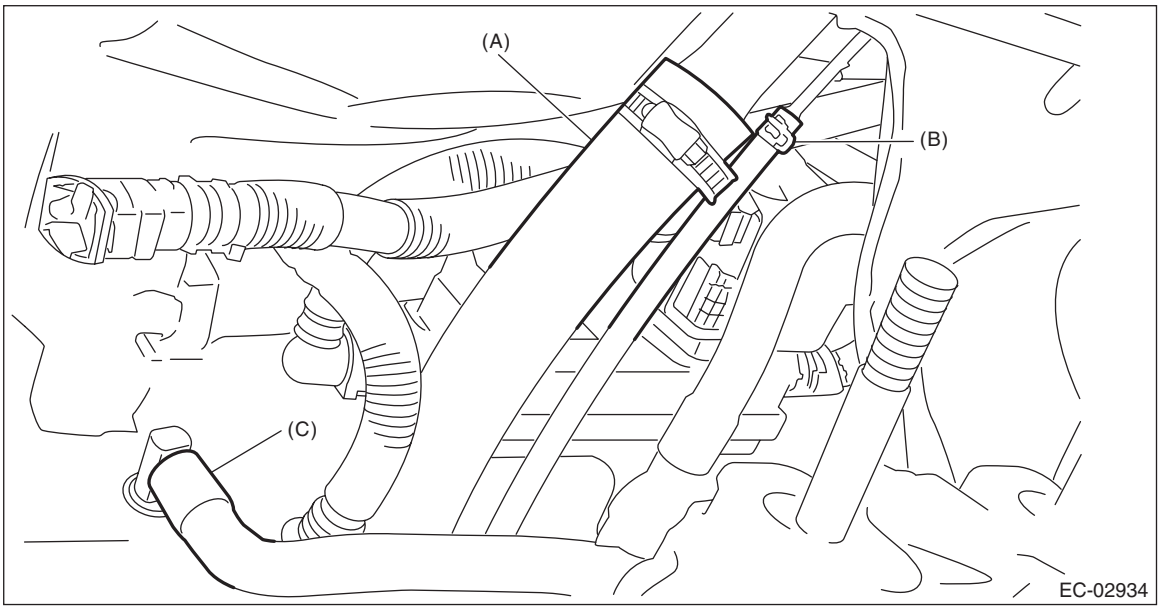
2) Connect the connector to the leak check valve assembly.

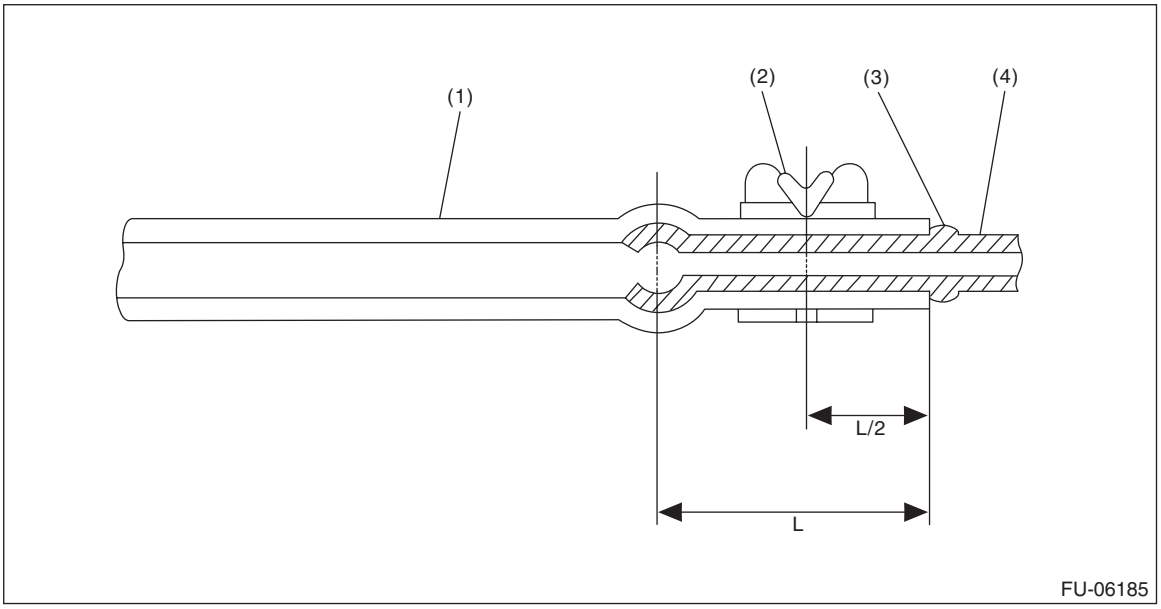


3) Connect the intake hose (C) to the connector.

4) Securely insert the fuel filler hose (A) and evaporation hose (B) until the hose end contacts the spool, then attach the clamp and clip as shown in the figure.

Tightening torque:
2.5 N·m (0.3 kgf-m, 1.8 ft-lb)

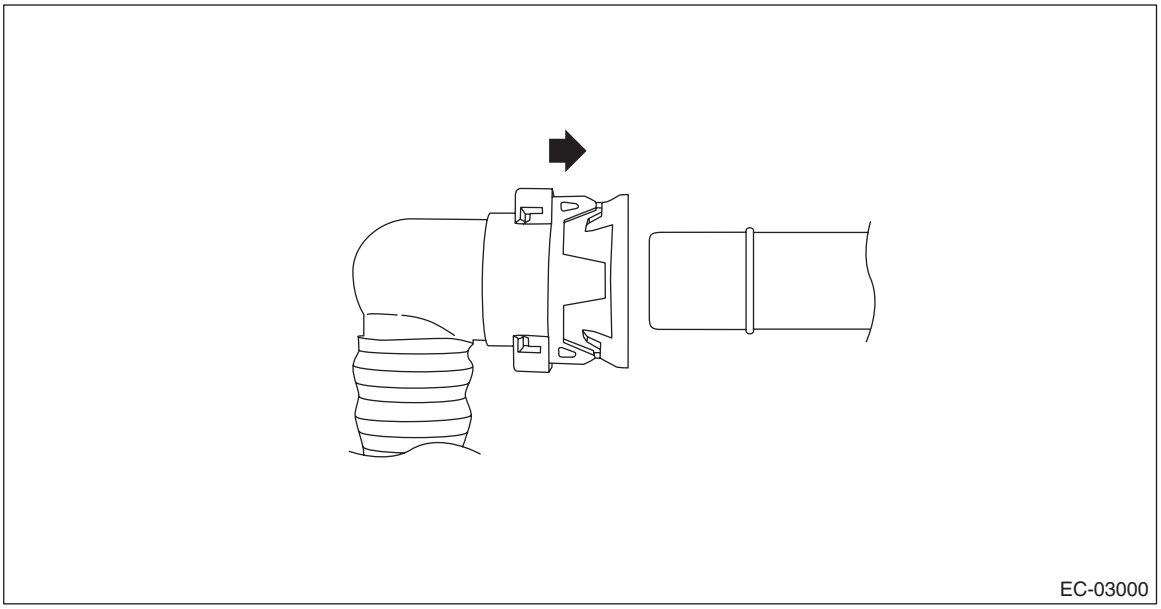


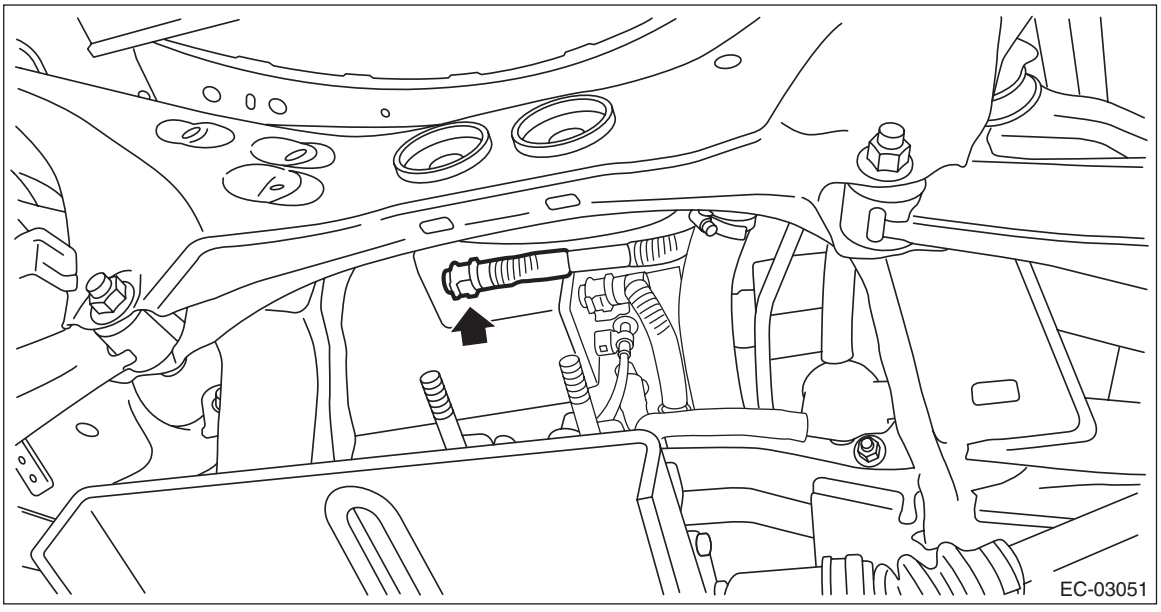


(1) Hose
(2) Clamp and clip
(3) Spool
(4) Pipe

5) Connect the drain tube to the canister.

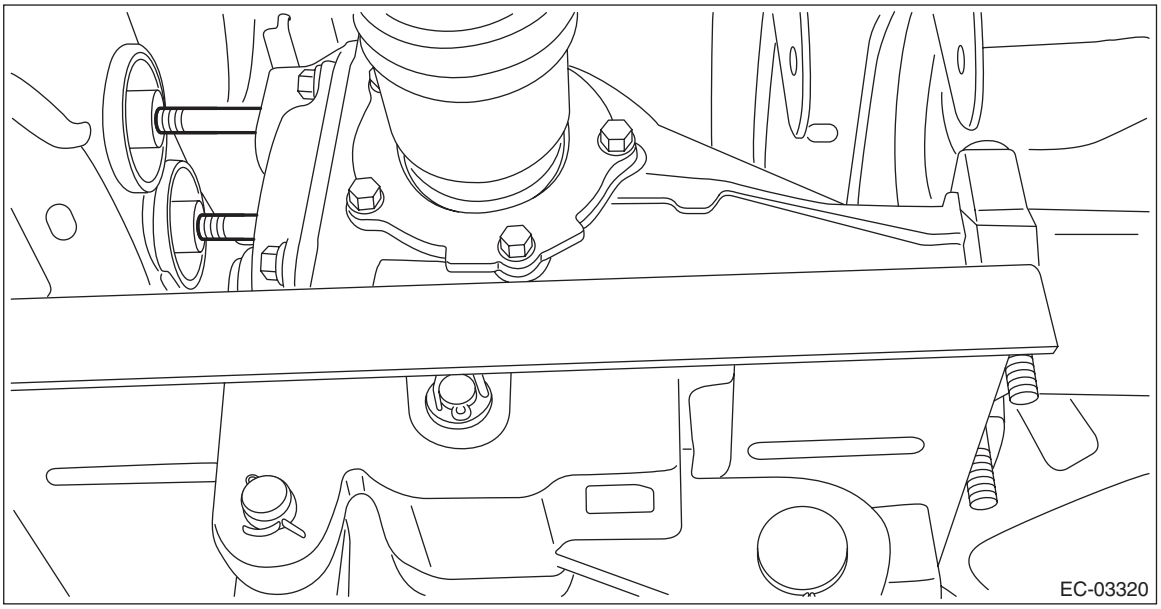
NOTE:
Connect the quick connector as shown in the figure.





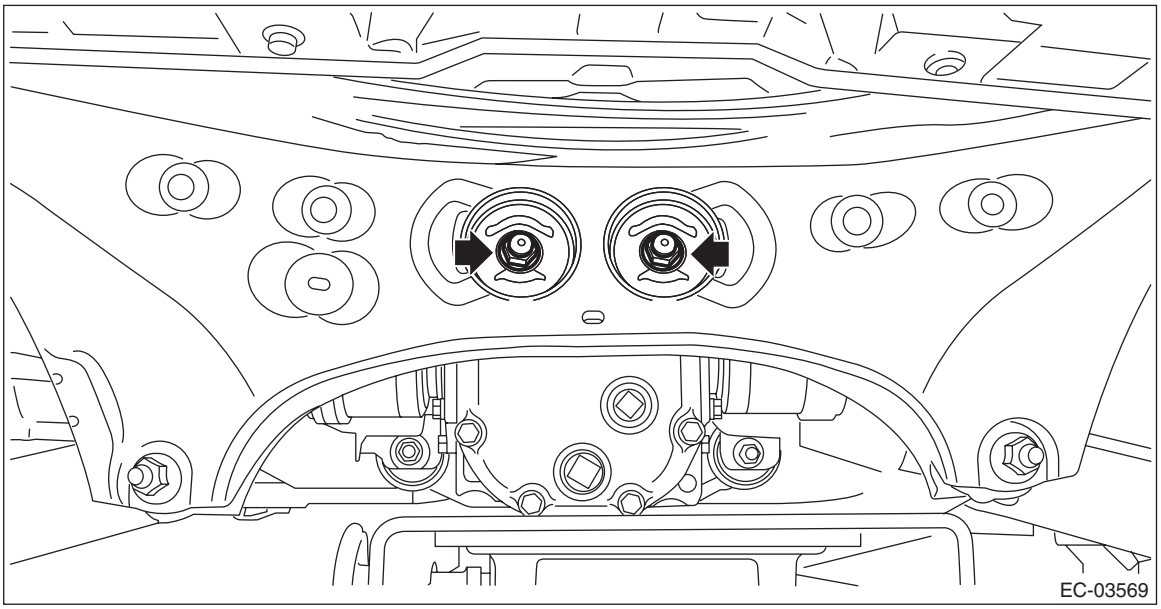
6) Lift up the transmission jack gradually, and set the rear differential to the rear sub frame assembly.

NOTE:
When inserting the stud bolt into the bushing portion of the rear sub frame assembly, adjust the angle and location of transmission jack and jack stand.



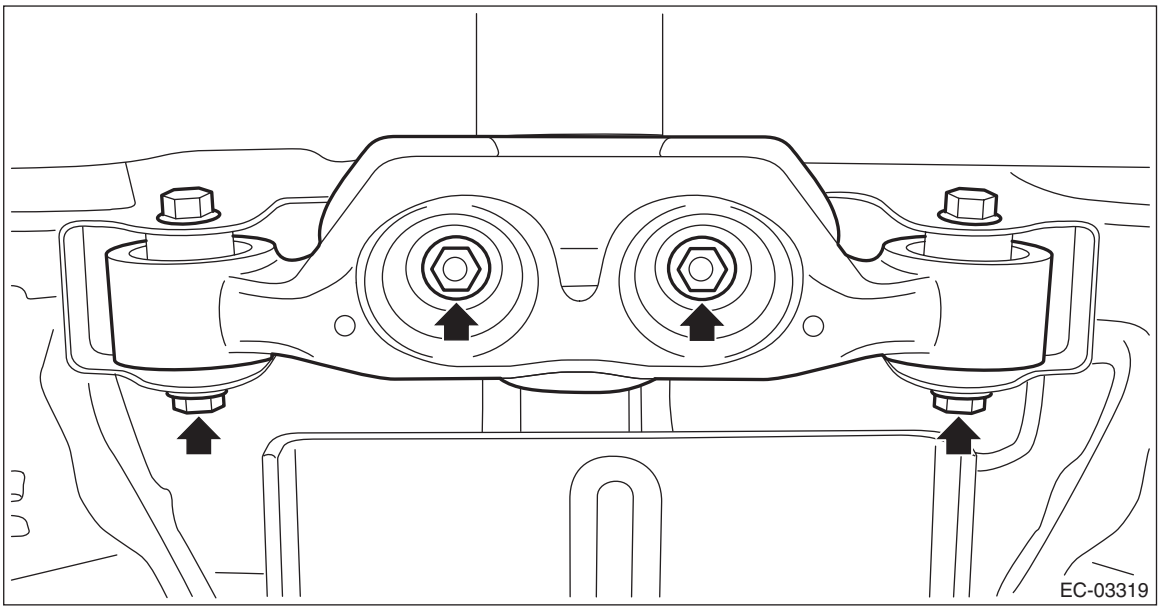
7) Temporarily tighten the self-locking nuts which hold the rear differential to the rear sub frame assembly.

NOTE:
Use a new self-locking nut.



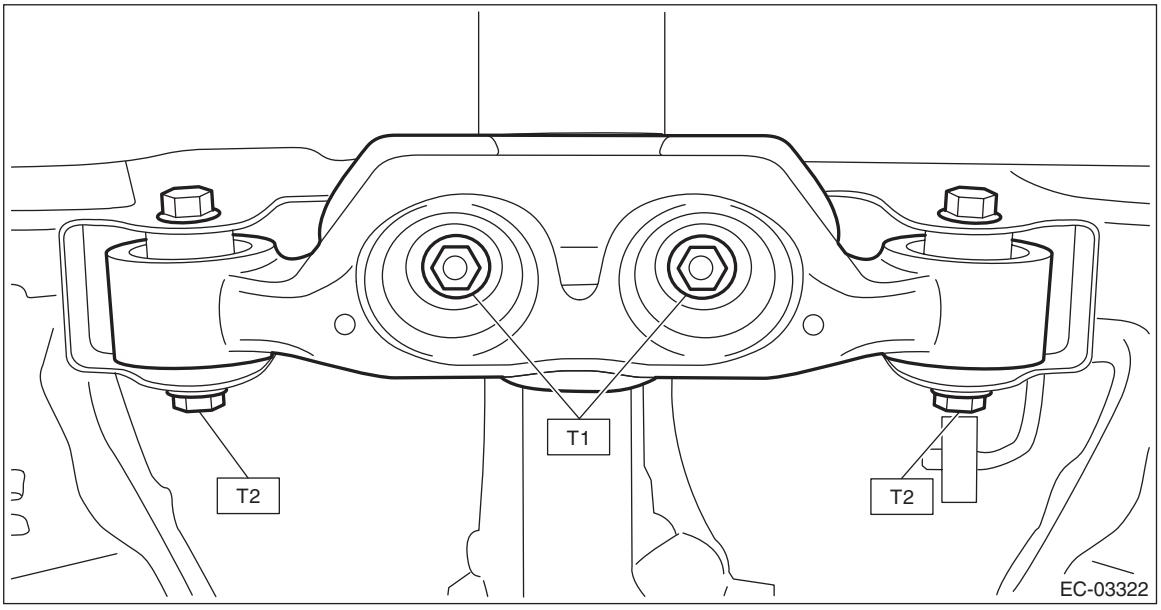
8) Set the rear differential member to the rear sub frame assembly and rear differential, and temporarily tighten the self-lock nuts which secure the rear differential member to the rear sub frame assembly and rear differential.

NOTE:
Use a new self-locking nut.



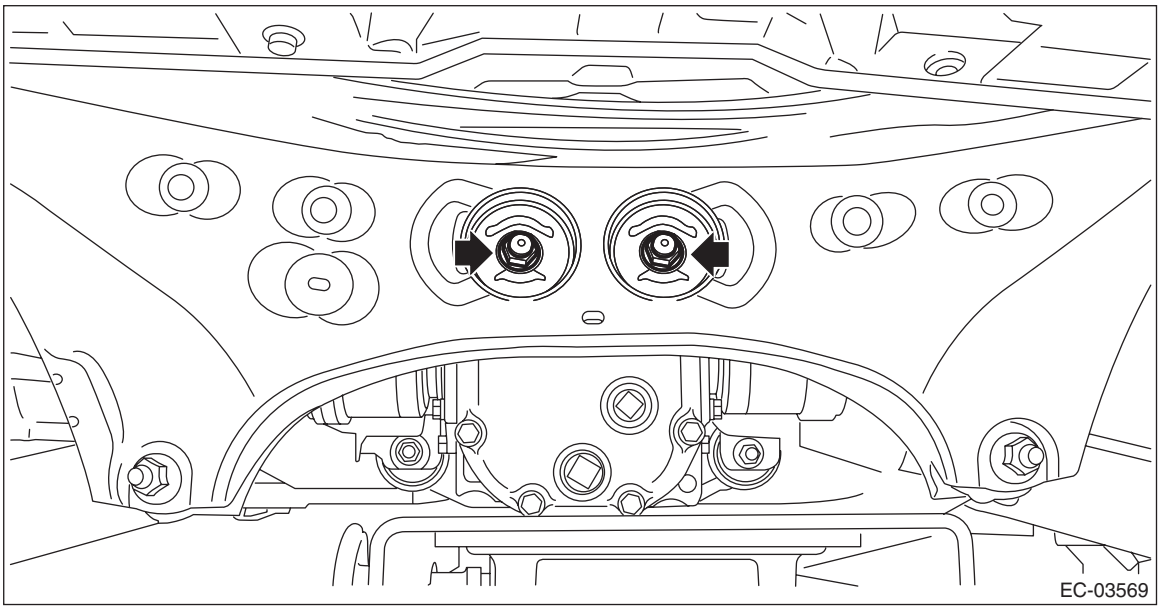
9) Remove the transmission jack from the rear differential.
10) Tighten the self-locking nuts which secure the rear differential member to the rear sub frame assembly and rear differential.

Tightening torque:
T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)
T2: 110 N·m (11.2 kgf-m, 81.1 ft-lb)

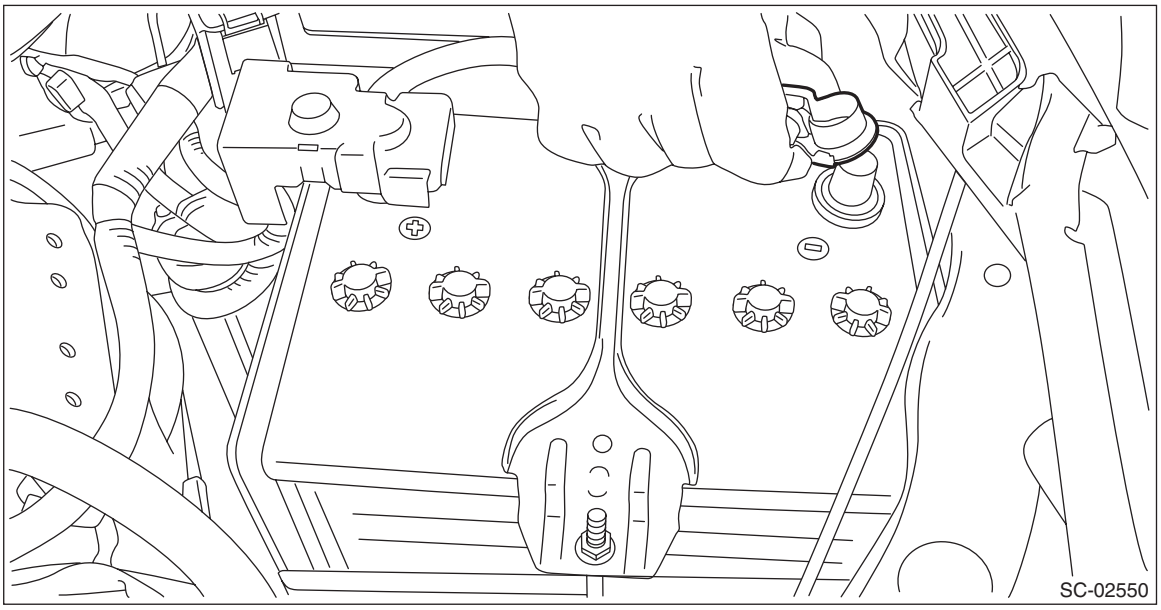


11) Tighten the self-locking nuts which secure the rear differential to the rear sub frame assembly.

Tightening torque:
70 N·m (7.1 kgf-m, 51.6 ft-lb)



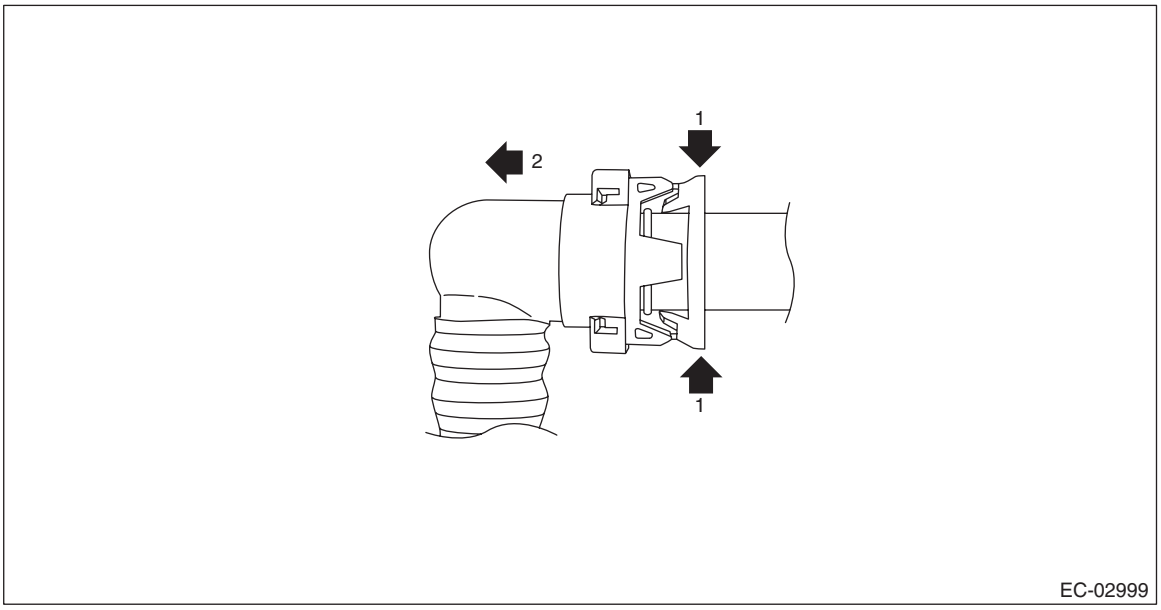
12) Install the propeller shaft. <Ref. to DS-13, INSTALLATION, Propeller Shaft.>
13) Install the rear exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-20, INSTALLATION, Rear Exhaust Pipe.>
14) Lower the vehicle.
15) Connect the battery ground terminal.

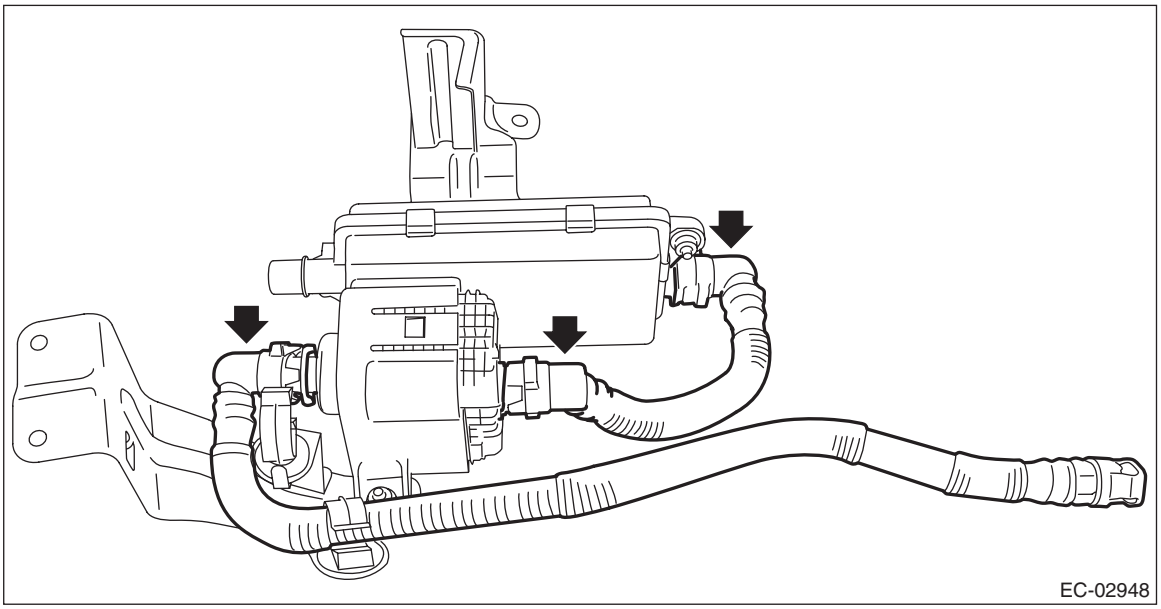


C: DISASSEMBLY

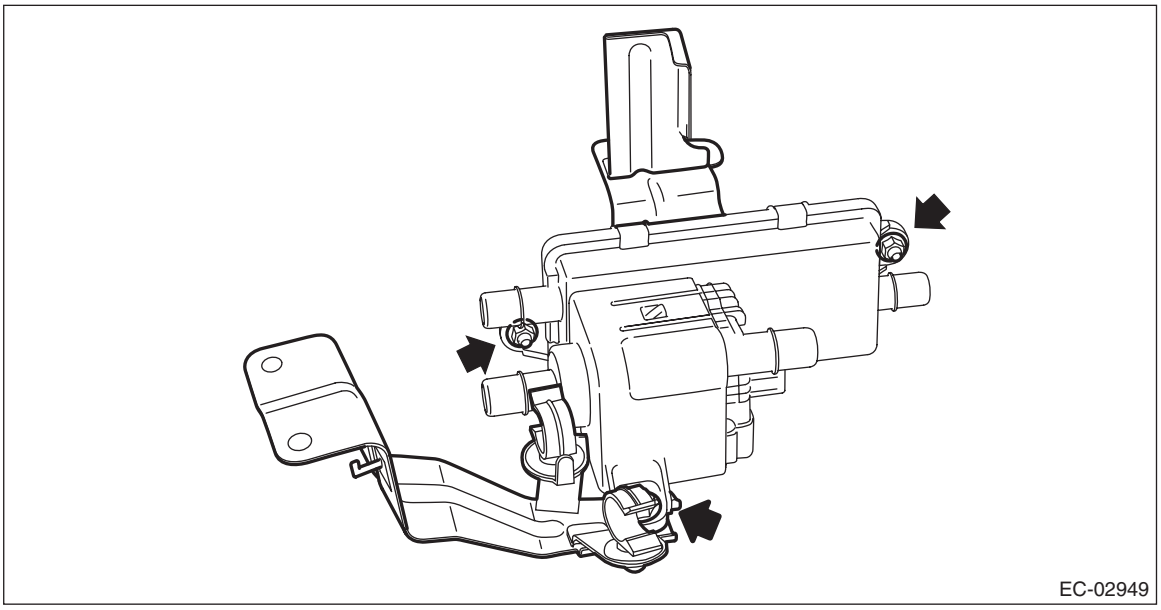
1) Remove the drain separator from the leak check valve assembly. <Ref. to EC(H4DO(w/o HEV))-62, REMOVAL, Drain Separator.>
2) Disconnect the drain tube from the leak check valve assembly.

NOTE:
Disconnect the quick connector as shown in the figure.





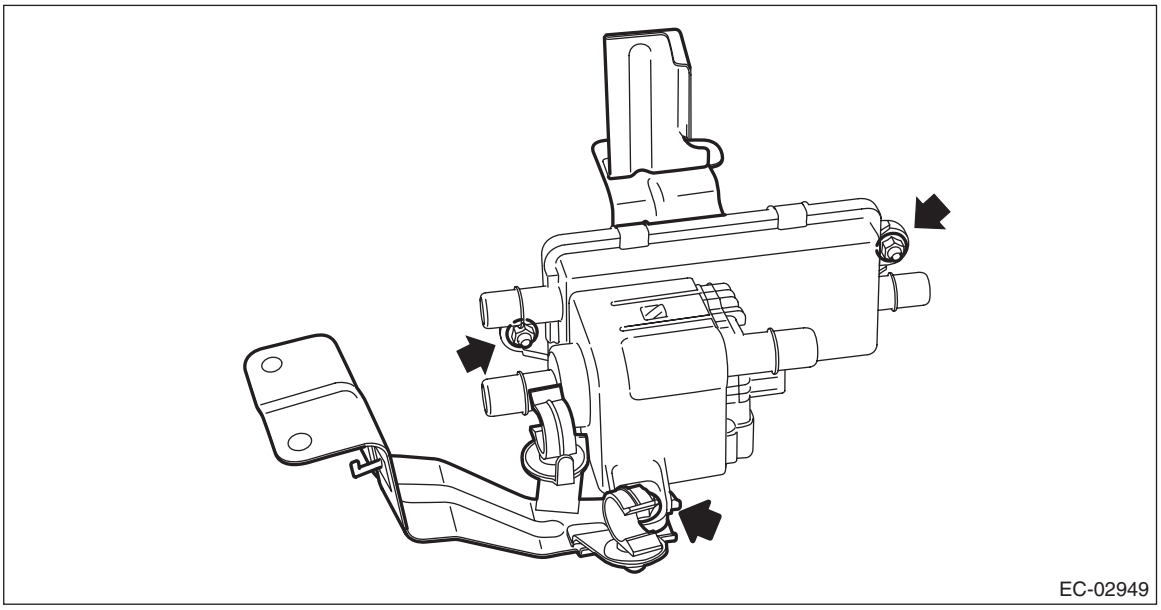
3) Remove the bracket from the leak check valve assembly.



D: ASSEMBLY

1) Install the bracket to the leak check valve assembly.

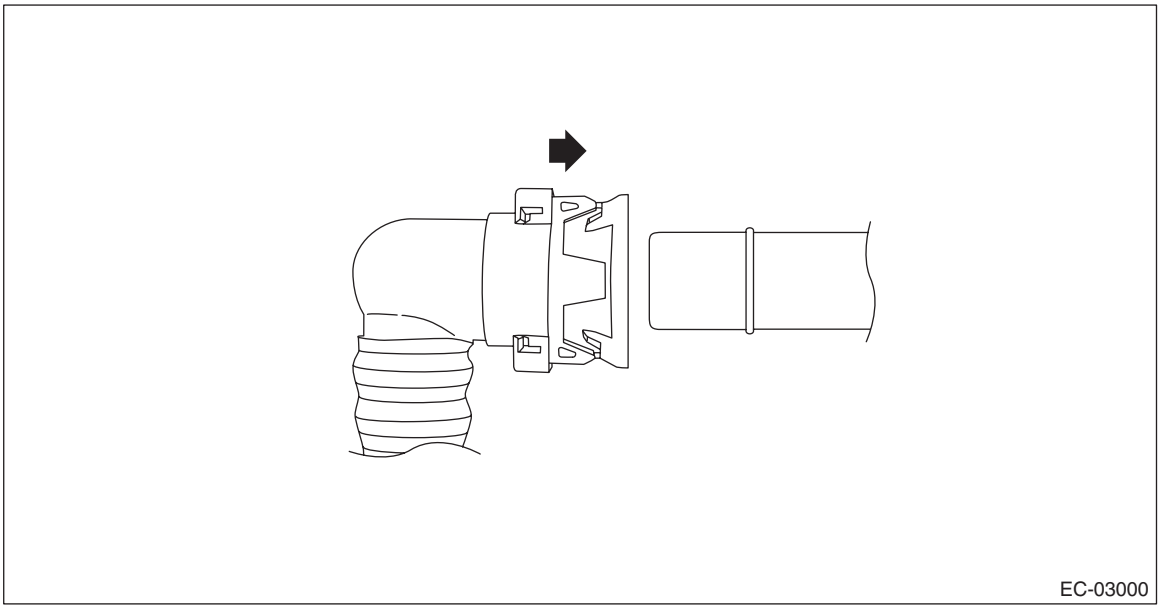
Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)

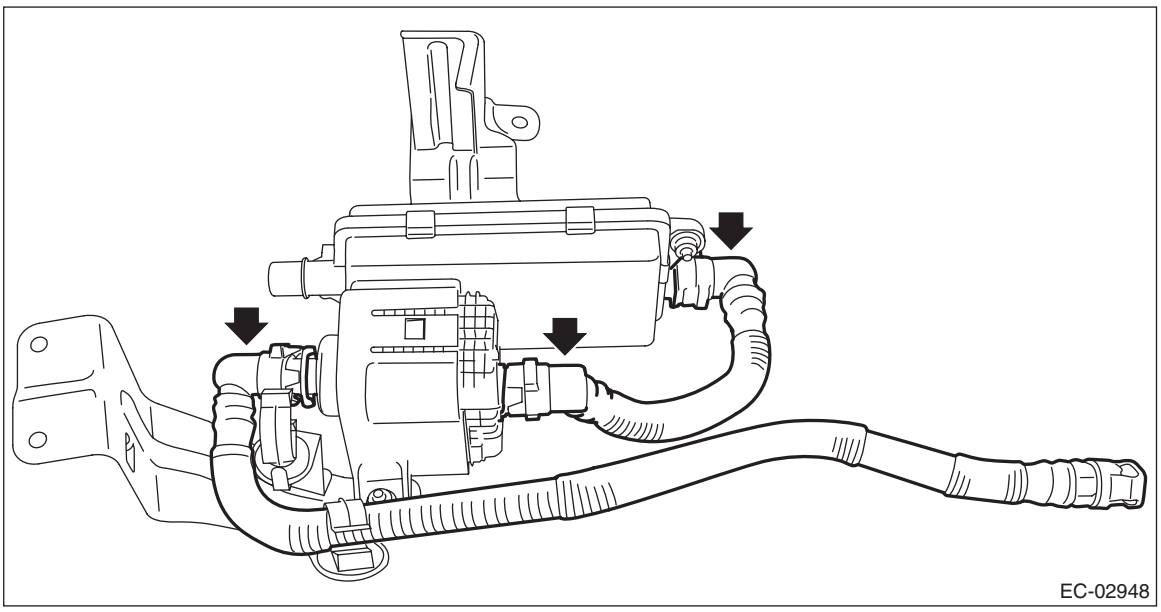


2) Install the drain tube to the leak check valve assembly.

CAUTION:
• Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
• Make sure that the quick connector is securely connected.

NOTE:
Connect the quick connector as shown in the figure.


EC-03000

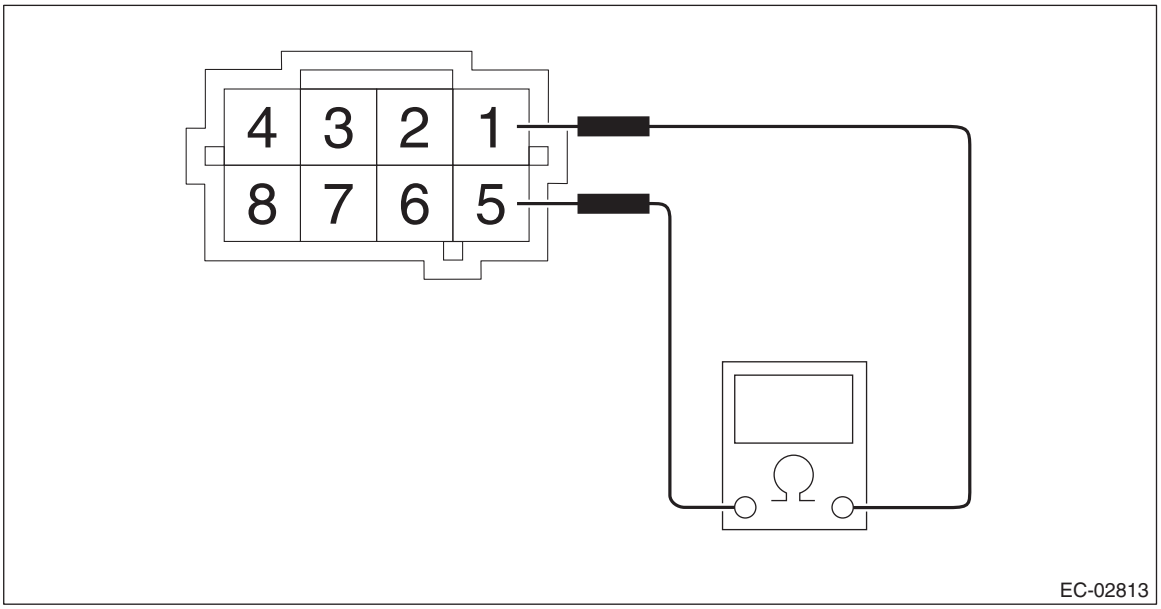

EC-02948

3) Install the drain separator to the leak check valve assembly. <Ref. to EC(H4DO(w/o HEV))-62, INSTALLATION, Drain Separator.>

E: INSPECTION

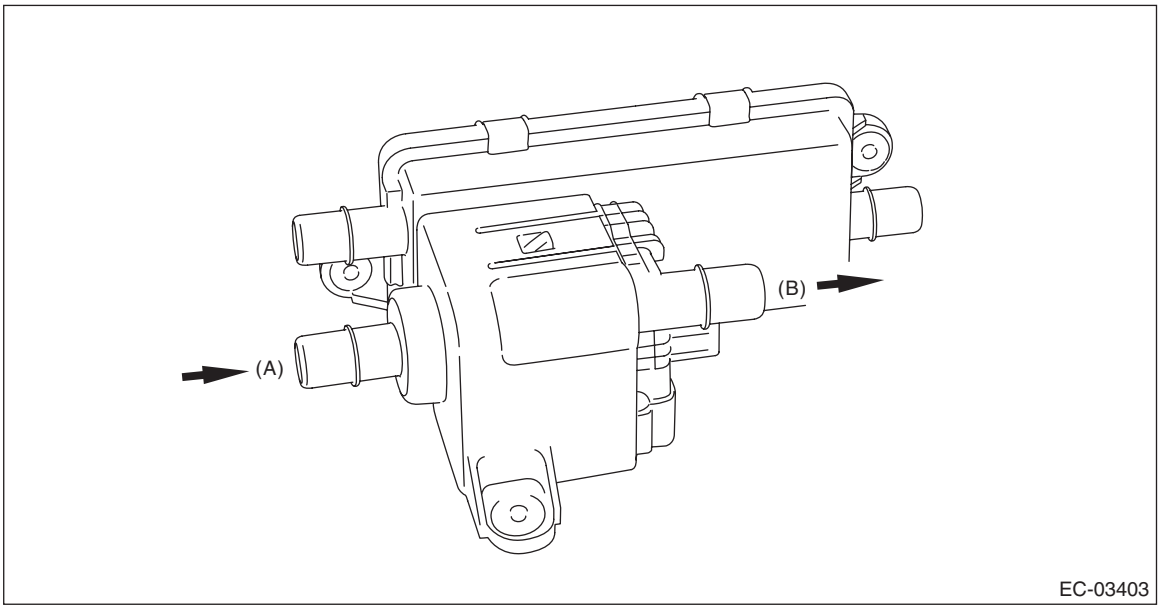
1. CHECK SWITCHING VALVE

1) Check the resistance between switching valve terminals.

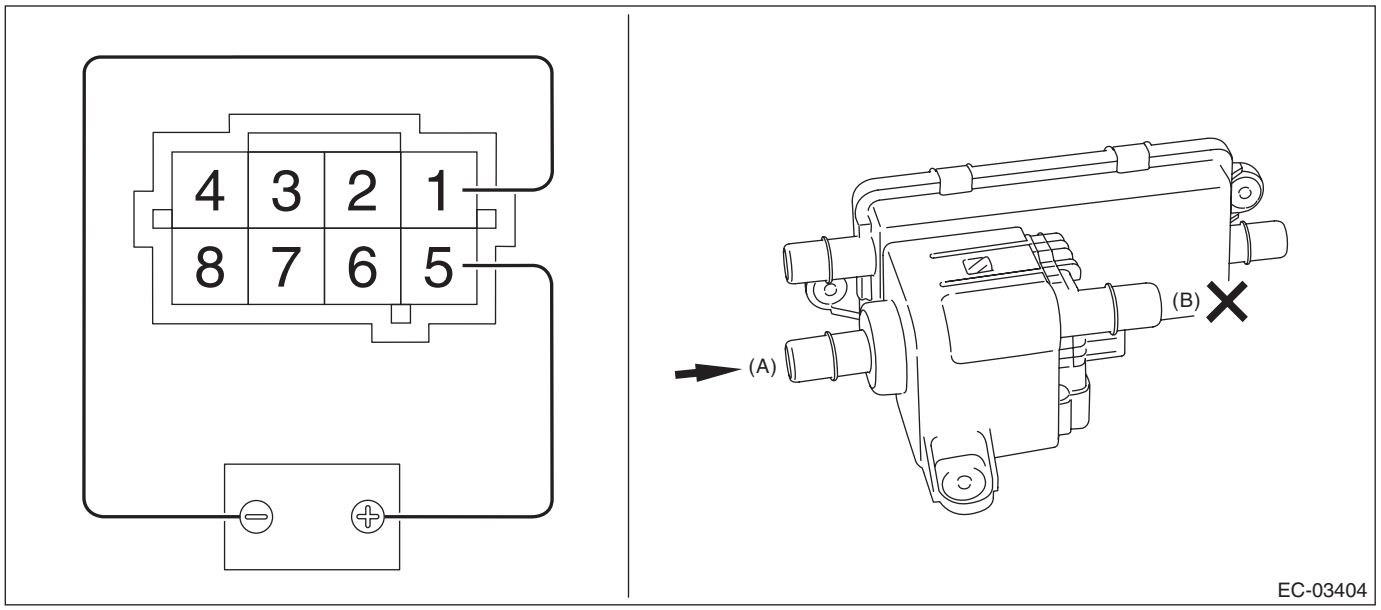


Terminal No.	Standard
1 and 5	27^{+3}_{-2} Ω (when 20°C (68°F))
	31±4 Ω (60°C (140°F))

2) Check that air is discharged from (B) when air is blown into (A).



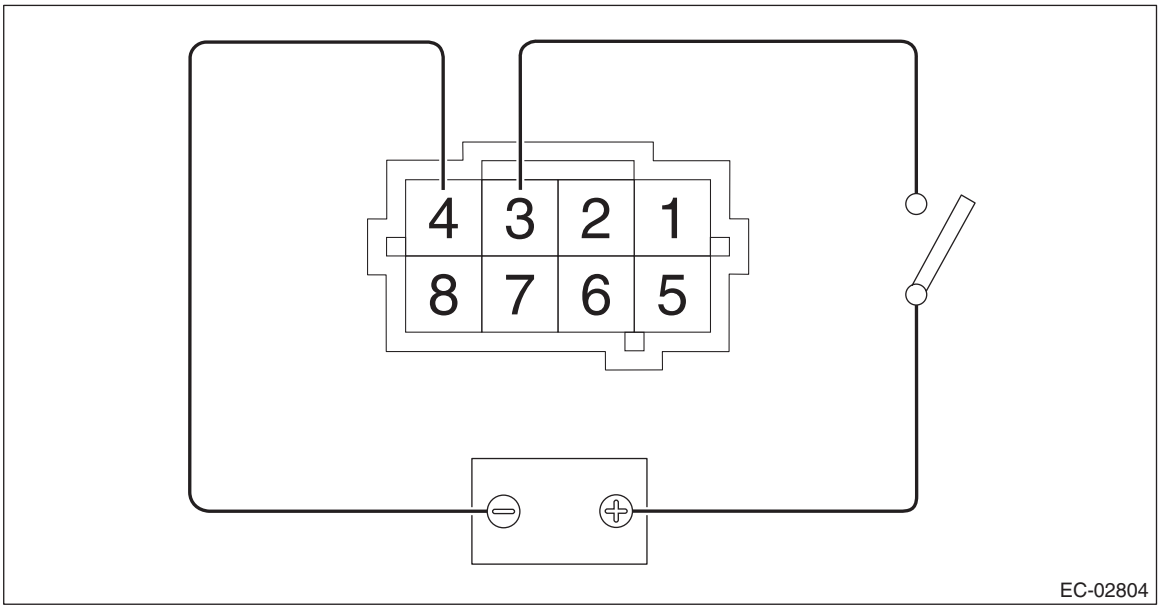
3) Connect the battery positive terminal to the terminal No. 5 and the battery negative terminal to the terminal No. 1. Check that air does not come out from (B) when air is blown into (A).



2. CHECK VACUUM PUMP

1) Connect the battery positive terminal to terminal No. 3 and the battery ground terminal to terminal No. 4, and inspect the vacuum pump operation.

CAUTION:
Do not operate the vacuum pump for 5 minutes or more.

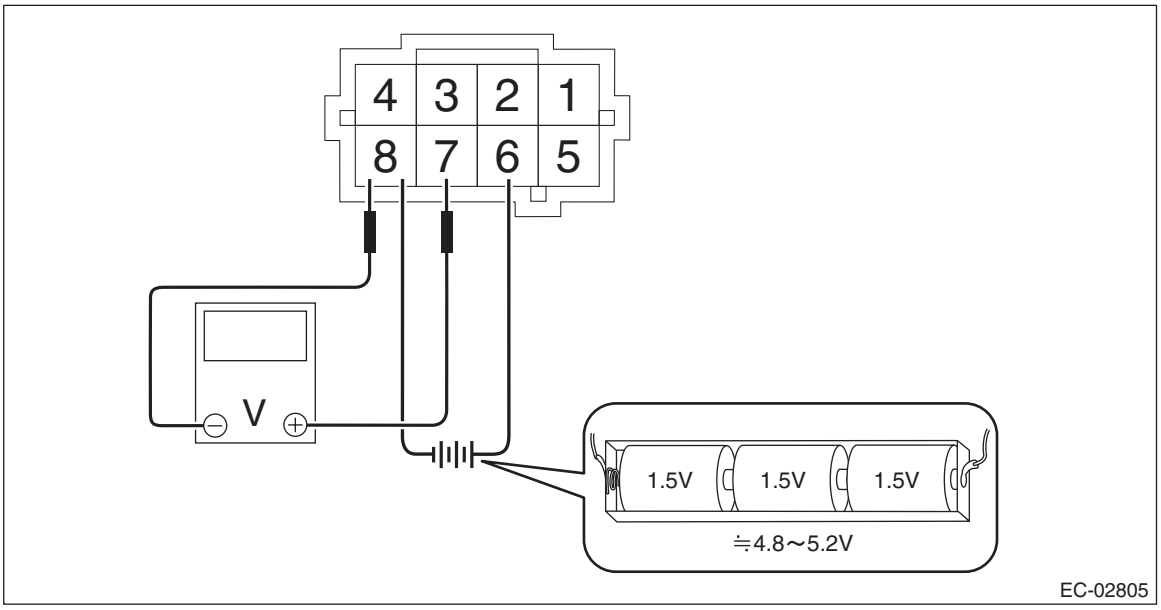


3. CHECK PRESSURE SENSOR

1) Connect dry-cell battery positive terminal to terminal No. 6 and dry-cell battery ground terminal to terminal No. 8, circuit tester positive terminal to terminal No. 7 and the circuit tester negative terminal to terminal No. 8.

NOTE:
- Use new dry-cell batteries.
- Using circuit tester, check the voltage of a single dry-cell battery is 1.6 V or more. And also check the voltage of three batteries in series is between 4.8 V and 5.2 V.

- For power supply, 5 V DC voltage source can also be used.

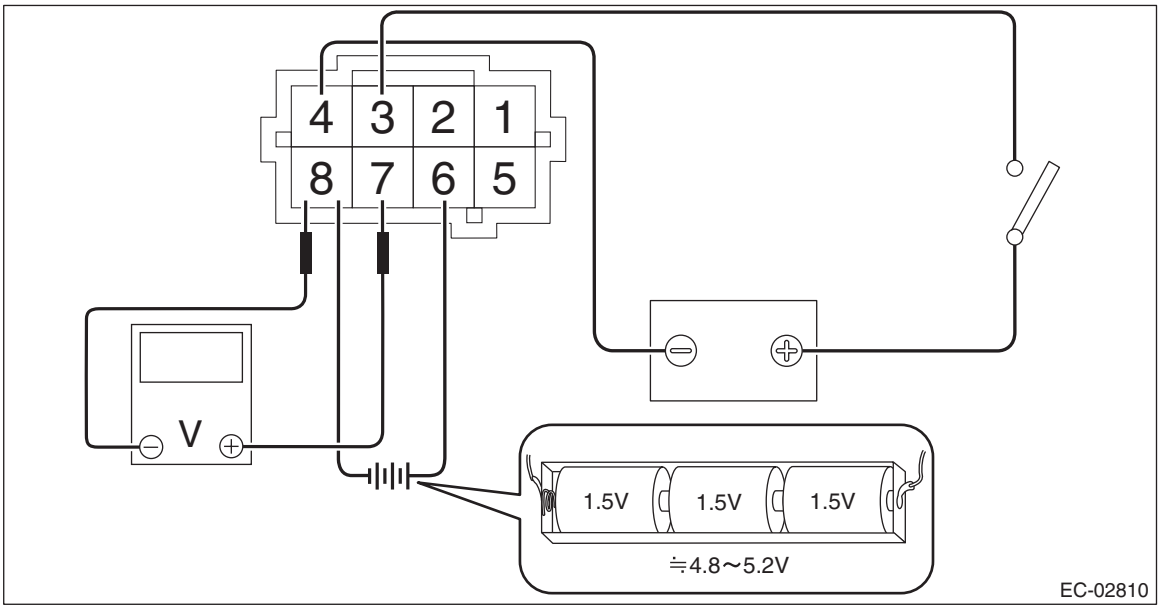


2) Check the voltage at a normal atmospheric pressure.

NOTE:
The atmospheric pressure at higher altitude is lower than normal. Therefore, the voltage is lower than the standard value.

Terminal No.	Standard
7 (+) and 8 (–)	Approx. 3.5 V (when 25°C (77°F))

3) Connect the battery positive terminal to terminal No. 3 and the battery ground terminal to terminal No. 4, and check that there is a voltage drop from the voltage measured in step 2) when the vacuum pump is operated.



4. OTHER INSPECTIONS

1) Check that the leak check valve assembly has no deformation, cracks or other damages.
2) Check that the tube or hose have no cracks, damage or loose part.

13.Drain Separator

A: REMOVAL

The drain separator is installed to the leak check valve assembly. Refer to “Leak Check Valve Assembly” for removal procedure. <Ref. to EC(H4DO(w/o HEV))-43, REMOVAL, Leak Check Valve Assembly.>

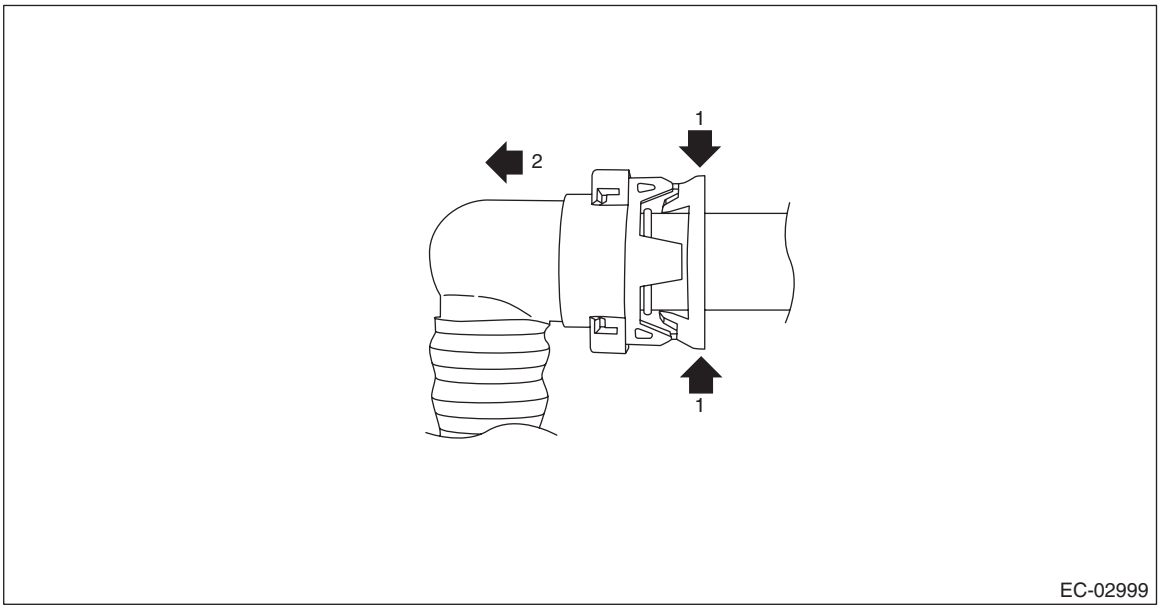
B: INSTALLATION

The drain separator is installed to the leak check valve assembly. Refer to “Leak Check Valve Assembly” for installation procedure. <Ref. to EC(H4DO(w/o HEV))-49, INSTALLATION, Leak Check Valve Assembly.>

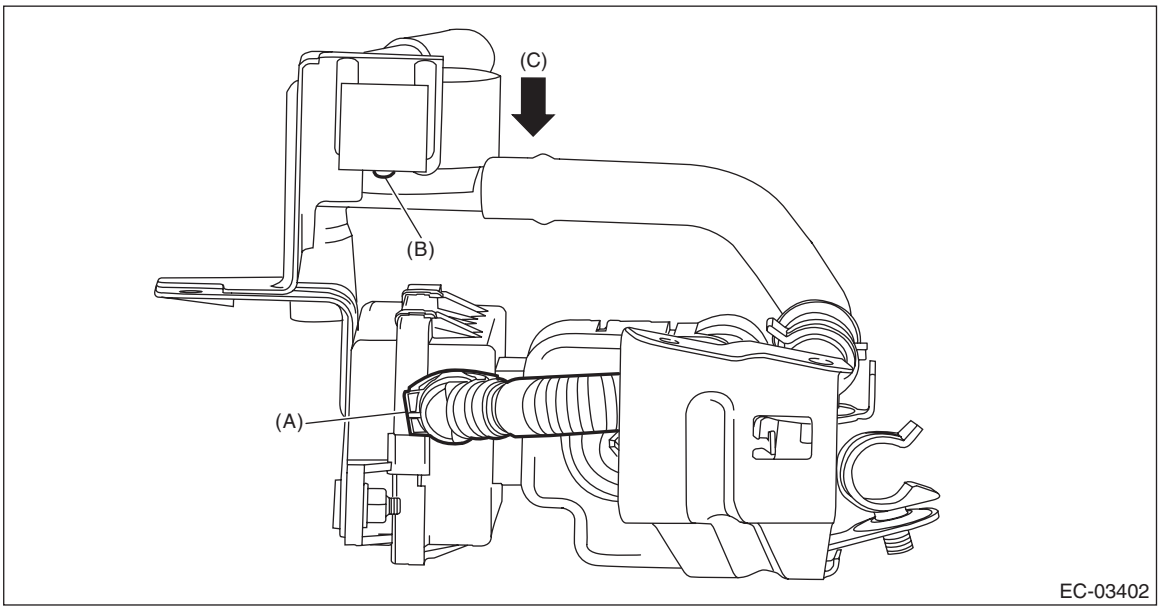
C: DISASSEMBLY

1) Disconnect the drain tube (A) from the leak check valve assembly.

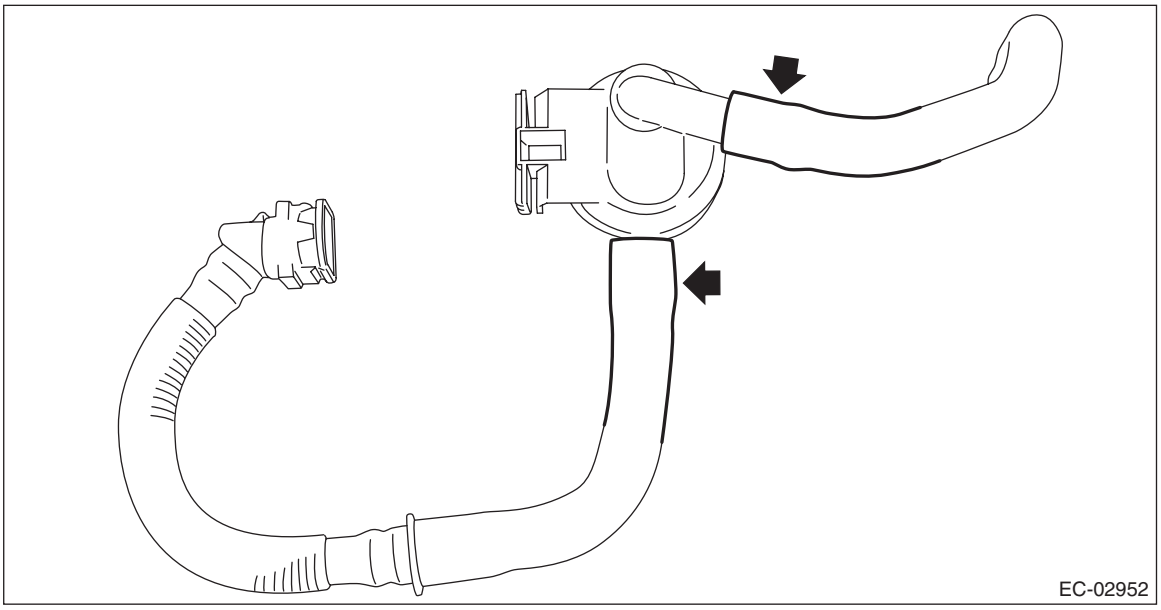
NOTE:
Disconnect the quick connector as shown in the figure.



2) Lift up the claw (B) of the drain separator and slide the drain separator in the direction of the arrow (C) to remove the drain separator.



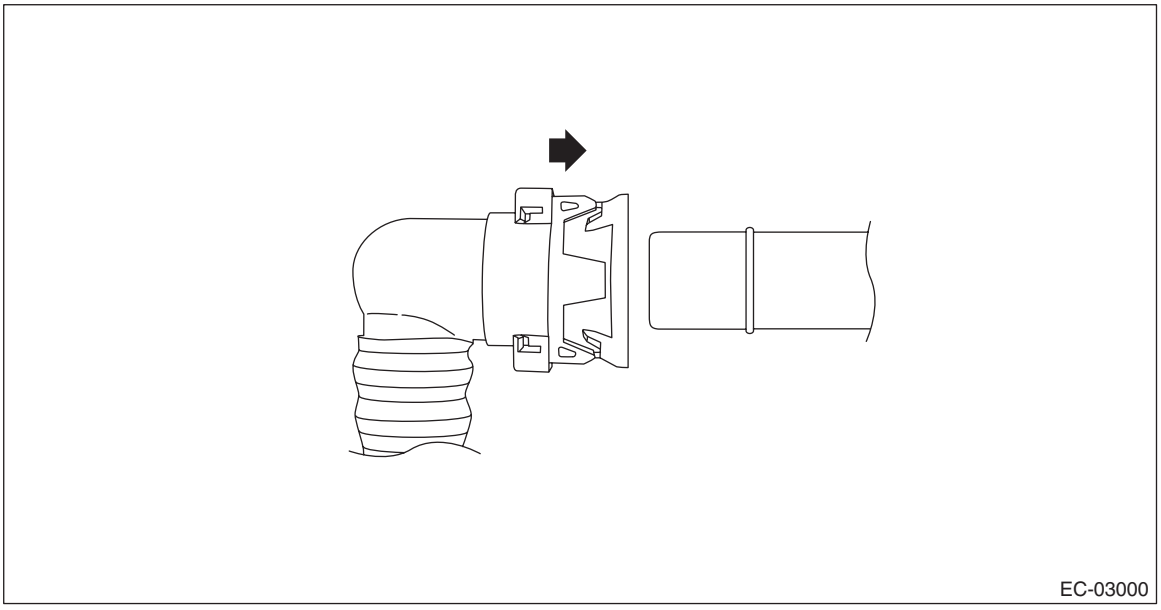
3) Remove the drain hose and drain tube from the drain separator.



D: ASSEMBLY

Assemble in the reverse order of disassembly.

NOTE:
Connect the quick connector as shown in the figure.



E: INSPECTION

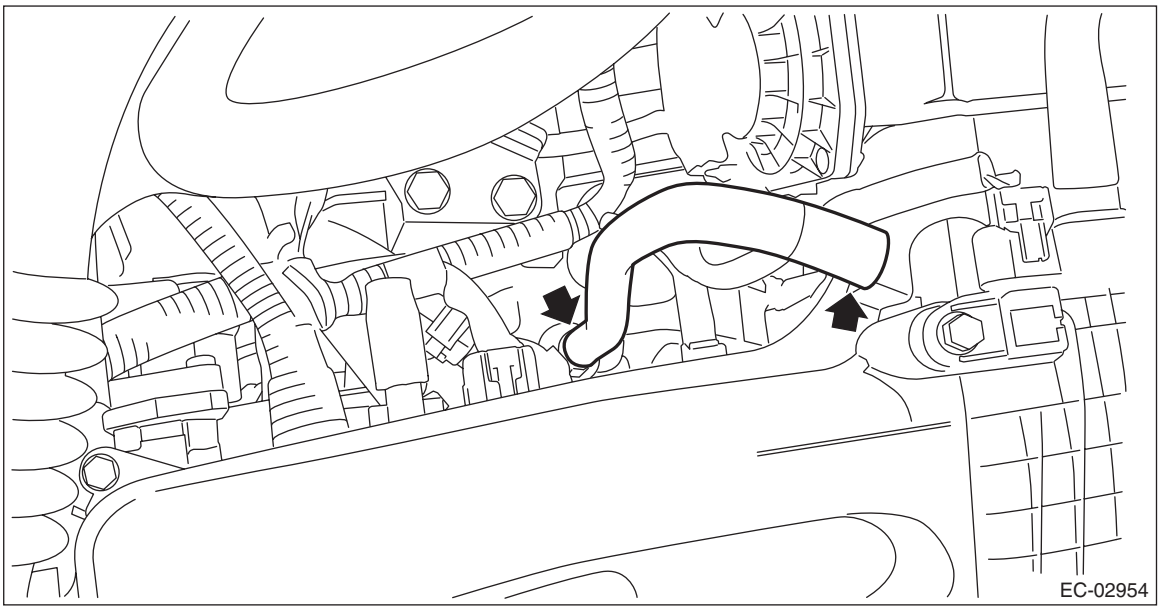
1) Check that the drain separator and drain separator bracket have no deformation, crack, or other damage.
2) Check that the drain hose and drain tube have no crack, damage, or looseness.
3) Check that no foreign substances are clogged in the drain separator.

14.PCV Hose

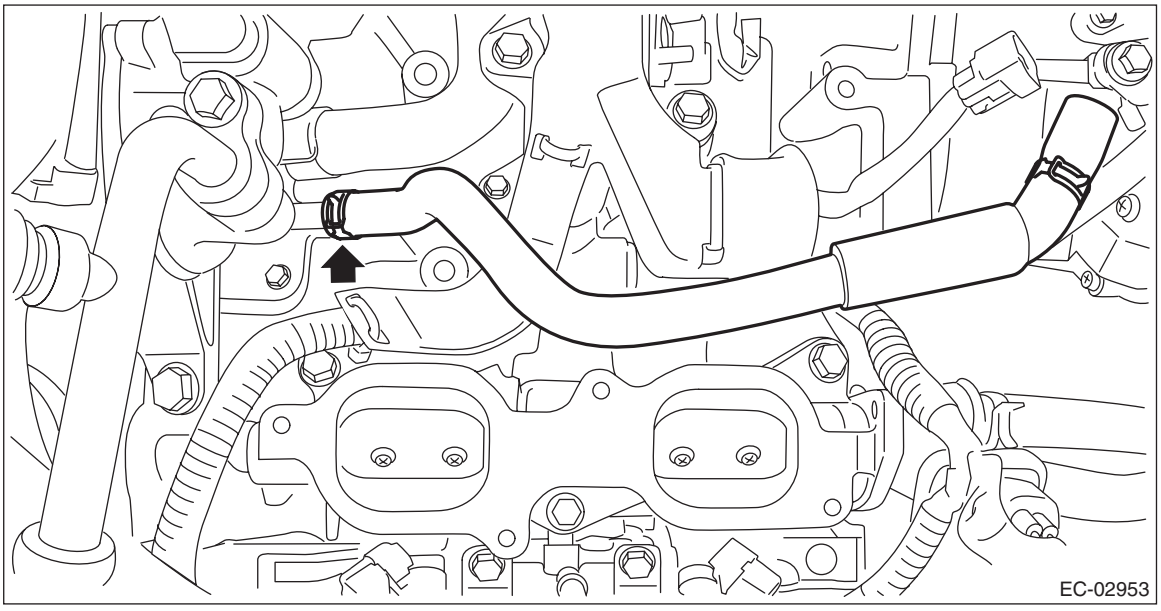
A: REMOVAL

CAUTION:
Do not remove except when the PCV hose is broken.

1) Disconnect the PCV hose A from the intake manifold and the PCV valve, and then remove the PCV hose A.



2) Remove the intake manifold. <Ref. to FU(H4DO(w/o HEV))-19, REMOVAL, Intake Manifold.>
3) Remove the PCV hose B from the PCV connector.



B: INSTALLATION

Install in the reverse order of removal.

C: INSPECTION

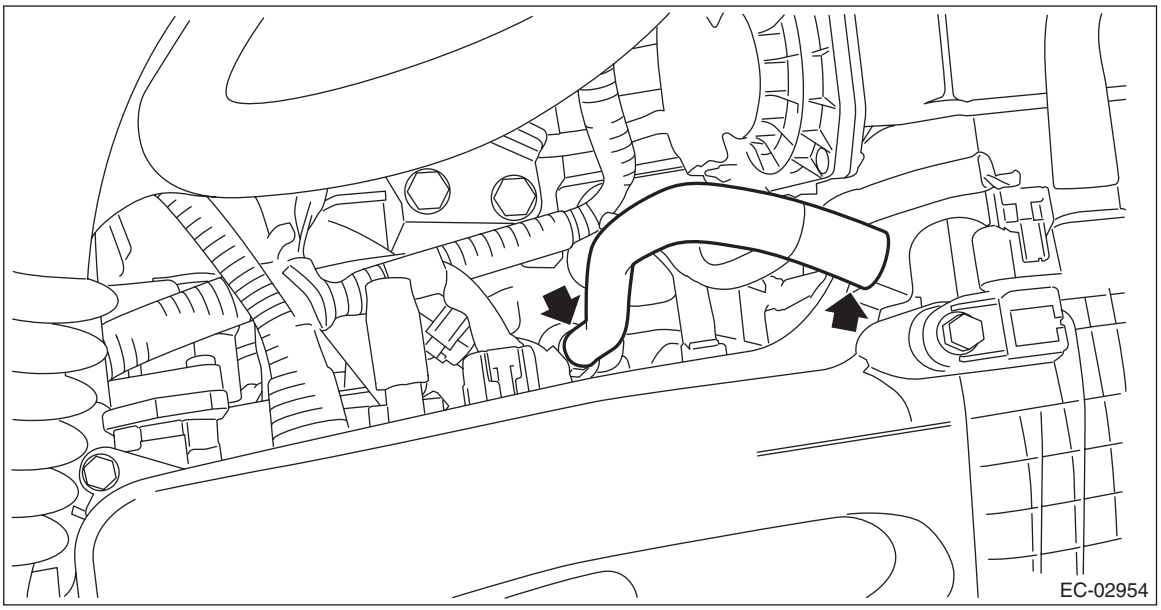
Check that the PCV hose has no cracks, damage or loose part.

15.PCV Valve

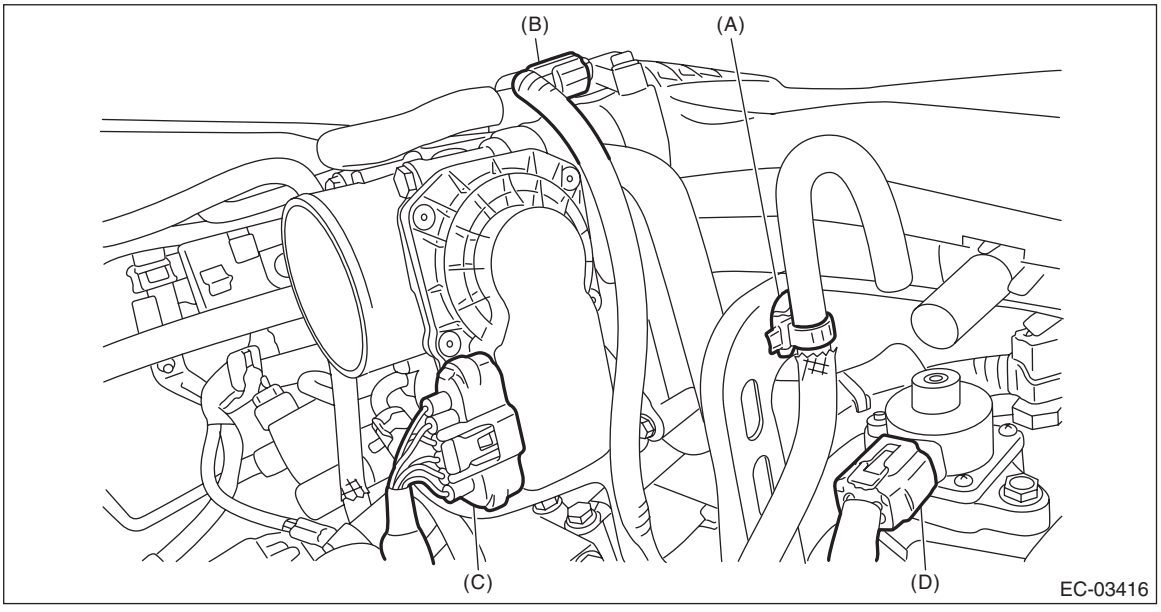
A: REMOVAL

CAUTION:
Do not remove unless the PCV valve is broken.

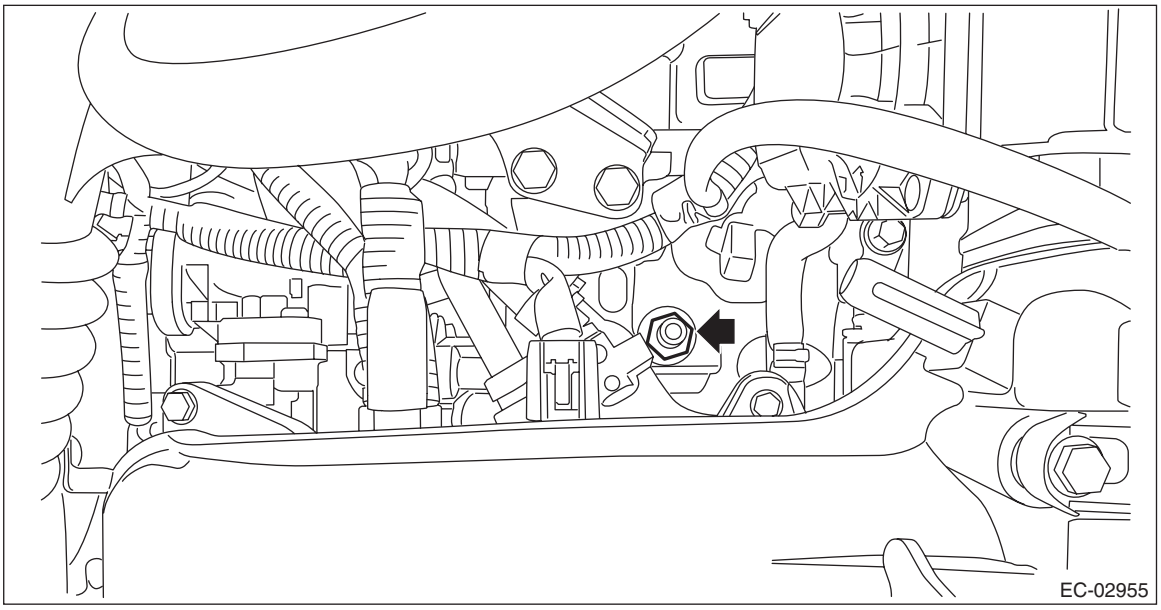
1) Disconnect the PCV hose from the intake manifold and the PCV valve, and then remove the PCV hose.



2) Remove the clip (A) holding the air breather hose from the engine hanger. (MT model)
3) Disconnect the connector (B) from manifold absolute pressure sensor. (MT model)
4) Disconnect the connector (C) from the throttle position sensor. (MT model)
5) Disconnect the connector (D) from the EGR control valve. (MT model)



6) Remove the PCV valve from the cylinder block RH.



B: INSTALLATION

Install in the reverse order of removal.

NOTE:
Apply liquid gasket to the bolt threads of PCV valve.

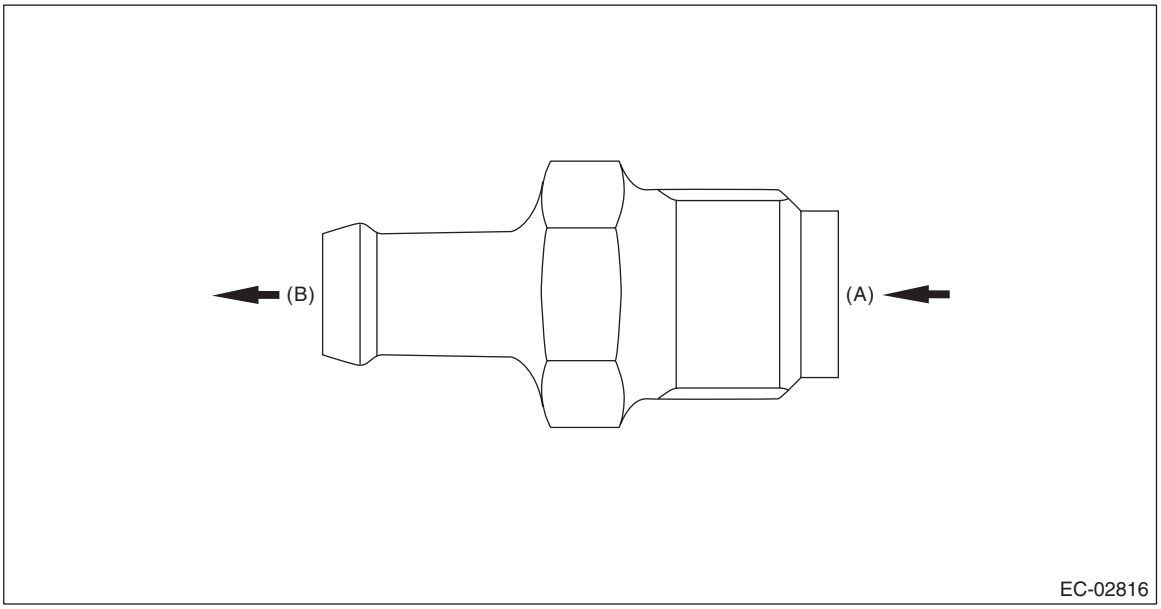
Liquid gasket:
THREE BOND 1324 (Part No. 004403042) or equivalent

Tightening torque:
23 N·m (2.3 kgf-m, 17.0 ft-lb)

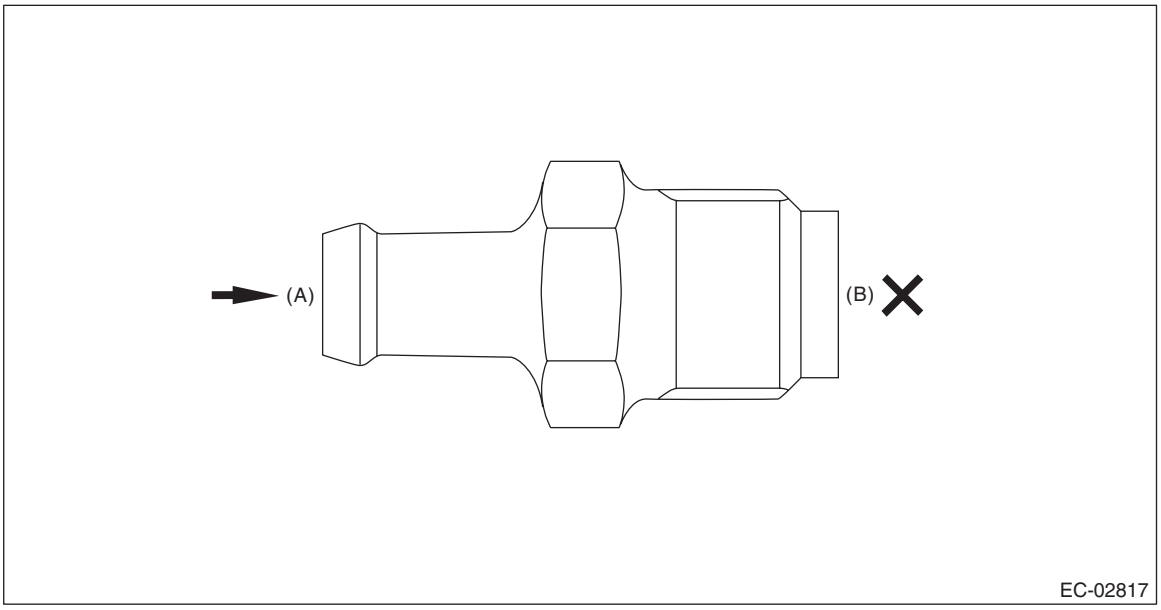
C: INSPECTION

1. PCV VALVE

1) Check that the PCV valve has no deformation, cracks or other damages.
2) Check that air is discharged from (B) when air is blown into (A).



3) Check that air does not come out from (B) when air is blown into (A).



2. OTHER INSPECTIONS

Check that the PCV hose has no cracks, damage or loose part.

INTAKE (INDUCTION)

IN(H4DO(w/o HEV))

Page

1. General Description 2
2. Air Cleaner Element 4
3. Air Cleaner Case 7
4. Air Intake Boot 12
5. Air Intake Duct 13

1. Basic Diagnostic Procedure

A: PROCEDURE

1. ENGINE

	Step	Check	Yes	No
1	**CHECK ENGINE START FAILURE.** 1) Ask the customer when and how the trouble occurred using the interview check list. <Ref. to EN(H4DO w/o HEV)(diag)-4, CHECK, Check List for Interview.> 2) Start the engine.	Does the engine start?	Go to step **2**.	Inspection using "Diagnostics for Engine Starting Failure". <Ref. to EN(H4DO w/o HEV)(diag)-73, Diagnostics for Engine Starting Failure.>
2	**CHECK ILLUMINATION OF MALFUNCTION INDICATOR LIGHT.**	Does the malfunction indicator light illuminate?	Go to step **3**.	Inspection using "General Diagnostic Table". <Ref. to EN(H4DO w/o HEV)(diag)-379, INSPECTION, General Diagnostic Table.>
3	**CHECK COMMUNICATION STATUS.** 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor or general scan tool to the data link connector. 3) Turn the ignition switch to ON, and run the Subaru Select Monitor or general scan tool. NOTE: • Subaru Select Monitor For detailed procedures, refer to "Subaru Select Monitor". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Does Subaru Select Monitor or general scan tool communicate with vehicle normally?	Go to step **4**.	Inspection using "Diagnostic Procedure for Subaru Select Monitor Communication". <Ref. to EN(H4DO w/o HEV)(diag)-94, Diagnostic Procedure for Subaru Select Monitor Communication.>
4	**CHECK DTC.** Read DTC using Subaru Select Monitor or general scan tool. NOTE: • Subaru Select Monitor Refer to "Read Diagnostic Trouble Code (DTC)" for detailed operation procedure. <Ref. to EN(H4DO w/o HEV)(diag)-49, Read Diagnostic Trouble Code (DTC).> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is DTC displayed on Subaru Select Monitor or general scan tool?	Record DTC and freeze frame data, then repair the trouble cause. <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).> After repair, go to the next step. Go to step **5**.	Repair the related parts. NOTE: If DTC is not shown on display although the malfunction indicator light illuminates, perform the diagnosis of malfunction indicator light circuit or combination meter. <Ref. to EN(H4DO w/o HEV)(diag)-67, Malfunction Indicator Light.>

Step		Check	Yes	No
5	**PERFORM DIAGNOSIS.** 1) Perform the Clear Memory Mode. <Ref. to EN(H4DO w/o HEV)(diag)-65, Clear Memory Mode.> 2) Perform the Inspection Mode or Drive Cycle. <Ref. to EN(H4DO w/o HEV)(diag)-50, Inspection Mode.> <Ref. to EN(H4DO w/o HEV)(diag)-55, Drive Cycle.>	Is DTC displayed on Subaru Select Monitor or general scan tool?	Inspect using "Diagnostic Procedure with Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DO w/o HEV)(diag)-105, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

2. Check List for Interview

A: CHECK

1. CHECK LIST NO. 1

Check the following item when problem has occurred.

NOTE:
Use copies of this page for interviewing customers.

Customer's name		Engine No.	
Date of purchase		Fuel type	
Date of repair		Odometer reading	km
V.I.N.			miles
Weather	❑ Fine ❑ Cloudy ❑ Rainy ❑ Snowy ❑ Various/Others:		
Ambient air temperature	°C (°F)		
	❑ Hot ❑ Warm ❑ Cool ❑ Cold		
Place	❑ Highway ❑ Suburbs ❑ Inner city ❑ Uphill ❑ Downhill ❑ Rough road ❑ Others:		
Engine temperature	❑ Cold ❑ Warming-up ❑ After warming-up ❑ Any temperature ❑ Others:		
Engine speed	rpm		
Vehicle speed	km/h (MPH)		
Driving conditions	❑ Not affected ❑ At starting ❑ While idling ❑ At racing ❑ While accelerating ❑ While cruising ❑ While decelerating ❑ While turning (RH/LH)		
Headlight	❑ ON/❑ OFF	Rear defogger	❑ ON/❑ OFF
Blower	❑ ON/❑ OFF	Audio	❑ ON/❑ OFF
A/C compressor	❑ ON/❑ OFF	Rear entertainment system	❑ ON/❑ OFF
Radiator fan	❑ ON/❑ OFF	Car phone	❑ ON/❑ OFF
Front wiper	❑ ON/❑ OFF	Wireless device	❑ ON/❑ OFF
Rear wiper	❑ ON/❑ OFF		

2. CHECK LIST NO. 2

Check the following item about the vehicle's state when the malfunction indicator light turns on.

Check List for Interview

NOTE:
Use copies of this page for interviewing customers.

a) Other warning lights or indicators illuminate: ❑ Yes / ❑ No
❑ Fuel level warning light ❑ Charge warning light ❑ Engine coolant temperature warning light ❑ Oil pressure warning light ❑ ATF temperature warning light or Sport indicator light ❑ Driver's control center differential indicator light ❑ ABS warning light ❑ VDC warning light ❑ Cruise indicator light ❑ SI-CRUISE warning light ❑ Immobilizer indicator light ❑ STEERING warning light ❑ Electronic parking brake warning light ❑ Glow indicator light ❑ Sedimentor warning light ❑ Others:
b) Fuel level
• Lack of fuel: ❑ Yes / ❑ No • Indicator position of fuel gauge: • Experienced running out of fuel: ❑ Yes / ❑ No
c) Intentional connecting or disconnecting of harness connectors or spark plug cords: ❑ Yes / ❑ No
• What:
d) Intentional connecting or disconnecting of hoses: ❑ Yes / ❑ No
• What:
e) Installing of other parts except genuine parts: ❑ Yes / ❑ No
• What: • Where:
f) Occurrence of noise: ❑ Yes / ❑ No
• From where: • What kind:
g) Occurrence of smell: ❑ Yes / ❑ No
• From where: • What kind:
h) Intrusion of water into engine compartment or passenger compartment: ❑ Yes / ❑ No
i) Troubles occurred
❑ Engine does not start. ❑ Engine stalls during idling. ❑ Engine stalls while driving. ❑ Engine speed decreases. ❑ Engine speed does not decrease. ❑ Rough idling ❑ Poor acceleration ❑ Back fire ❑ After fire ❑ Does not shift. ❑ Excessive shift shock

3. General Description

A: CAUTION

1) Airbag system wiring harness is routed near the ECM, main relay and fuel pump relay.

CAUTION:
• Do not use electrical test equipment on the airbag system circuits.
• Be careful not to damage the airbag system wiring harness when servicing the ECM, TCM, main relay and fuel pump relay.

2) Never connect the battery in reverse polarity. Doing so will damage the ECM instantly, and other parts will also be damaged.

3) Do not disconnect the battery cables while the engine is running. A large counter electromotive force will be generated in the generator, and this voltage may damage electronic parts such as ECM etc.

4) When disconnecting the connectors of the electrical components, always be sure to turn the ignition switch to OFF. Perform the Clear Memory Mode after connecting the connectors. <Ref. to EN(H4DO w/o HEV)(diag)-65, Clear Memory Mode.>

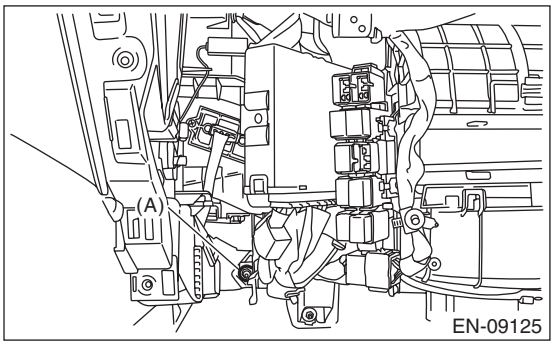
5) When measuring the voltage or resistance of individual sensor or all electrical control modules, use a tapered pin with a diameter of 0.6 mm (0.024 in) or less and touch it to the tip of terminal. Never insert the tapered pin into the terminal because it deforms inside which may lead to malfunction.

CAUTION:
When replacing the ECM, be careful not to use the ECM of wrong specification to avoid any damage on the fuel injection system.

NOTE:
When replacing the ECM of the models with immobilizer, immobilizer system must be registered. For detailed procedures, refer to “REGISTRATION MANUAL FOR IMMOBILIZER”.

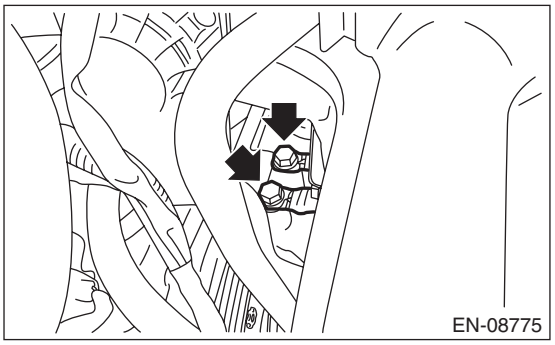
6) Take care not to allow water to get into the connectors when servicing or washing the vehicle in rainy weather. Avoid exposure to water even if the connectors are waterproof.

7) Use ECM mounting stud bolts for the grounding point when measuring voltage and resistance inside the passenger compartment.



(A) Stud bolt

8) Use the engine ground terminal or engine assembly for the grounding point when measuring the voltage and resistance in engine compartment.



9) All parts related to the engine control system are precision parts. Do not drop or otherwise apply impact. Do not reuse the parts that are dropped accidentally.

10) Observe the following cautions when installing a radio in vehicle.

CAUTION:
• The antenna must be kept as far apart as possible from the ECM. <Ref. to EN(H4DO w/o HEV)(diag)-9, CONTROL MODULE, LOCATION, Electrical Component Location.>
• The antenna feeder must be placed as far apart as possible from the ECM and engine control system harness.
• Carefully adjust the antenna for correct matching.
• When mounting a large power type radio, pay special attention to the three items mentioned above.
• Incorrect installation of the radio may affect the operation of ECM.

11) When disconnecting the fuel hose, release the fuel pressure. <Ref. to FU(H4DO(w/o HEV))-109, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>

12) Warning lights may illuminate when performing driving test with jacked-up or lifted-up condition, but this is not a system malfunction. The reason for this is the rotating speed difference between the front and rear wheels. When engine control system diagnosis is finished, perform the VDC memory clearance procedure of self-diagnosis function. <Ref. to VDC(diag)-25, Clear Memory Mode.>

B: INSPECTION

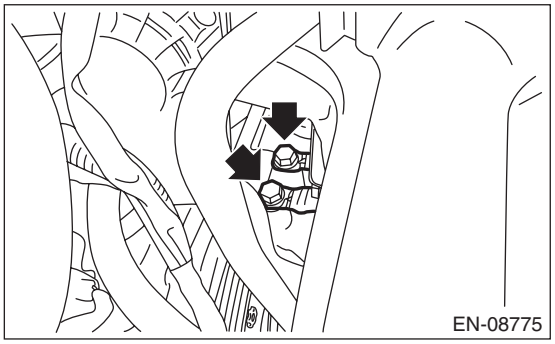
Before performing diagnostics, check the following item which might affect engine problems.

1. BATTERY

1) Check the battery. <Ref. to SC(H4DO(w/o HEV))-53, INSPECTION, Battery.>
2) Check the condition of the main and other fuses, and harnesses and connectors. Also check for proper grounding.

2. ENGINE GROUND

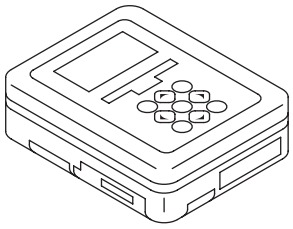
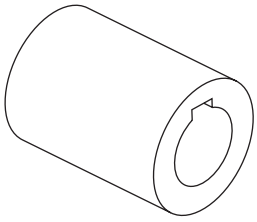
Make sure that the engine ground terminal has no contamination, corrosion or looseness and is properly connected to the engine.



C: NOTE

• The on-board diagnostic (OBD) system detects and indicates a fault in various inputs and outputs of the complex electronic control. Malfunction indicator light in the combination meter indicates occurrence of a fault or trouble.
• Further, against such a failure of sensors as may disable the drive, the fail-safe function is provided to ensure the minimal drivability.
• The OBD system incorporated with the vehicles within this type of engine complies with OBD-II regulations. The OBD system monitors the components and the system malfunction listed in “Engine Section” which affects on emissions.
• When the system decides that a malfunction occurs, malfunction indicator light illuminates. At the same time of the malfunction indicator light illumination or blinking, a DTC and a freeze frame engine conditions are stored into on-board computer.
• The OBD system stores freeze frame engine condition data (engine load, engine coolant temperature, fuel trim, engine speed and vehicle speed, etc.) into on-board computer when it detects a malfunction.
• Freeze frame engine condition data are stored until the DTCs are cleared. However when such malfunctions as fuel trim fault and misfire are detected with the freeze frame engine condition data stored, they are rewritten into those related to the fuel trim fault and misfire.
• When the malfunction does not occur again for three consecutive driving cycles*, malfunction indicator light is turned off, but DTC remains at on-board computer.
*: One driving cycle means the period between the ignition switch ON and the ignition switch OFF after driving.
• When performing diagnosis, connect the Subaru Select Monitor or general scan tool to the vehicle.

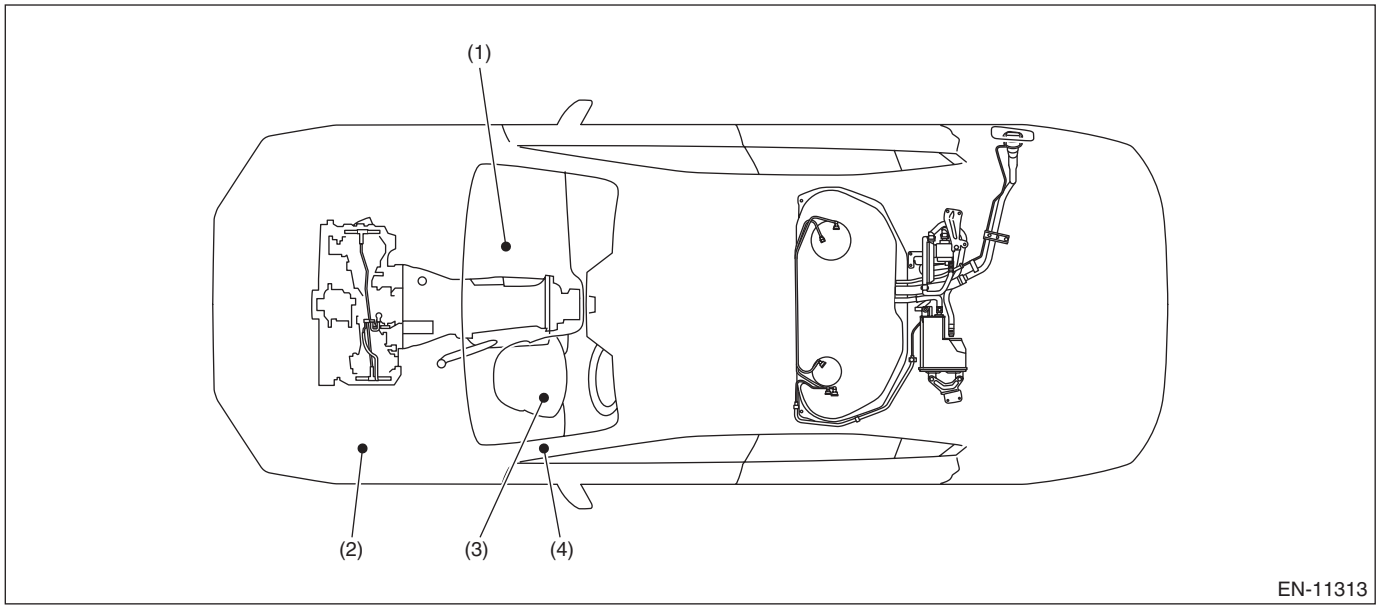
D: PREPARATION TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for setting of each function and trouble-shooting for electrical system. NOTE: For detailed operation procedures of Subaru Select Monitor III, refer to “PC application help for Subaru Select Monitor”.
 ST18252AA000	18252AA000	CRANKSHAFT SOCKET	Used for rotating crankshaft.

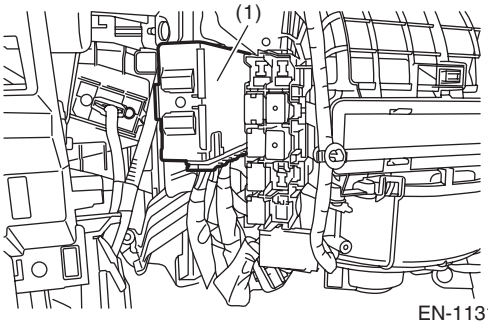
4. Electrical Component Location

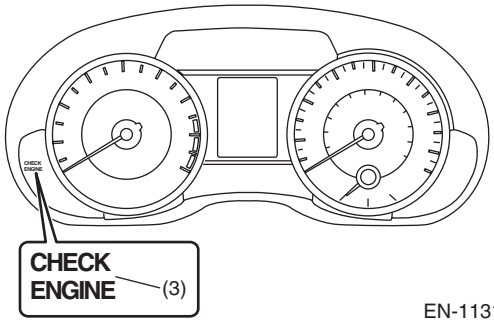
A: LOCATION

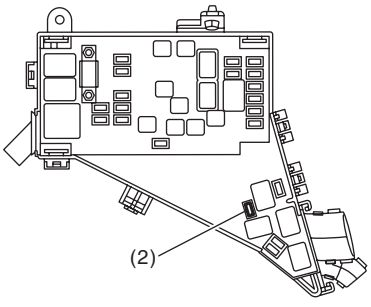
1. CONTROL MODULE

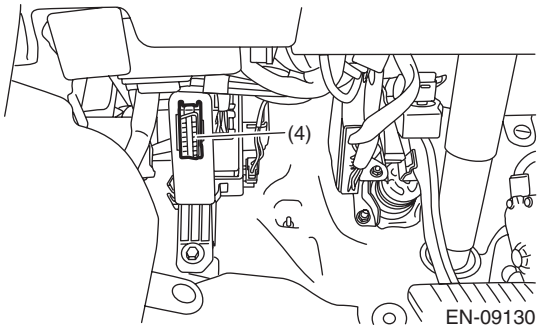


(1) Engine control module (ECM)
(2) Delivery (test) mode fuse
(3) Malfunction indicator light
(4) Data link connector

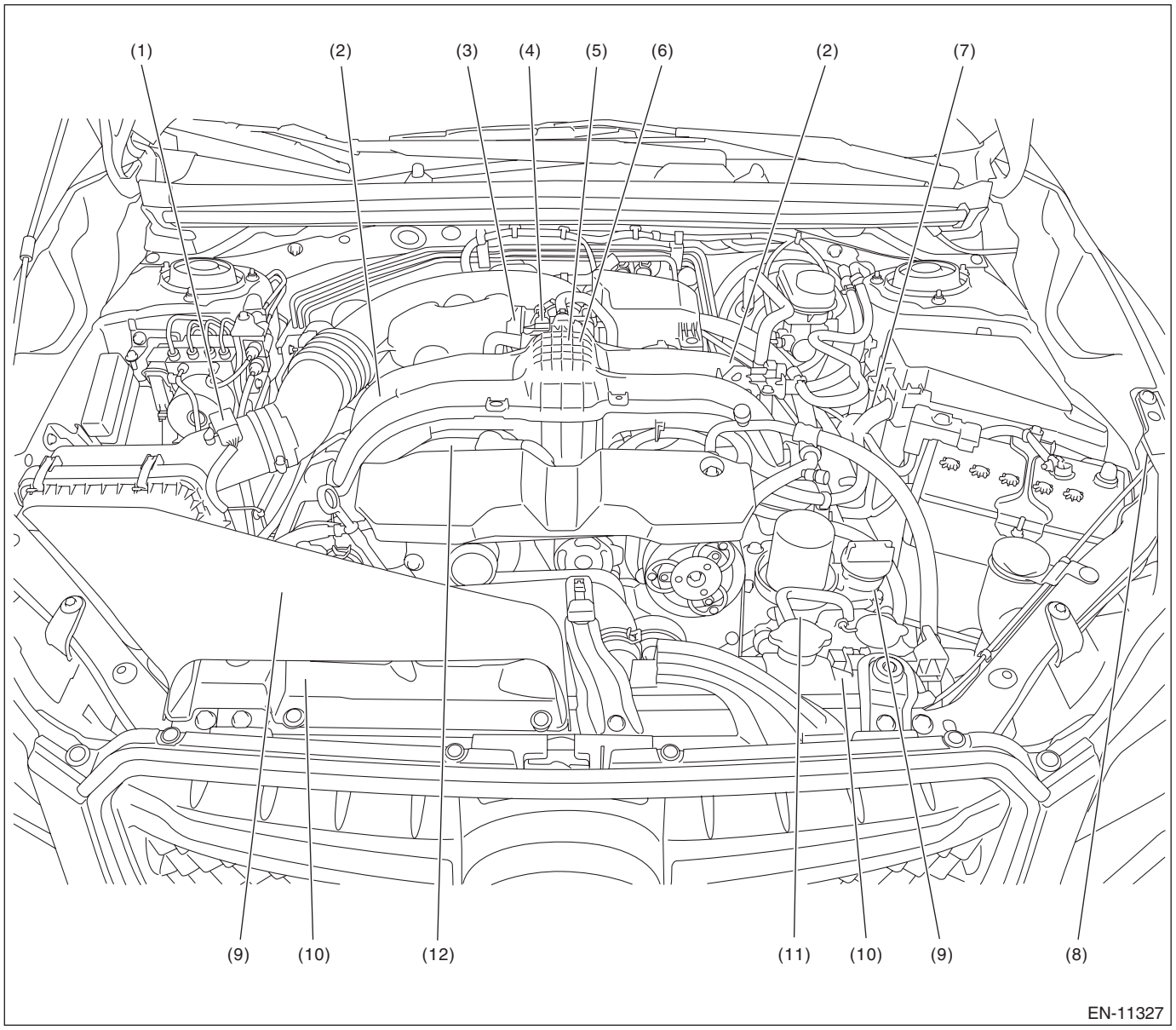




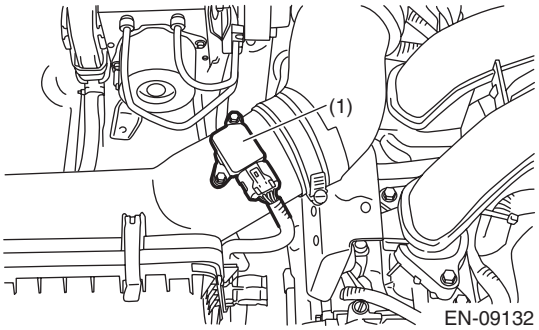


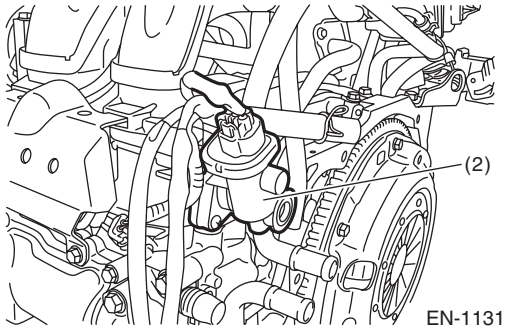


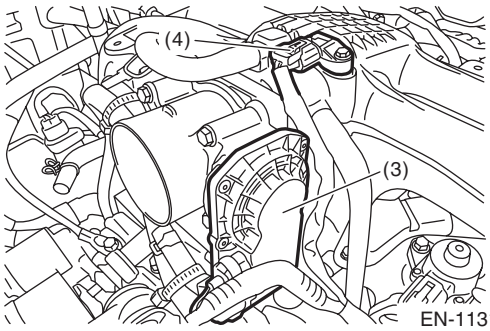
2. SENSOR

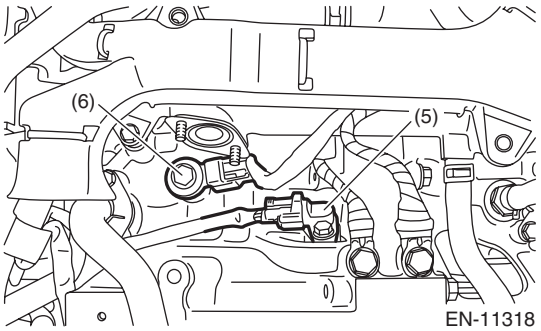


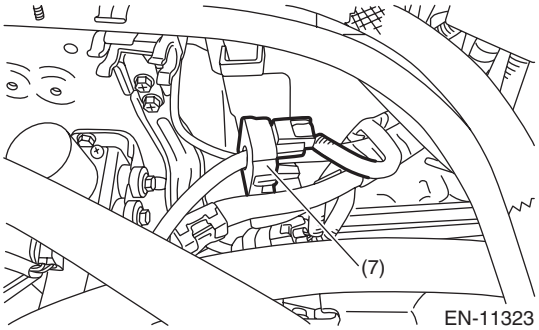
(1) Mass air flow and intake air temperature sensor
(2) Tumble generator valve actuators (with built-in opening angle switch)
(3) Electronic throttle control
(4) Manifold absolute pressure sensor
(5) Crankshaft position sensor
(6) Knock sensor
(7) Battery current sensor
(8) Battery temperature sensor
(9) Intake camshaft position sensor
(10) Exhaust camshaft position sensor
(11) Engine oil temperature sensor
(12) Engine coolant temperature sensor

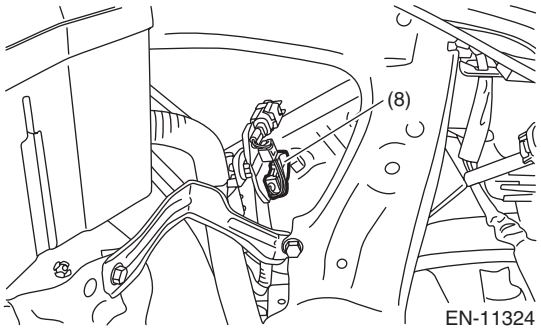

(1)
EN-09132

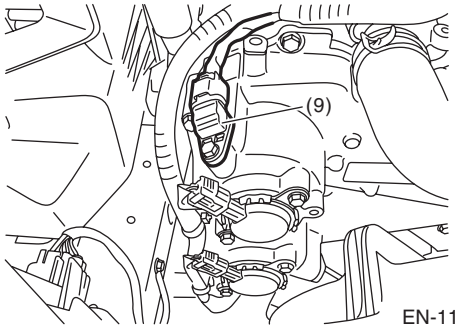

(2)
EN-11319

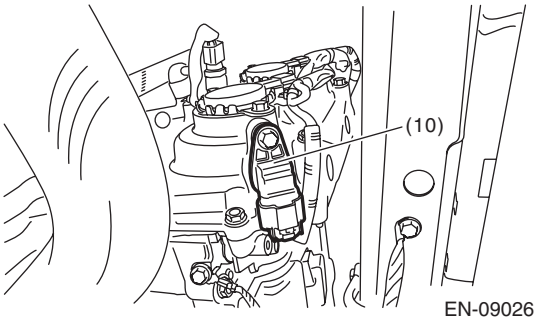

(4)
(3)
EN-11317

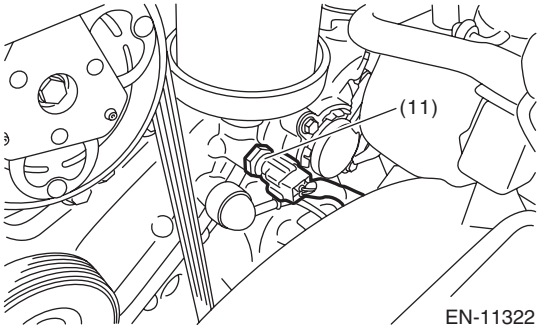

(6)
(5)
EN-11318

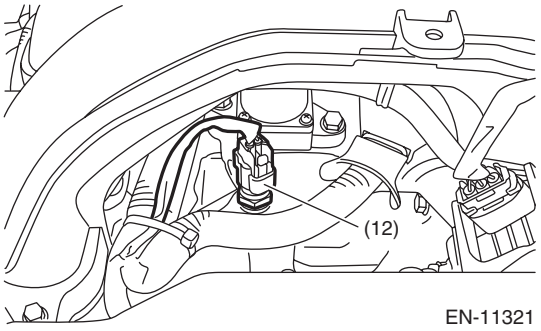

(7)
EN-11323

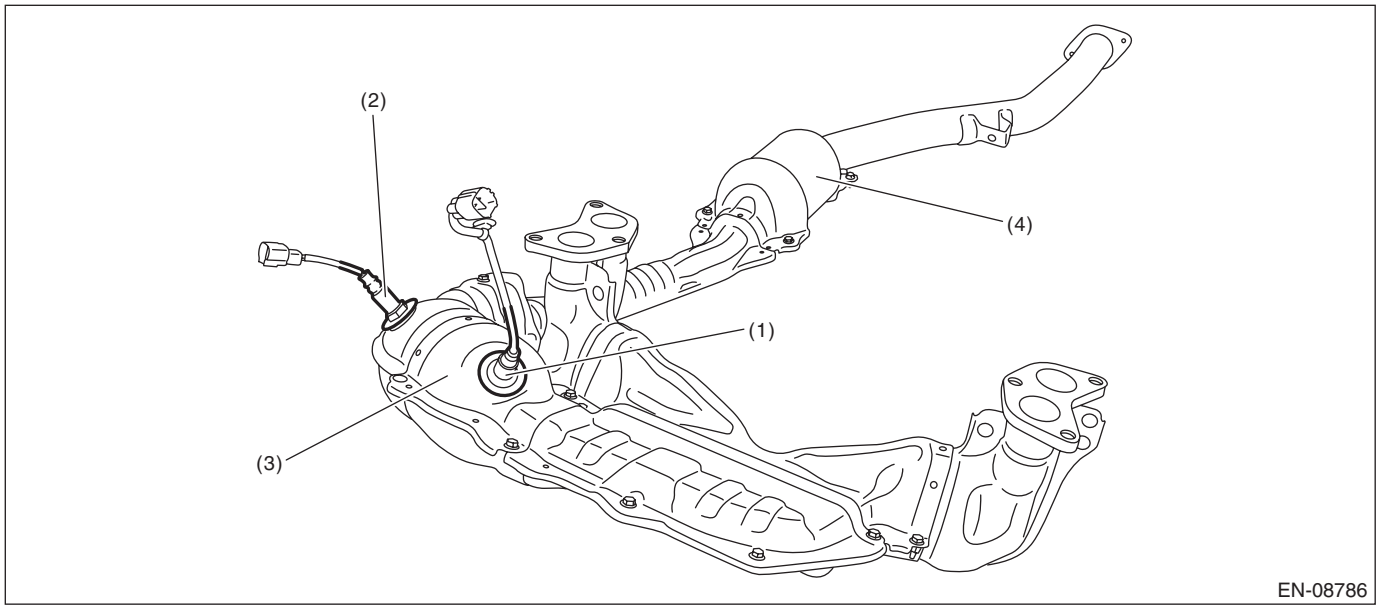

(8)
EN-11324


(9)
EN-11320

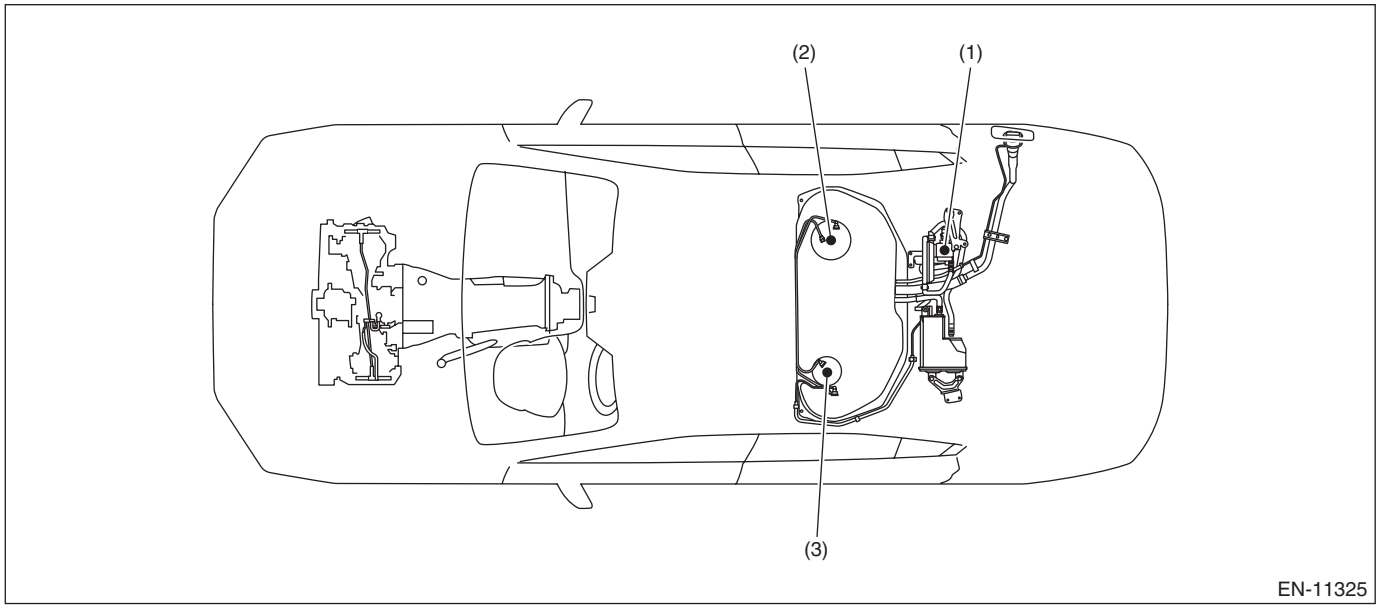

(10)
EN-09026


(11)
EN-11322

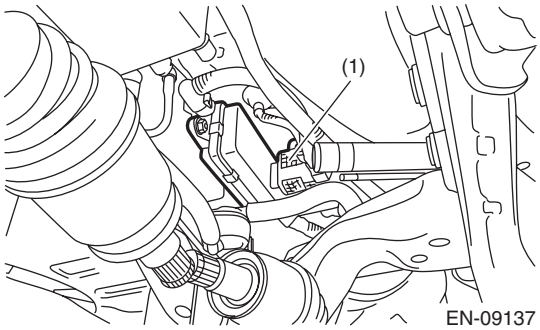

(12)
EN-11321



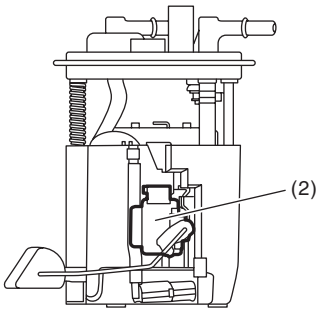
(1) Front oxygen (A/F) sensor
(2) Rear oxygen sensor
(3) Front catalytic converter
(4) Rear catalytic converter



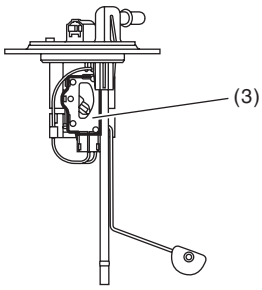
(1) Leak check valve ASSY (with built-in pressure sensor)
(2) Fuel level sensor
(3) Fuel sub level sensor



EN-09137

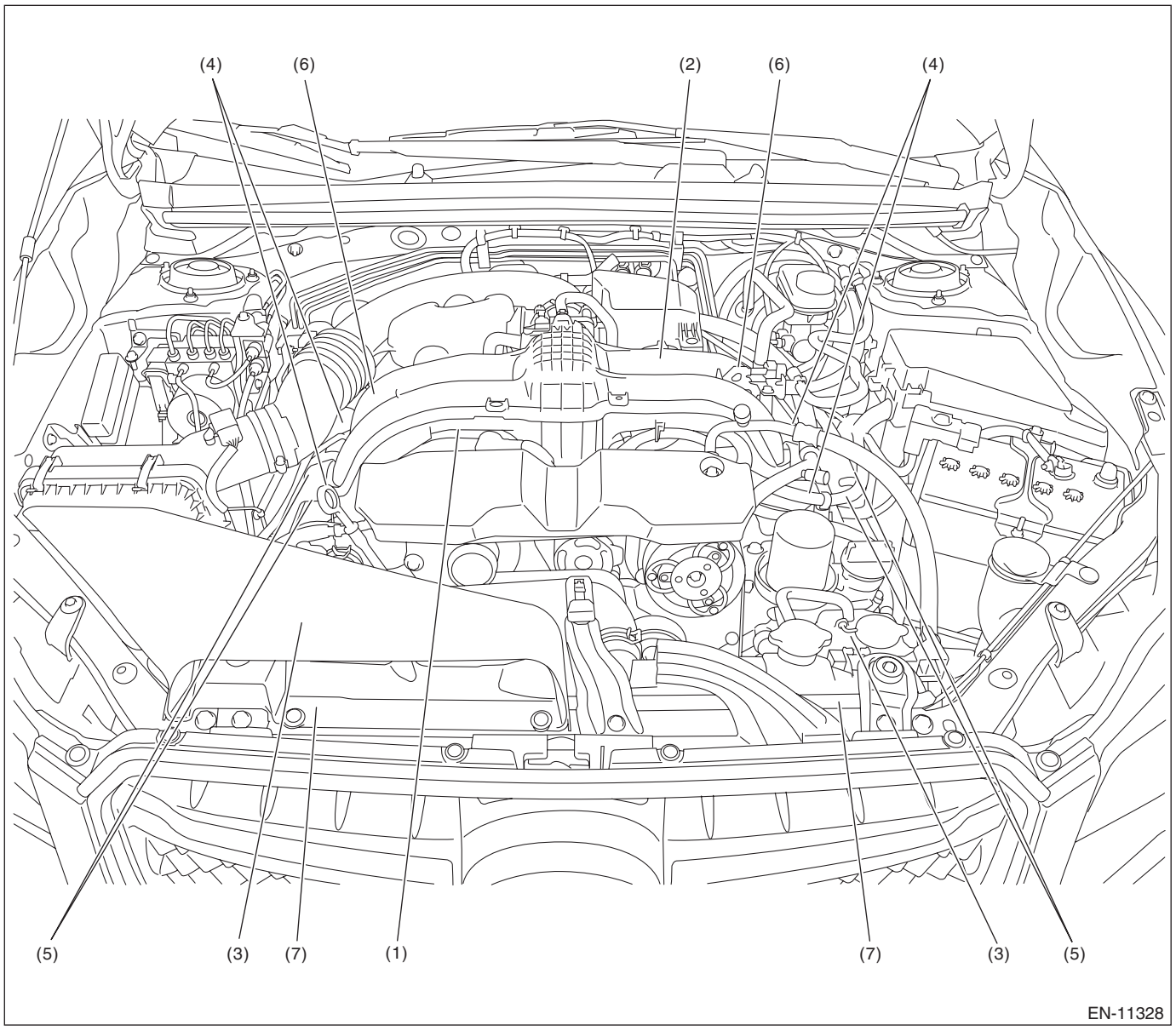


EN-11326

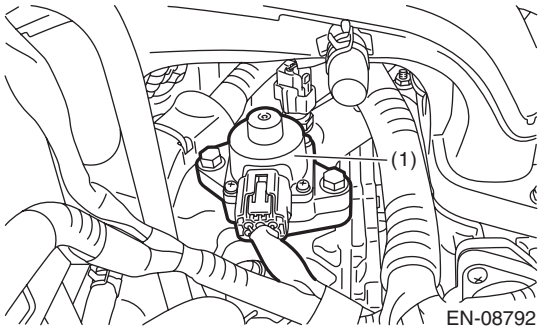


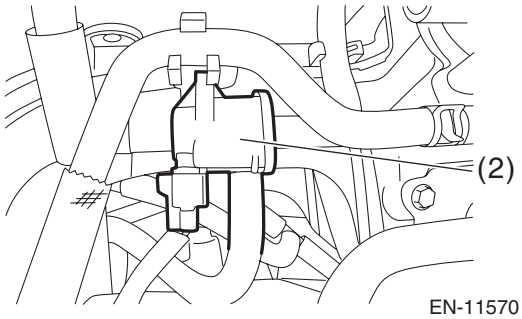
EN-08790

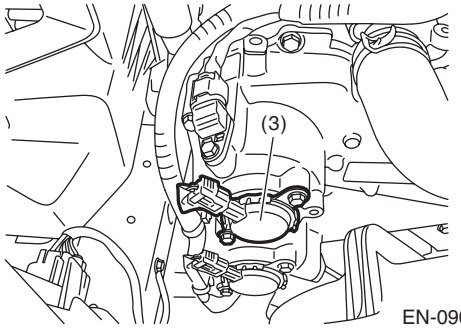
3. SOLENOID VALVE, ACTUATOR, EMISSION CONTROL SYSTEM PARTS AND IGNITION SYSTEM PARTS

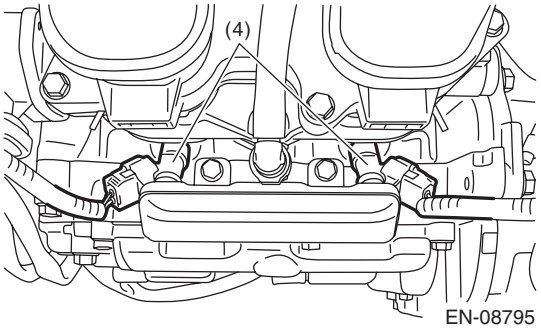


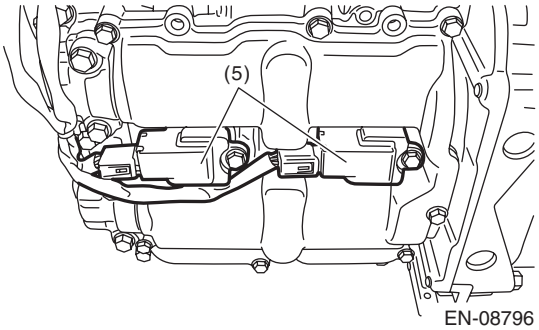
(1) EGR control valve
(2) Purge control solenoid valve
(3) Intake oil control solenoid
(4) Fuel injector
(5) Ignition coil
(6) Tumble generator valve actuator
(7) Exhaust oil control solenoid

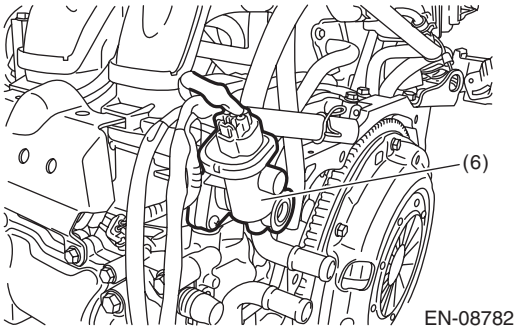

(1)
EN-08792

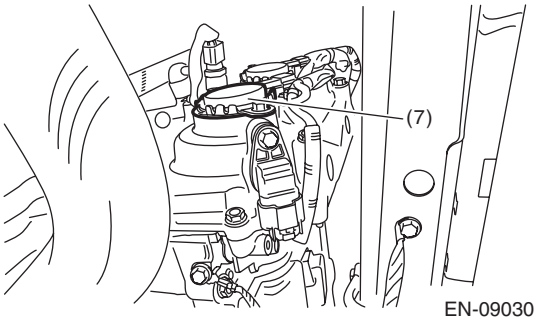

(2)
EN-11570

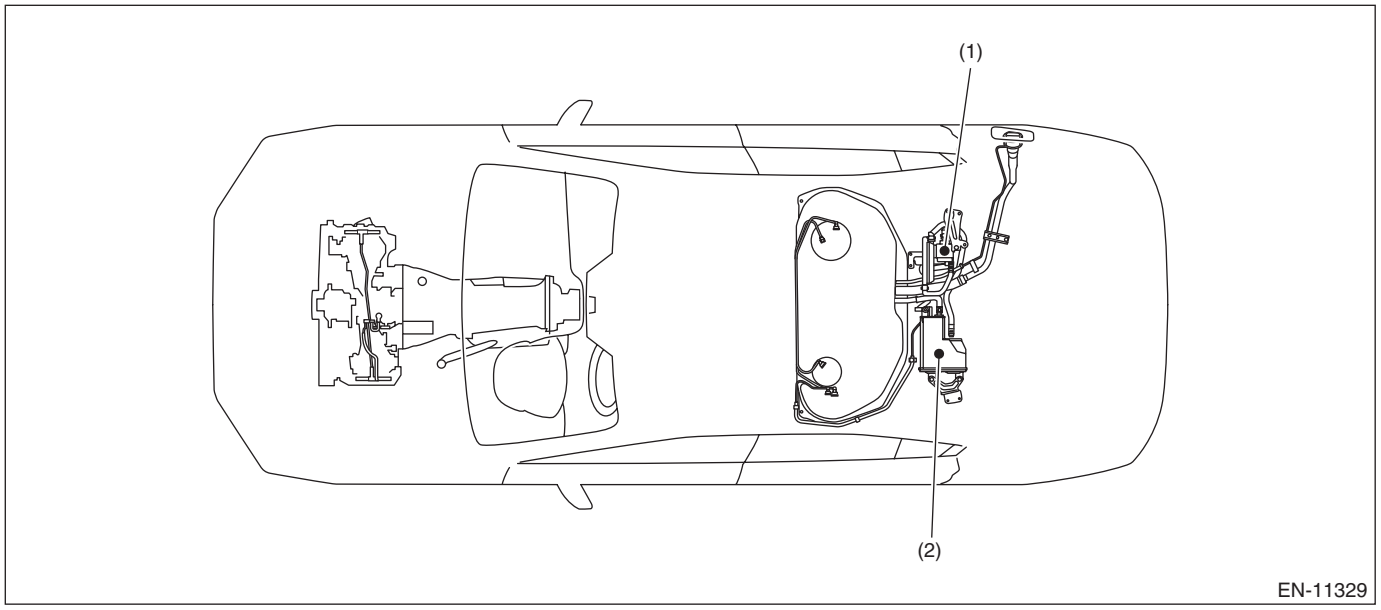

(3)
EN-09029


(4)
EN-08795

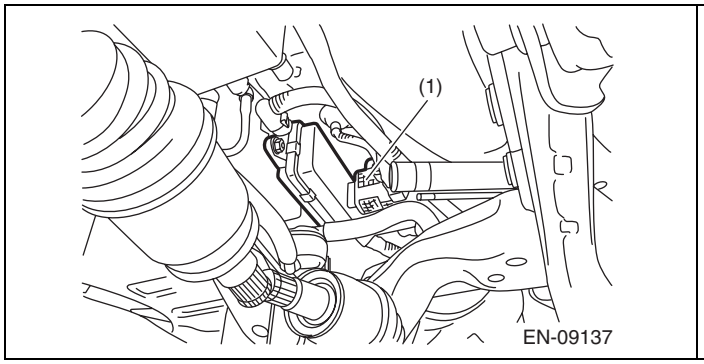

(5)
EN-08796

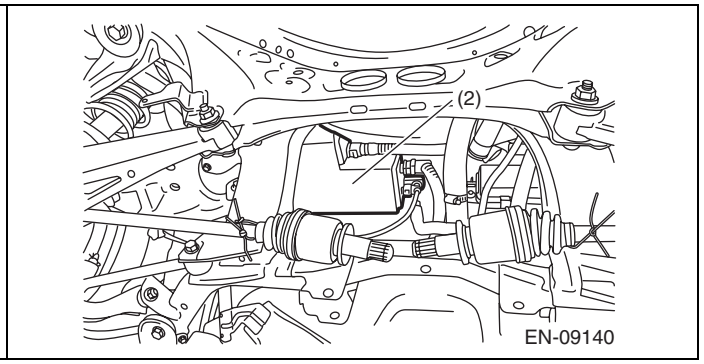

(6)
EN-08782

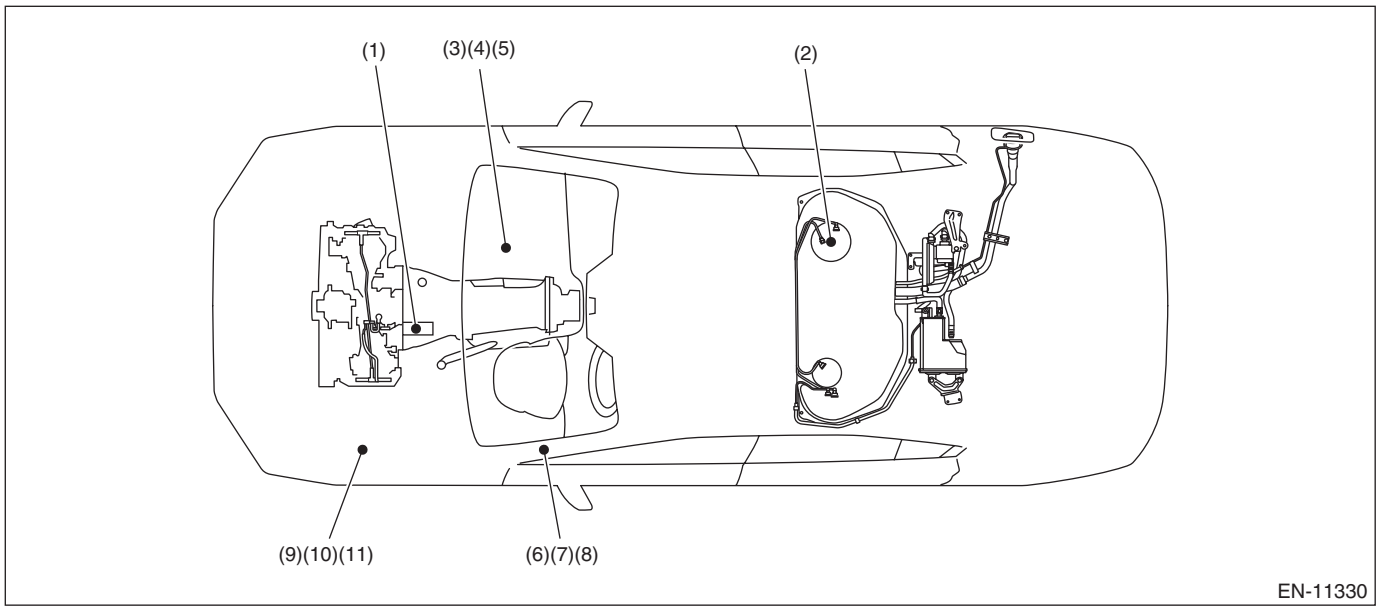

(7)
EN-09030



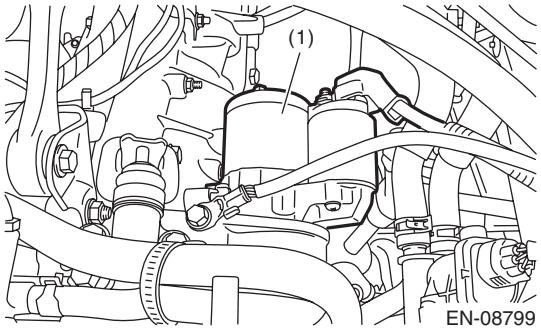
(1) Leak check valve ASSY (2) Canister

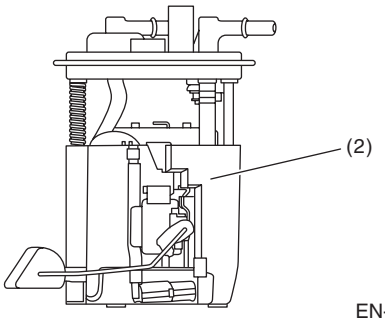


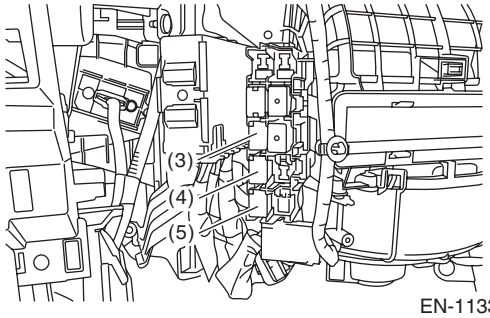


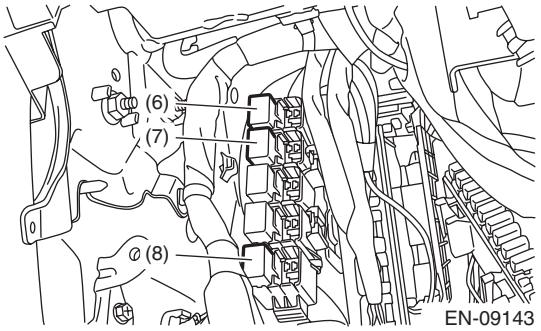


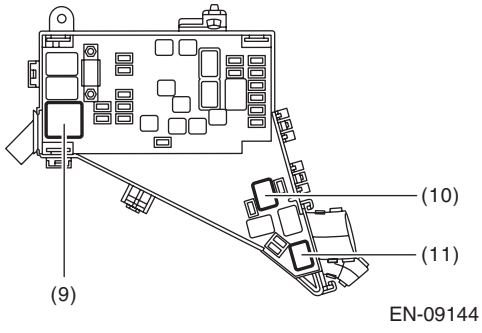
(1) Starter
(2) Fuel pump
(3) Main relay
(4) IG relay
(5) Fuel pump relay
(6) A/F, oxygen sensor relay
(7) Electronic throttle control relay
(8) Starter relay 1
(9) Radiator main fan relay 1
(10) Radiator main fan relay 2
(11) Radiator sub fan relay


(1)
EN-08799


(2)
EN-11331


(3)
(4)
(5)
EN-11332

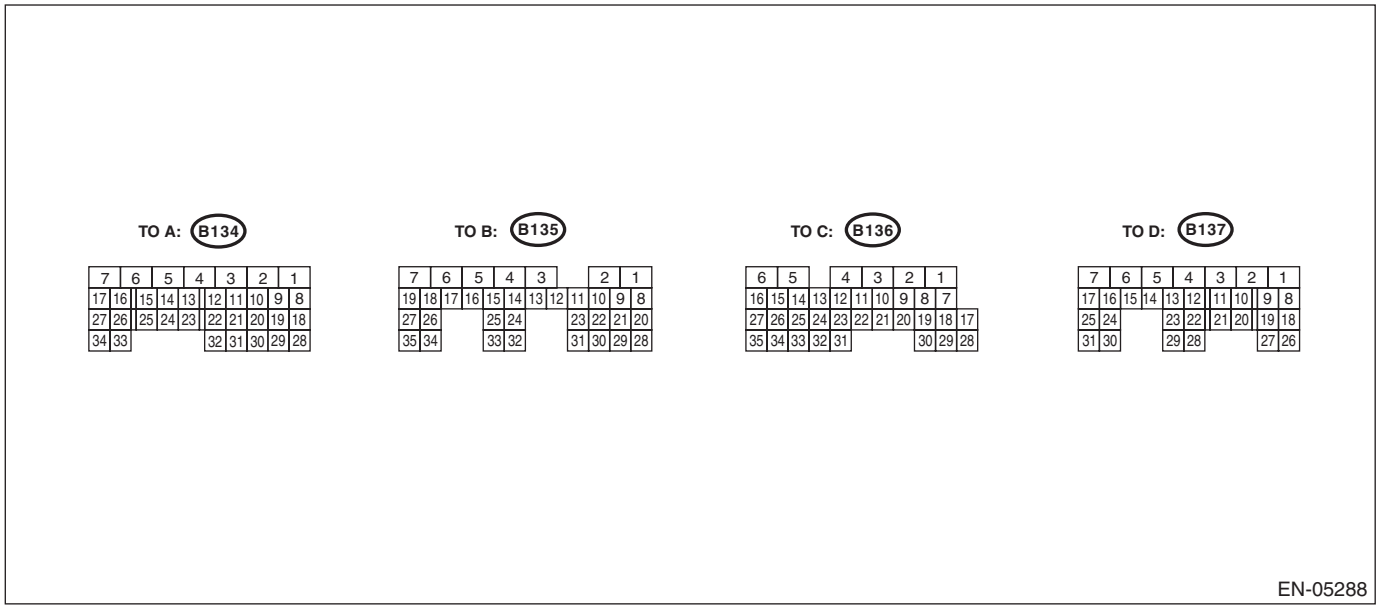

(6)
(7)
(8)
EN-09143


(10)
(11)
(9)
EN-09144

5. Engine Control Module (ECM) I/O Signal

A: ELECTRICAL SPECIFICATION

1. ENGINE CONTROL MODULE (ECM)



DESCRIPTION		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (engine OFF)	Engine ON (idling)	
Crankshaft position sensor	Signal (+)	B136	16	5	0 or 5	Waveform
	Signal (–)	B136	27	0	0	—
Front oxygen (A/F) sensor	Signal (+)	B136	19	2.8 — 3.2	2.8 — 3.2	—
	Signal (–)	B136	18	2.4 — 2.7	2.4 — 2.7	—
	Shield	B136	30	0	0	—
Rear oxygen sensor	Signal	B136	21	0	0 — 0.9	—
	Shield	B136	30	0	0	—
Front oxygen (A/F) sensor heater signal		B136	5	Battery voltage	0 or battery voltage	Waveform
Rear oxygen sensor heater signal		B134	6	Battery voltage	0 or battery voltage	Waveform
Engine coolant temperature sensor	Signal	B134	30	1.0 — 1.4	1.0 — 1.6	—
Air flow sensor	Signal	B137	22	—	0.3 — 4.5	—
	Shield	B137	28	0	0	—
	Ground	B137	29	0	0	—
Intake air temperature sensor signal		B137	12	0.3 — 4.6	0.3 — 4.6	—
Engine oil temperature sensor signal		B134	20	1.0 — 1.4	1.0 — 1.6	—
Starter switch		B137	17	Waveform	Waveform	Models without push button start: Waveform Models with push button start: Waveform
Accessory cut request		B135	32	Waveform	Waveform	Models without push button start: Waveform Models with push button start: Waveform

Engine Control Module (ECM) I/O Signal

DESCRIPTION		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (engine OFF)	Engine ON (idling)	
Starter switch 2		B137	14	Waveform	Waveform	Models without push button start: Waveform Models with push button start: Waveform
Starter cut relay		B135	34	Waveform	Waveform	Models without push button start: Waveform Models with push button start: Waveform Waveform
Ignition switch		B137	27	Battery voltage	Battery voltage	—
Neutral position switch		B137	16	ON: 0 OFF: Battery voltage	ON: 0 OFF: Battery voltage	—
Delivery mode switch		B137	13	Battery voltage	Battery voltage	When fuse is installed: 0
Knock sensor	Signal	B136	28	2.5	2.5	—
	Shield	B136	29	0	0	—
Back-up power supply		B137	2	Battery voltage	Battery voltage	—
Control module power supply		B136	6	Battery voltage	Battery voltage	—
		B137	1	Battery voltage	Battery voltage	—
Sensor power supply		B134	19	5	5	—
		B135	22	5	5	—
Ignition control	#1	B134	21	0	0 or 5	Waveform
	#2	B134	10	0	0 or 5	Waveform
	#3	B134	31	0	0 or 5	Waveform
	#4	B134	8	0	0 or 5	Waveform
Fuel injector	#1	B134	12	Battery voltage	0 or battery voltage	Waveform
	#2	B134	22	Battery voltage	0 or battery voltage	Waveform
	#3	B134	32	Battery voltage	0 or battery voltage	Waveform
	#4	B134	13	Battery voltage	0 or battery voltage	Waveform
Fuel pump relay control		B135	19	Battery voltage	ON: 0.5 or less OFF: Battery voltage	—
A/C relay control		B135	35	ON: 0.5 or less OFF: Battery voltage	ON: 0.5 or less OFF: Battery voltage	—
A/C switch		B137	26	ON: Battery voltage OFF: 0	ON: Battery voltage OFF: 0	Manual A/C model
Blower fan switch		B137	20	ON: 0 OFF: Battery voltage	ON: 0 OFF: Battery voltage	Manual A/C model
A/C middle pressure switch		B137	8	ON: 0 OFF: Battery voltage	ON: 0 OFF: Battery voltage	—
Main fan relay control		B135	12	ON: 0.5 or less OFF: Battery voltage	ON: 0.5 or less OFF: Battery voltage	—
Sub fan relay control		B135	11	ON: 0.5 or less OFF: Battery voltage	ON: 0.5 or less OFF: Battery voltage	—
Engine speed output		B135	15	—	0 or battery voltage	Waveform
Purge control solenoid valve		B134	11	Battery voltage	Battery voltage	In operation: Waveform
EGR control valve	Signal 1	B136	11	Battery voltage	0 or battery voltage	—
	Signal 2	B136	13	Battery voltage	0 or battery voltage	—
	Signal 3	B136	31	Battery voltage	0 or battery voltage	—
	Signal 4	B136	32	Battery voltage	0 or battery voltage	—
Manifold absolute pressure sensor signal		B136	20	3.4 — 3.8	1.0 — 1.6	—

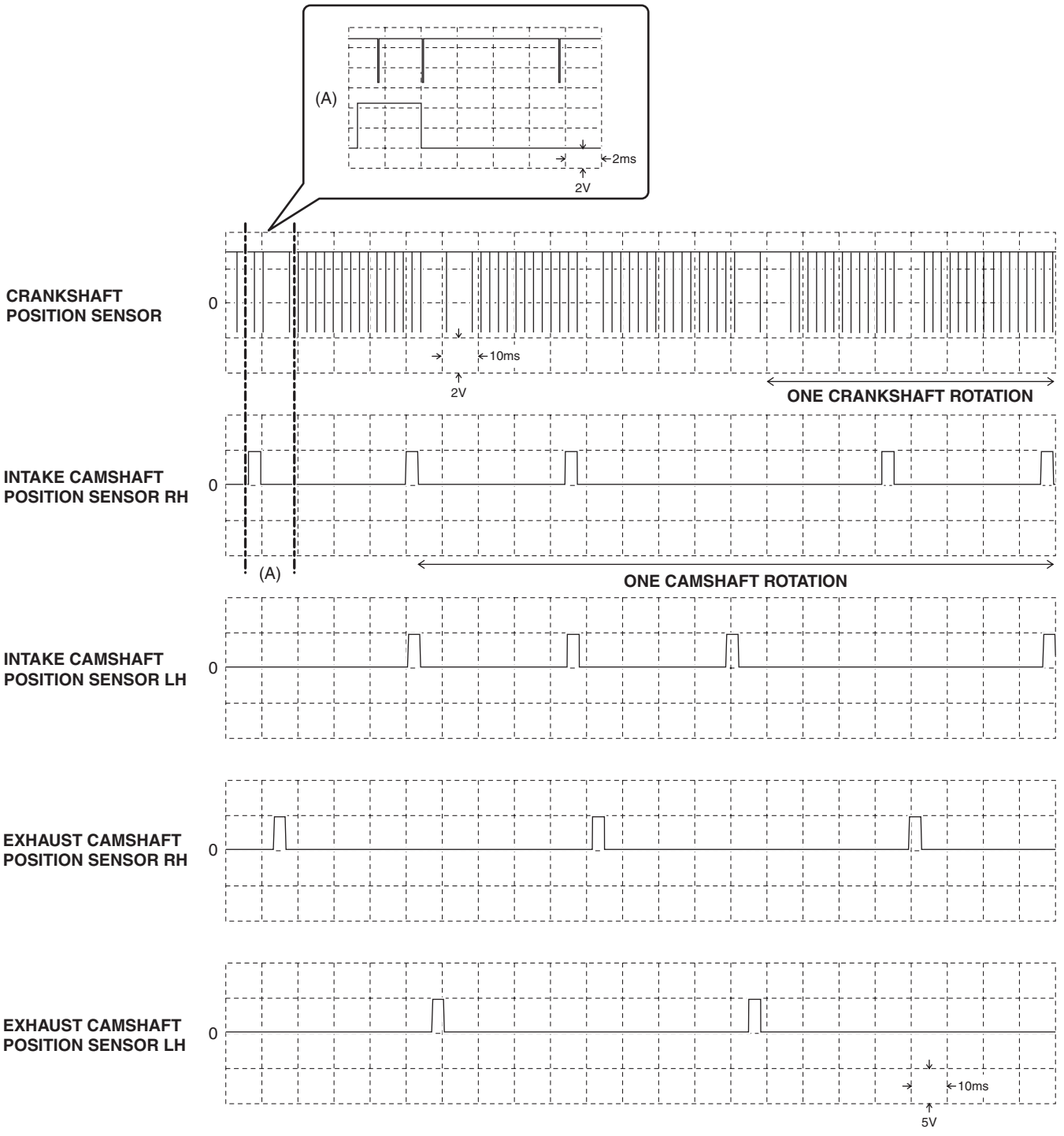
DESCRIPTION		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (engine OFF)	Engine ON (idling)	
Electronic throttle control	Main	B134	18	Approx. 0.7	Approx. 0.6 — 0.7	Fully closed: Approx. 0.6 Fully open: Approx. 4.0
	Sub	B134	28	Approx. 1.6	Approx. 1.5 — 1.6	Fully closed: Approx. 1.5 Fully open: Approx. 4.2
Electronic throttle control motor (+)		B134	2	Duty waveform	Duty waveform	Drive frequency: 500 Hz
Electronic throttle control motor (–)		B134	1	Duty waveform	Duty waveform	Drive frequency: 500 Hz
Electronic throttle control motor power supply		B135	7	Battery voltage	Battery voltage	—
Electronic throttle control motor relay		B135	17	0	0	—
Intake oil control solenoid (LH)		B134	16	Battery voltage	0 or battery voltage	Waveform
Intake oil control solenoid (RH)		B134	17	Battery voltage	0 or battery voltage	Waveform
Exhaust oil control solenoid (LH)		B134	5	Battery voltage	0 or battery voltage	Waveform
Exhaust oil control solenoid (RH)		B134	7	Battery voltage	0 or battery voltage	Waveform
Intake camshaft position sensor (LH)		B136	15	0 or 5	0 or 5	Waveform
Intake camshaft position sensor (RH)		B136	26	0 or 5	0 or 5	Waveform
Exhaust camshaft position sensor (LH)		B136	25	0 or 5	0 or 5	Waveform
Exhaust camshaft position sensor (RH)		B136	14	0 or 5	0 or 5	Waveform
Camshaft position sensor ground		B136	34	0	0	—
Accelerator pedal position sensor	Main sensor signal	B135	23	Fully closed: 0.4 — 1.0 Fully opened: 2.4 — 3.7	Fully closed: 0.4 — 1.0 Fully opened: 2.4 — 3.7	—
	Main power supply	B135	21	5	5	—
	Ground (main sensor)	B135	29	0	0	—
	Sub signal sensor	B135	31	Fully closed: 0.3 — 1.1 Fully opened: 2.3 — 3.8	Fully closed: 0.3 — 1.1 Fully opened: 2.3 — 3.8	—
Starter relay		B135	26	Waveform	Waveform	Models without push button start: Waveform Models with push button start: Waveform
Clutch switch		B137	15	ON: 0 OFF: Battery voltage	ON: 0 OFF: Battery voltage	—
Brake switch 1 (brake switch)		B137	7	When brake pedal is depressed: 0 When brake pedal is released: Battery voltage	When brake pedal is depressed: 0 When brake pedal is released: Battery voltage	—
Brake switch 2 (stop light switch)		B137	3	When brake pedal is depressed: Battery voltage When brake pedal is released: 0	When brake pedal is depressed: Battery voltage When brake pedal is released: 0	—

DESCRIPTION		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (engine OFF)	Engine ON (idling)	
Cruise control command switch		B137	30	When operating nothing: 3.5 — 4.5 When operating RES/ACC: 2.5 — 3.5 When operating SET/COAST: 0.5 — 1.5 When operating CANCEL: 0 — 0.5	When operating nothing: 3.5 — 4.5 When operating RES/ACC: 2.5 — 3.5 When operating SET/COAST: 0.5 — 1.5 When operating CANCEL: 0 — 0.5	—
Cruise control main switch		B137	23	ON: 0 OFF: 5	ON: 0 OFF: 5	—
CAN communication (MAIN-CAN)	(Hi)	B137	19	—	—	—
	(Lo)	B137	18	—	—	—
Self-shutoff control		B135	13	0	0	—
Generator control		B135	18	0 or 6.5	0 or 6.5	Waveform
Battery current sensor		B137	11	2.6 — 2.8	2.4 — 2.6	—
Battery temperature sensor		B137	24	1.1 — 2.4	1.1 — 2.4	When battery temperature is 20 — 50°C (68 — 122°F)
Oil level switch		B136	24	0	0	Oil level LOW: Battery voltage
Tumble generator valve opening angle switch signal (LH)		B136	9	0	Fully closed: 0.5 or less Fully opened: 4.5 or more	While operating: Waveform
Tumble generator valve actuator (LH open)		B134	23	0	0	While operating: Waveform
Tumble generator valve actuator (LH closed)		B134	24	0	0	While operating: Waveform
Tumble generator valve opening angle switch signal (RH)		B136	23	0	Fully closed: 0.5 or less Fully opened: 4.5 or more	While operating: Waveform
Tumble generator valve actuator (RH open)		B134	25	0	0	While operating: Waveform
Tumble generator valve actuator (RH closed)		B134	14	0	0	While operating: Waveform
Immobilizer communication		B135	25	—	—	—
ELCM	Switching valve	B135	1	Battery voltage	Battery voltage	Operating: 0
	Pressure sensor	B135	20	1 — 4	1 — 4	—
	Vacuum pump	B135	8	Battery voltage	Battery voltage	Operating: 0
Ground	Sensor	B134	29	0	0	—
		B135	30	0	0	—
	Engine 1	B134	4	0	0	—
	Engine 2	B134	3	0	0	—
	Engine 3	B136	1	0	0	—
	Engine 4	B136	2	0	0	—
	Engine 5	B136	3	0	0	—
	Body	B137	4	0	0	—

NOTE:
- Measurement should be performed after warming up the engine.
- Place the select lever in “P” range or “N” range position.
- Turn the A/C to OFF.
- Turn all the accessory switches to OFF.
- Waveforms vary depending on a measurement environment and vehicle condition.

Input/output name:

- Crankshaft position sensor
- Intake camshaft position sensor RH
- Intake camshaft position sensor LH
- Exhaust camshaft position sensor RH
- Exhaust camshaft position sensor LH
- At idling

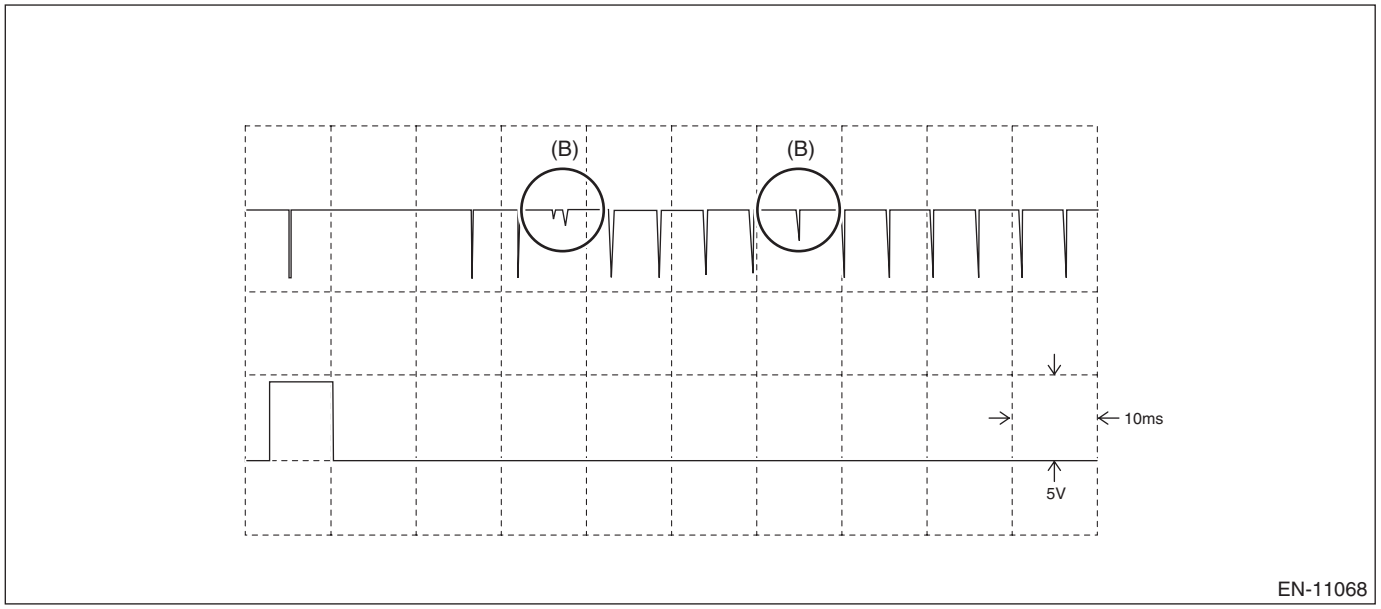


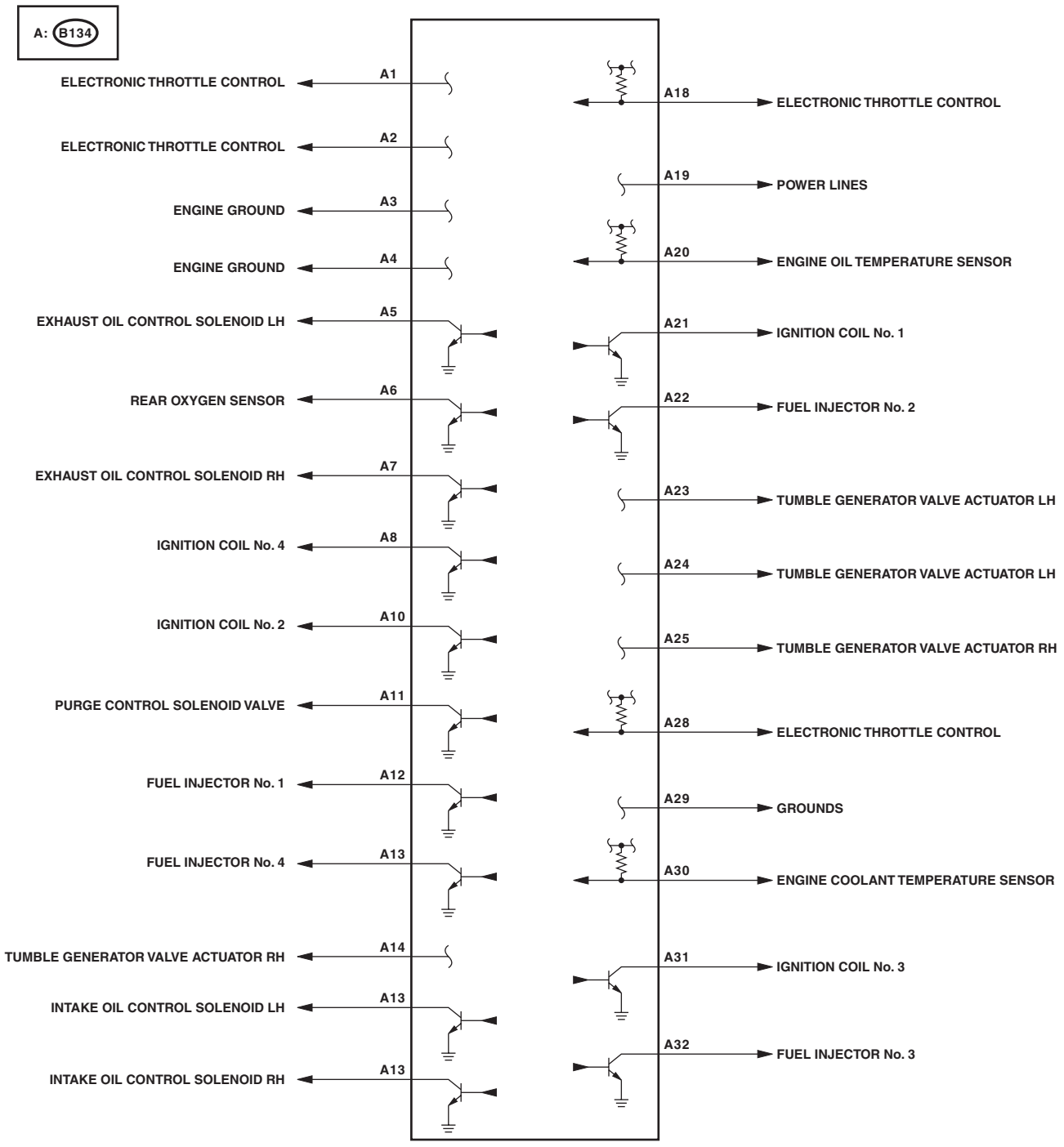
EN-10986

(A) Magnified waveform of crankshaft position sensor and camshaft position sensor

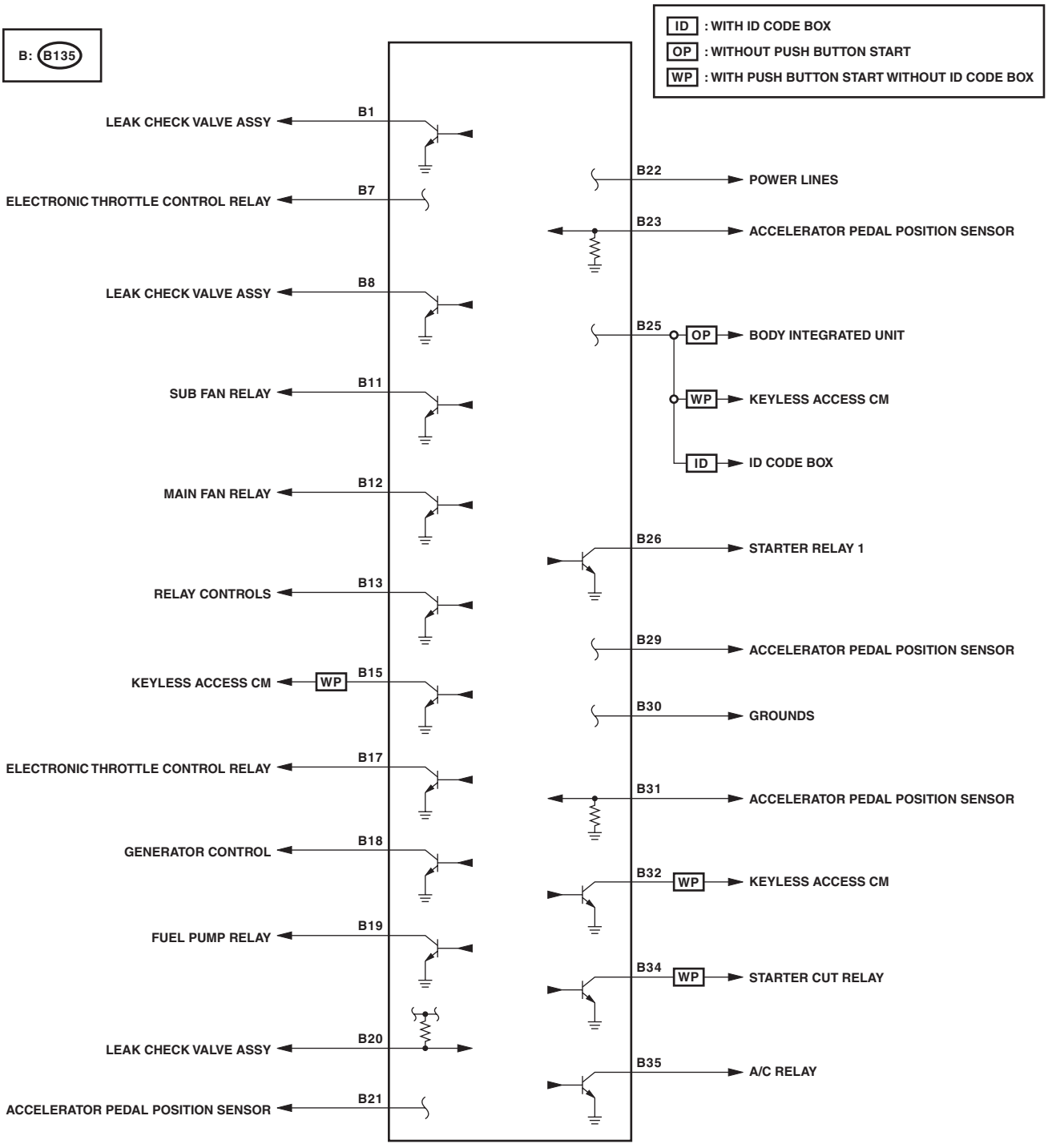
NOTE:
- For measuring the waveforms of the crankshaft position sensor, use of oscilloscope function of DST-i or an ordinary oscilloscope is recommended.
- If the oscilloscope function of the Subaru Select Monitor is used, the waveform of the crankshaft position sensor may be shown as in diagram (B).

This is not a malfunction of the Subaru Select Monitor or crankshaft position sensor, because the unit of output from the crankshaft position sensor is smaller than the minimal measurement unit of the Subaru Select Monitor.

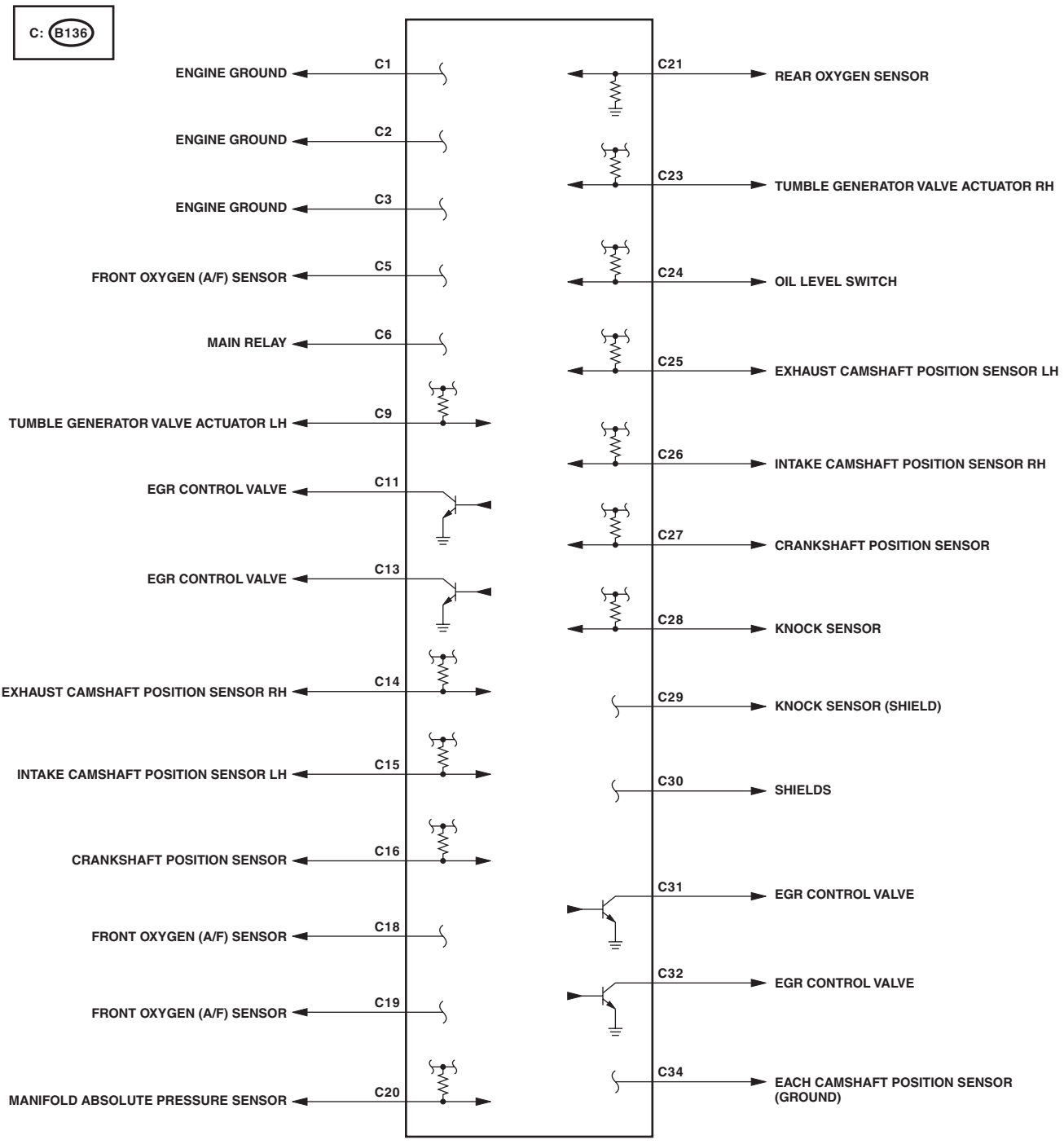



A: B134
ELECTRONIC THROTTLE CONTROL
A1
ELECTRONIC THROTTLE CONTROL
A2
ENGINE GROUND
A3
ENGINE GROUND
A4
EXHAUST OIL CONTROL SOLENOID LH
A5
REAR OXYGEN SENSOR
A6
EXHAUST OIL CONTROL SOLENOID RH
A7
IGNITION COIL No. 4
A8
IGNITION COIL No. 2
A10
PURGE CONTROL SOLENOID VALVE
A11
FUEL INJECTOR No. 1
A12
FUEL INJECTOR No. 4
A13
TUMBLE GENERATOR VALVE ACTUATOR RH
A14
INTAKE OIL CONTROL SOLENOID LH
A13
INTAKE OIL CONTROL SOLENOID RH
A13
A18
ELECTRONIC THROTTLE CONTROL
A19
POWER LINES
A20
ENGINE OIL TEMPERATURE SENSOR
A21
IGNITION COIL No. 1
A22
FUEL INJECTOR No. 2
A23
TUMBLE GENERATOR VALVE ACTUATOR LH
A24
TUMBLE GENERATOR VALVE ACTUATOR LH
A25
TUMBLE GENERATOR VALVE ACTUATOR RH
A28
ELECTRONIC THROTTLE CONTROL
A29
GROUNDS
A30
ENGINE COOLANT TEMPERATURE SENSOR
A31
IGNITION COIL No. 3
A32
FUEL INJECTOR No. 3

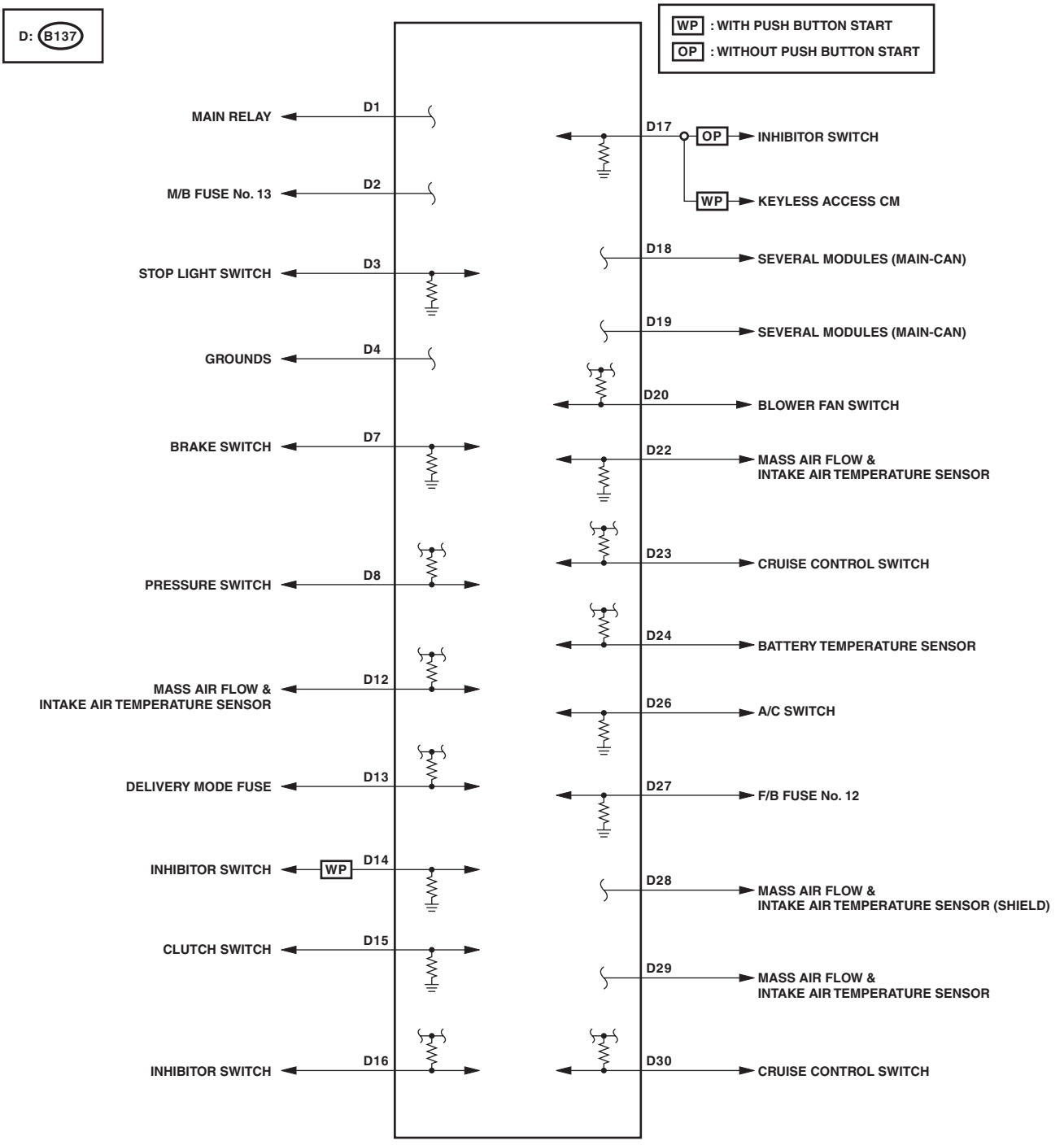
EN-11626


ID : WITH ID CODE BOX
OP : WITHOUT PUSH BUTTON START
WP : WITH PUSH BUTTON START WITHOUT ID CODE BOX
B: B135
B1
LEAK CHECK VALVE ASSY
B7
ELECTRONIC THROTTLE CONTROL RELAY
B8
LEAK CHECK VALVE ASSY
B11
SUB FAN RELAY
B12
MAIN FAN RELAY
B13
RELAY CONTROLS
B15
KEYLESS ACCESS CM
WP
B17
ELECTRONIC THROTTLE CONTROL RELAY
B18
GENERATOR CONTROL
B19
FUEL PUMP RELAY
B20
LEAK CHECK VALVE ASSY
B21
ACCELERATOR PEDAL POSITION SENSOR
B22
POWER LINES
B23
ACCELERATOR PEDAL POSITION SENSOR
B25
OP
BODY INTEGRATED UNIT
WP
KEYLESS ACCESS CM
ID
ID CODE BOX
B26
STARTER RELAY 1
B29
ACCELERATOR PEDAL POSITION SENSOR
B30
GROUNDS
B31
ACCELERATOR PEDAL POSITION SENSOR
B32
WP
KEYLESS ACCESS CM
B34
WP
STARTER CUT RELAY
B35
A/C RELAY

EN-11627


C: B136
ENGINE GROUND
C1
ENGINE GROUND
C2
ENGINE GROUND
C3
FRONT OXYGEN (A/F) SENSOR
C5
MAIN RELAY
C6
TUMBLE GENERATOR VALVE ACTUATOR LH
C9
EGR CONTROL VALVE
C11
EGR CONTROL VALVE
C13
EXHAUST CAMSHAFT POSITION SENSOR RH
C14
INTAKE CAMSHAFT POSITION SENSOR LH
C15
CRANKSHAFT POSITION SENSOR
C16
FRONT OXYGEN (A/F) SENSOR
C18
FRONT OXYGEN (A/F) SENSOR
C19
MANIFOLD ABSOLUTE PRESSURE SENSOR
C20
C21
REAR OXYGEN SENSOR
C23
TUMBLE GENERATOR VALVE ACTUATOR RH
C24
OIL LEVEL SWITCH
C25
EXHAUST CAMSHAFT POSITION SENSOR LH
C26
INTAKE CAMSHAFT POSITION SENSOR RH
C27
CRANKSHAFT POSITION SENSOR
C28
KNOCK SENSOR
C29
KNOCK SENSOR (SHIELD)
C30
SHIELDS
C31
EGR CONTROL VALVE
C32
EGR CONTROL VALVE
C34
EACH CAMSHAFT POSITION SENSOR (GROUND)

EN-11628


D: B137
WP : WITH PUSH BUTTON START
OP : WITHOUT PUSH BUTTON START
MAIN RELAY
D1
M/B FUSE No. 13
D2
STOP LIGHT SWITCH
D3
GROUNDS
D4
BRAKE SWITCH
D7
PRESSURE SWITCH
D8
MASS AIR FLOW &
INTAKE AIR TEMPERATURE SENSOR
D12
DELIVERY MODE FUSE
D13
INHIBITOR SWITCH
WP
D14
CLUTCH SWITCH
D15
INHIBITOR SWITCH
D16
D17
OP
INHIBITOR SWITCH
WP
KEYLESS ACCESS CM
D18
SEVERAL MODULES (MAIN-CAN)
D19
SEVERAL MODULES (MAIN-CAN)
D20
BLOWER FAN SWITCH
D22
MASS AIR FLOW &
INTAKE AIR TEMPERATURE SENSOR
D23
CRUISE CONTROL SWITCH
D24
BATTERY TEMPERATURE SENSOR
D26
A/C SWITCH
D27
F/B FUSE No. 12
D28
MASS AIR FLOW &
INTAKE AIR TEMPERATURE SENSOR (SHIELD)
D29
MASS AIR FLOW &
INTAKE AIR TEMPERATURE SENSOR
D30
CRUISE CONTROL SWITCH

EN-11629

6. Engine Condition Data

A: ELECTRICAL SPECIFICATION

Contents	Specifications
Engine load	13.6 — 40.5 (%): Idling
	14.7 — 29.8 (%): 2,500 rpm racing

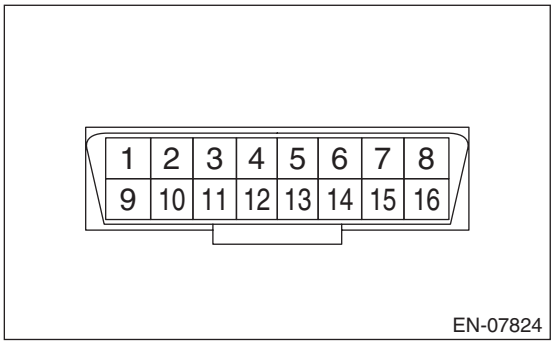
Measuring condition:
- After engine is warmed up.
- Set the select lever in “P” range or “N” range, or the shift lever in neutral.
- Turn the A/C to OFF.
- Turn all the accessory switches to OFF.

7. Data Link Connector

A: NOTE

This connector is used for Subaru Select Monitor.

CAUTION:
Do not connect any scan tools other than Subaru Select Monitor or general scan tool. Otherwise the circuit may be damaged.



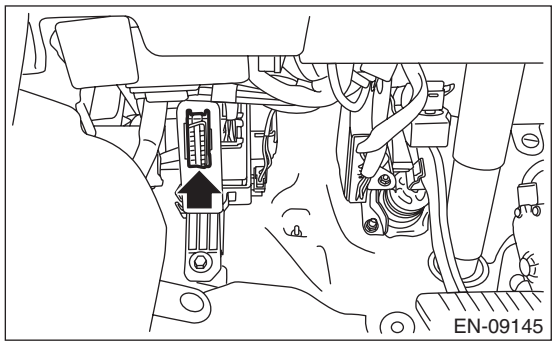
Terminal No.	Contents	Terminal No.	Contents
1	Not used	9	Not used
2	Not used	10	Not used
3	Not used	11	Not used
4	Ground	12	Not used
5	Ground	13	Not used
6	CAN communication (Hi)	14	CAN communication (Lo)
7	Subaru Select Monitor signal	15	Not used
8	Not used	16	Power supply

8. General Scan Tool

A: OPERATION

1. HOW TO USE GENERAL SCAN TOOL

1) Prepare a scan tool (general scan tool) required by SAE J1978.
2) Connect the general scan tool to data link connector located in the lower portion of the instrument panel (on the driver's side).



3) Using the general scan tool, call up each data. General scan tool functions consist of:
   (1) MODE $01: Current powertrain diagnostic data
   (2) MODE $02: Powertrain freeze frame data
   (3) MODE $03: Emission-related powertrain DTC
   (4) MODE $04: Clear/Reset emission-related diagnostic information
   (5) MODE $06: Request on-board monitoring test results for intermittently monitored systems
   (6) MODE $07: Request on-board monitoring test results for continuously monitored systems
   (7) MODE $08: Request control for on-board system, test, and component
   (8) MODE $09: Request vehicle information
4) Read out the data according to repair procedures. (For detailed operation procedure, refer to the general scan tool operation manual.)

NOTE:
For details concerning DTC, refer to "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>

2. MODE $01: (CURRENT POWERTRAIN DIAGNOSTIC DATA)

Refer to data denoting the current operating condition of analog input/output, digital input/output or the powertrain system.
A list of the support data and PID (Parameter Identification) codes are shown in the following table.

PID	Data	Unit of measure
$01	Number of emission-related powertrain DTC, and malfunction indicator light status and diagnosis support information	—
$03	Fuel system control status	—
$04	Calculated engine load value	%
$05	Engine coolant temperature	°C
$06	Short term fuel trim	%
$07	Long term fuel trim	%
$0B	Intake manifold absolute pressure	kPa
$0C	Engine speed	rpm
$0D	Vehicle speed	MPH
$0E	Ignition timing advance	°
$0F	Intake air temperature	°C
$10	Intake air amount	g/s
$11	Throttle valve opening angle	%
$13	Air fuel ratio sensor	—
$15	Oxygen sensor output voltage and short term fuel trim associated with oxygen sensor (Bank 1 Sensor 2)	V and %
$1C	Supporting OBD system	—
$1F	Elapsed time after starting the engine	sec
$21	Travel distance after the malfunction indicator light illuminates	miles
$24	A/F value and A/F sensor output voltage (Bank 1 Sensor 1)	— and V
$2C	Target EGR	%
$2D	EGR deviation	%
$2E	Evaporative purge	%
$2F	Fuel level	%
$30	Number of warm ups after DTC clear	time
$31	Travel distance after DTC clear	miles
$33	Barometric pressure	kPa
$34	A/F value and A/F sensor current (Bank 1 Sensor 1)	— and mA
$3C	Catalyst temperature #1	°C
$41	Diagnostic monitor of each drive cycle	—
$42	ECM power voltage	V
$43	Absolute load	%
$44	A/F target lambda	—
$45	Relative throttle opening angle	%
$46	Ambient temperature	°C
$47	Absolute throttle opening angle 2	%
$49	Absolute accelerator opening angle 1	%
$4A	Absolute accelerator opening angle 2	%
$4C	Target throttle opening angle	%
$4D	Engine operating time while malfunction indicator lit	min
$4E	Elapsed time after DTC clear	min
$51	Fuel used	—
$53	ELCM pressure	—
$5A	Relative accelerator opening angle	%
$5C	Engine oil temperature	°C
$65	Neutral status	—

NOTE:
Refer to general scan tool manufacturer's operation manual to access current powertrain diagnostic data (MODE $01).

3. MODE $02 (POWERTRAIN FREEZE FRAME DATA)

Refer to data denoting the operating condition when trouble is detected by on-board diagnosis system.
A list of the support data and PID (Parameter Identification) codes are shown in the following table.

PID	Data	Unit of measure
$02	DTC that caused freeze frame data to be stored	—
$03	Fuel system control status	—
$04	Calculated engine load value	%
$05	Engine coolant temperature	°C
$06	Short term fuel trim (Bank 1 Sensor 1)	%
$07	Long term fuel trim (Bank 1 Sensor 1)	%
$0B	Intake manifold absolute pressure	kPa
$0C	Engine speed	rpm
$0D	Vehicle speed	MPH
$0E	Ignition timing advance	°
$0F	Intake air temperature	°C
$10	Intake air amount	g/s
$11	Throttle valve opening angle	%
$13	Air fuel ratio sensor	—
$15	Oxygen sensor output voltage and short term fuel trim associated with oxygen sensor (Bank 1 Sensor 2)	V and %
$1C	Supporting OBD system	—
$1F	Elapsed time after starting the engine	sec
$2C	Target EGR	%
$2D	EGR deviation	%
$2E	Evaporative purge	%
$2F	Fuel level	%
$33	Barometric pressure	kPa
$42	ECM power voltage	V
$43	Absolute load	%
$44	A/F target lambda	—
$45	Relative throttle opening angle	%
$46	Ambient temperature	°C
$47	Absolute throttle opening angle 2	%
$49	Absolute accelerator opening angle 1	%
$4A	Absolute accelerator opening angle 2	%
$4C	Target throttle opening angle	%
$51	Fuel used	—
$65	Neutral status	—

NOTE:
Refer to general scan tool manufacturer's instruction manual to access freeze frame data (MODE $02).

4. MODE $03 (EMISSION-RELATED POWERTRAIN DTC)

Refer to "List of Diagnostic Trouble Code (DTC)" for information about data denoting emission-related powertrain DTC. <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>

5. MODE $04 (CLEAR/RESET EMISSION-RELATED DIAGNOSTIC INFORMATION)

Refer to the mode used to clear or reset emission-related diagnostic information.

NOTE:
Refer to general scan tool manufacturer's instruction manual to clear the emission-related diagnostic information (MODE $04).

6. MODE $06

Refer to diagnostic value of troubleshooting and data of test limit indicated on the support data bit sequence table. A list of the support data is shown in the following table.

NOTE:
Some items are not displayed according to the specifications.

OBDMID	TID	SID	Diagnostic item
$01	$84	$1E	A/F sensor range failure (Bank 1 Sensor 1)
	$85	$1E	
	$86	$20	A/F sensor response failure (Bank 1 Sensor 1)
	$91	$20	
	$92	$10	
	$A3	$20	
	$A4	$10	
	$AC	$10	
	$AD	$10	
	$AE	$10	
	$AF	$10	
	$CD	$20	
	$CF	$20	
	$DF	$10	
$02	$07	$0B	Oxygen sensor drop failure (Bank 1 Sensor 2)
	$08	$0B	
	$05	$10	Oxygen sensor response failure (Bank 1 Sensor 2)
	$06	$10	
	$BD	$10	
	$D1	$10	Oxygen sensor delay failure (Bank 1 Sensor 2)
	$D2	$01	
$21	$89	$20	Catalyst deterioration diagnosis (Bank 1)
$31	$8A	$FD	EGR system diagnosis
$35	$8B	$9D	VVT monitor (Bank 1)
	$8C	$9D	
	$8D	$9D	
	$8E	$9D	
	$D3	$9D	
	$D5	$9D	
	$D6	$9D	
$36	$8B	$9D	VVT monitor (Bank 2)
	$8C	$9D	
	$8D	$9D	
	$8E	$9D	
	$D3	$9D	
	$D5	$9D	
	$D6	$9D	

OBDMID	TID	SID	Diagnostic item
$3C	$96	$FE	Evaporative emission control system (0.02 inch leak)
	$C1	$FE	
	$C2	$FE	
	$C3	$FE	
	$C4	$FE	
	$C5	$FE	
	$C6	$35	
	$C7	$FE	
	$C8	$FE	
	$C9	$FE	
	$CA	$FE	
$3D	$98	$FE	Evaporative emission control system (purge flow)
	$E2	$FE	ELCM purge flow
$41	$9B	$14	A/F sensor heater characteristics failure (Bank 1 Sensor 1)
$42	$A2	$24	Oxygen sensor heater characteristics failure (Bank 1 Sensor 2)
$A1	$0B	$24	Misfire monitoring (all cylinders)
	$0C	$24	
$A2	$0B	$24	Misfire monitoring (#1 cylinder)
	$0C	$24	
$A3	$0B	$24	Misfire monitoring (#2 cylinder)
	$0C	$24	
$A4	$0B	$24	Misfire monitoring (#3 cylinder)
	$0C	$24	
$A5	$0B	$24	Misfire monitoring (#4 cylinder)
	$0C	$24	

7. MODE $07

Refer to the data of DTC (pending code) for troubleshooting result about emission in the first time.

8. MODE $09

Perform “Active Test” of the on-board system.

9. MODE $09

Refer to the data of the vehicle specification.

9. Subaru Select Monitor

A: OPERATION

1. HOW TO USE SUBARU SELECT MONITOR

NOTE:
For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.

2. DISPLAY ENGINE CURRENT DATA

NOTE:
- For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.
- A list of the support data is shown in the following table.
- *: For models without cruise control, the brake switch signal does not change.

Display	Contents	Note (at idling)	Remarks
Engine Speed	Calculated from crankshaft position sensor signal.	700 rpm (Agree with the tachometer indication)	rpm
Mass Air Flow	Intake air temperature calculated from intake air temperature sensor output value.	2.5 g/s or 0.33 lb/m	g/s or lb/m
Vehicle speed	Value calculated from vehicle speed sensor output value.	0 km/h	km/h
Throttle Opening Angle	Throttle valve opening angle (in percentage) calculated from throttle position sensor output value.	13.0%	%
Accel opening angle	Accelerator pedal opening angle (in percentage) calculated from accelerator pedal position sensor output value.	0.0%	%
A/F Sensor #1	Actual lambda value calculated from front A/F sensor output value on the RH bank. (Bank 1)	1.0	—
Ignition timing adv. #1	Ignition timing control value for No. 1 cylinder. Calculated from rotation speed, intake manifold pressure, intake air temperature, water temperature, and data from knock sensor etc.	16.0°	°
Coolant Temperature	Value calculated from engine coolant temperature sensor output value.	85°C or 185°F or more (after warm-up)	°C or °F
Fuel Injection #1 Pulse	Control value of fuel injection time by ECM. (Bank 1)	2.82 ms	ms
Short term fuel trim B1	Air fuel ratio correction control value for the RH bank front side.	–0.8%	%
Long term fuel trim B1	Air fuel ratio learning control value for the RH bank front side.	0.0%	%
Learned Ignition Timing	Ignition timing learning value. Advance or retard angle amount when knocking occurs.	0 deg	deg
Mani. Absolute Pressure	Value after subtracting atmospheric pressure from intake manifold absolute pressure. [(Intake manifold absolute pressure) – (atmospheric pressure)]	200 — 300 mmHg, 26.7 — 40 kPa, 7.8 — 11.8 inHg or 3.8 — 5.8 psig	kPa, mmHg, inHg or psig
Oxygen sensor #12	Rear oxygen sensor output voltage value on the RH side.	0.7 V	V
VVT Adv. Ang. Amount R	Intake AVCS advance angle amount. (Bank 1)	0 deg	deg
VVT Adv. Ang. Amount L	Intake AVCS advance angle amount. (Bank 2)	0 deg	deg
Exh. VVT Retard Ang. R	AVCS actual retard angle amount for the RH bank on the exhaust side.	±5 deg	deg
Exh. VVT Retard Ang. L	AVCS actual retard angle amount for the RH bank on the exhaust side.	±5 deg	deg
VVT Initial Position Learning Value #1	AVCS initial position learning value for the RH bank on the intake side. Controls the angle against a standard angle. Deviation learning is performed based on this standard value.	29.9°CA	°CA

Display	Contents	Note (at idling)	Remarks
VVT Initial Position Learning Value #2	AVCS initial position learning value for the LH bank on the intake side. Controls the angle against a standard angle. Deviation learning is performed based on this standard value.	27.7°CA	°CA
VVT Ex Initial Position Learning Value #1	AVCS initial position learning value for the RH bank on the intake side. Controls the angle against a standard angle. Deviation learning is performed based on this standard value.	0	°CA
VVT Ex Initial Position Learning Value #2	AVCS initial position learning value for the RH bank on the intake side. AVCS initial position learning value for the RH bank on the intake side. Controls the angle against a standard angle. Deviation learning is performed based on this standard value.	0	°CA
ECU ACC	ECM input power supply voltage.	13.789 V	V
Target engine speed	TCM target engine speed.	675 rpm	rpm
Target Equivalence Ratio	Target air fuel ratio. (Lambda) It usually becomes 1.0 aiming at a theoretical air fuel ratio.	0.976	—
Oil Temperature	Value calculated from the VVL system engine oil temperature and the oil temperature sensor output.	≥ 85°C (after warm-up)	°C or °F
Intake Air Temp.	Intake air temperature calculated from the intake air temperature sensor output value.	36°C	°C or °F
Ambient Temperature	Ambient temperature that ECM estimates by input values from the engine coolant temperature sensor or the intake air temperature sensor etc.	Ambient Temp for A/C	°C or °F
Ambient Temperature Sensor Signal	Data value of the ambient sensor input from the combination meter via CAN. Ambient temperature used for diagnosis.	—	°C or °F
Calculated load value	Current rate of air amount. Value assuming that the air amount at the current engine speed with the throttle fully open is 100%.	17.0	%
Absolute Load Value	Percentage of current intake air amount against the maximum air intake amount of the engine. For non-turbo engine, the value can be close to 95%, but will never be 100%. For turbo engine, this value may be close to 300% due to a boost pressure.	17	%
Atmospheric pressure	Atmospheric pressure calculated from atmospheric pressure sensor output value.	(Atmospheric pressure)	kPa, mmHg, inHg or psig
Mani. Relative Pressure	Pressure value calculated from manifold pressure sensor output value. (Absolute value) (Air intake absolute pressure – Atmospheric pressure)	(Air intake absolute pressure – Atmospheric pressure)	kPa, mmHg, inHg or psig
Target Throttle Opening Angle	Target throttle opening angle calculated by ECM.	16 deg	deg
Actual Throttle Opening Angle	Actual throttle opening angle. Calculated by ECM based on the throttle sensor input value.	16 deg	deg
Target Throttle Opening Angle	Control value of the target throttle opening angle calculated by ECM. Shows the target value of opening angle in percentage when 0% means fully closed and 100% means fully open.	0.0%	%
Relative Throttle Pos.	Current throttle opening angle in percentage against the throttle voltage (full range) that has reflected the full close point learning value. The value will be approx. 70% at full open.	2	%

Display	Contents	Note (at idling)	Remarks
Throttle Motor Voltage	Power supply voltage of the throttle motor. ECM input value.	(Battery voltage)	V
Main-Throttle Sensor	Voltage value of the main throttle position sensor. ECM input value.	0.66 V	V
Sub-Throttle Sensor	Voltage value of the sub throttle position sensor. ECM input value.	1.52 V	V
Throttle Motor Duty	Throttle motor control duty ratio. ECM output value.	–15%	%
Main-Accelerator Sensor	Voltage value of the main throttle position sensor. ECM input value.	0.68 V	V
Sub-Accelerator Sensor	Voltage value of the main accelerator pedal position sensor. ECM input value.	0.68 V	V
Air Flow Sensor Voltage	Air flow sensor output value. Input value to ECM.	1.26 V	V
Fuel Level	Fuel level sensor output value. ECM input value. Total value of main and sub.	—	%
Fuel level resistance	Fuel level sensor resistance value. ECM input value.	—	Ω
Evap Purge	Evaporative purge rate displayed by the OBD.	0%	%
CPC Valve Duty Ratio	Purge control solenoid valve control duty ratio. ECM output value.	0 — 3%	%
ALT Duty	Electric power generation voltage is calculated by the ECM. Indicator voltage value from ECM to alternator is under a DUTY control.	0 — 100%	%
Alternator control mode	Control mode of the electric power generation voltage by the alternator. Low: Mode focusing on fuel economy Mid: Mode focusing on fuel economy when the battery is charged and the current is being discharged (electric load is turned on) High: Normal mode ExHigh: Depending on the models, Exhigh mode is selected during deceleration. This mode focuses more on fuel economy.	High/Mid/Low	—
Battery current value	Charge/discharge current value of the battery input from the battery sensor. When the value is positive: The current flows to a direction that the battery is charged. When the value is negative: The current flows to a direction that the battery is discharged.	–2 — 5 A	A
Battery Temperature	Estimated value of battery temperature which is output from the battery temperature sensor and is input in communicating with ECM.	20 — 50°C or 68 — 112°F	°C or °F
Knocking Correction	Retard angle amount when knocking occurs. Partially learning value of ignition timing learning value.	0.0 deg	deg
Fuel system for Bank 1	Feedback status of air fuel ratio for the RH bank. Open: Feedback is stopped Closed: Feedback control is being performed	Cl_normal	—
A/F Sensor #1 Current	Front A/F sensor output current value on the RH bank. ECM input value.	–0.2 — 0.2 mA	mA
A/F Sensor #1 Resistance	Front A/F sensor resistance value calculated from the front A/F sensor output value on the RH bank.	32 Ω	Ω
A/F Correction #3	Sub correction value of A/F feedback control	0.3%	%

Display	Contents	Note (at idling)	Remarks
No. of EGR steps	Number of EGR valve steps. Number of stepping motor steps. ECM output value.	0 STEP	STEP
Commanded EGR	EGR setting value is calculated by ECM and the target value is displayed.	—	%
EGR Error	Displays a difference (%) between the target EGR steps and the actual EGR steps. When the value is positive, it opens more than the target value. When the value is negative, it does not reach to the target value.	—	%
TGV Position SW1	Shows an open/close status of the TGV opening angle SW for RH bank. Input value from the TGV opening angle SW for RH bank to the ECM.	Close	—
TGV Position SW2	Shows an open/close status of the TGV opening angle SW for RH bank. Input value from the TGV opening angle SW for LH bank to the ECM.	Close	—
TGV Output	Drive signal to TGV motor. Set to “ON” when the TGV is activated (when the duty output is other than 0%). ECM output value.	—	OFF
TGV Drive	Display of TGV drive status. Set to “Open” when the TGV is open. ECM control status.	—	Close
OCV Duty R	OCV control duty ratio. (Bank 1) ECM output value.	40 — 60% (except for Euro 4 (2.0 L model)) 45 — 55% (Euro 4 (2.0 L model))	%
OCV Duty L	OCV control duty ratio. (Bank 2) ECM output value.	40 — 60% (except for Euro 4 (2.0 L model)) 45 — 55% (Euro 4 (2.0 L model))	%
OCV Current R	OCV actual current value. (Bank 1) ECM input value.	550 — 850 mA (except for Euro 4 (2.0 L model)) 650 — 800 mA (Euro 4 (2.0 L model))	mA
OCV Current L	OCV actual current value. (Bank 2) ECM input value.	550 — 850 mA (except for Euro 4 (2.0 L model)) 650 — 800 mA (Euro 4 (2.0 L model))	mA
Exh. OCV Duty R	Exhaust side OCV control duty ratio on the RH bank. ECM output value.	45 — 55%	%
Exh. OCV Duty L	Exhaust side OCV control duty ratio on the LH bank. ECM output value.	45 — 55%	%
Exh. OCV Current R	Actual current value of the exhaust side OCV on the RH bank, and engine input value.	650 — 800 mA	mA
Exh. OCV Current L	Actual current value of the exhaust side OCV on the LH bank, and engine input value.	650 — 800 mA	mA
Roughness Monitor #1	#1 cylinder roughness monitor count value.	0	—
Roughness Monitor #2	#2 cylinder roughness monitor count value.	0	—
Roughness Monitor #3	#3 cylinder roughness monitor count value.	0	—
Roughness Monitor #4	#4 cylinder roughness monitor count value.	0	—

Display	Contents	Note (at idling)	Remarks
Ignition SW ON Count	Time stamp information. Number of times the ignition is ON since the vehicle was manufactured. The number of ignition ON is also recorded when a trouble code is recorded, so the comparison with that number will show you how many times the ignition has turned on since the diagnostic code was recorded.	—	times
Count	Time stamp information. Each unit individually counts the elapsed time since the ignition is turned ON. Master integrated unit and ECM synchronize with the master time. When synchronized: “Common” When not synchronized: “Originally” is displayed.	Common	—
Time Count	Time stamp information. Elapsed time after ignition ON. When a trouble code is recorded, the elapsed time after ignition ON is also recorded.	—	ms
Time Since Engine Start	Elapsed time after starting the engine. Displays the elapsed time after engine start based on the OBD regulations.	—	sec
Meter since DTC cleared	Travel distance after DTC clear.	—	km
Time while MIL lighted	Engine operating time from when the malfunction indicator light illuminated till when it went off.	—	min
Time since DTC cleared	Elapsed time after DTC clear.	—	min
Number of warm-ups	Number of warm ups after DTC clear. Shows the number of cycle, considering that 1 cycle is the time from when starting and warming the engine till when stopping the engine.	—	times
Lighted MI lamp history	Travel distance after the warning light illuminated.	—	km
Odometer	ECM calculates the total cumulative travel distance from the vehicle speed, separately from the odometer in the combination meter. Small difference from the odometer will be possible, but if there is a big difference, ECM or the combination meter may need to be replaced.	—	km
Memorized Cruise Speed	Cruise control system target vehicle speed. (Set speed)	0 km/h or 0 MPH	km/h or MPH
Catalyst Temperature #11	Estimated temperature of the front catalytic converter for RH bank.	—	°C
Type of fuel	Fuel information recorded in the ECM. Not the fuel information currently used.	GAS	—
AT drive status	Neutral condition. Information input from the inhibitor SW.	NEUT	—
Absolute Evap System Vapor Pressure	Measured value of the evaporative emission system pressure. Pressure sensor input value.	101.43	kPa
Neutral switch	Neutral switch signal. P or N range signal for AT. Value input to ECM.	Neutral	—
ETC Motor Relay	Drive signal to the electronic throttle motor relay. Set to ON when drive signal is output. ECM output value.	ON	—
Stop light SW	Stop light switch signal. Set to ON when the stop light illuminates. ECM input value.	OFF (when OFF)	—

Display	Contents	Note (at idling)	Remarks
Brake Switch*	Brake switch signal. Set to ON when the brake pedal is depressed. ECM input value.	OFF (when OFF)	—
Idle Switch Signal	Idle signal. Set to “Idle” while idling.	Idle	—
Ignition switch	Ignition switch signal. Set to ON when the ignition switch is ON.	ON	—
A/C Mid Pressure Switch	Air conditioner middle pressure switch signal. Set to “ON” when the switch is ON. ECM input value.	OFF (when OFF)	—
A/C Compressor Signal	A/C compressor drive signal. Set to “ON” when the drive signal is output. ECM output value.	OFF (when OFF)	—
Radiator Fan Relay #1	Radiator fan relay drive signal. Set to ON when the drive signal is output. ECM output value.	OFF (when OFF)	—
Radiator Fan Relay #2	Radiator fan relay drive signal. Set to ON when the drive signal is output. ECM output value.	OFF (when OFF)	—
A/C Switch	Air conditioner switch signal. Set to ON when the air conditioner switch of the heater control is ON. ECM input value.	OFF (when OFF)	—
Starter SW	Starter switch signal. Set to ON when the starter is ON. ECM input value.	OFF	—
Rear Defogger SW	Rear defogger switch input signal. Set to “ON” when the switch is ON. ECM input value.	OFF (when OFF)	—
Blower Fan SW	Blower fan switch input signal. Set to “ON” when the switch is ON. ECM input value.	OFF (when OFF)	—
Light Switch	Light switch input signal. Set to “ON” when the switch is ON. ECM input value.	OFF (when OFF)	—
Front Fog Light Switch	Front fog light switch input signal. Set to “ON” when the switch is ON. ECM input value.	OFF (when OFF)	—
Wiper Switch	Wiper switch input signal. Set to “ON” when the switch is ON. ECM input value.	OFF (when OFF)	—
Delivery Mode Connector (Test Mode Connector)	Delivery mode terminal fuse installation status. ECM displays delivery mode status.	OFF	—
Rear O2 Rich Signal	Rear oxygen sensor output value. Displays “Rich” when the air fuel ratio of rear oxygen sensor is rich, and displays “Lean” when lean.	ON/OFF	—
Knocking Signal	Knock sensor output signal. Judges if a knocking occurs or not.	OFF	—
Crankshaft Position Sig.	Crankshaft position sensor output signal. Set to “ON” when the engine is running, ECM input signal.	ON	—
Camshaft Position Sig.	Camshaft position sensor output signal. Set to “ON” when the engine is running. ECM input signal.	ON	—

Display	Contents	Note (at idling)	Remarks
Ban of Torque Down	Torque down prohibition notification signal to the vehicle dynamics control (VDC) module. Set to “OFF” when the prohibition signal is output. ECM output value.	ON	—
Request Torque Down VDC	Torque down request signal transmitted from the vehicle dynamics control (VDC) module. Set to “ON” when the request signal is sent. Vehicle dynamics control (VDC) ECM input signal.	OFF	—
Torque Permission Signal	Torque down permission notification signal to the transmission control module. Set to “ON” when the permission signal is output. ECM output value.	ON (OFF on MT vehicles)	—
SET/COAST SW	Cruise control system SET/COAST SW signal. Set to ON when the switch is operated. ECM input signal.	OFF (when OFF)	—
RESUME/ACCEL SW	Cruise control system RESUME/ACCEL SW signal. Set to ON when the switch is operated. ECM input signal.	OFF (when OFF)	—
Main switch	Cruise control system main switch signal. Set to ON when the switch is operated. ECM input signal.	OFF (when OFF)	—
Distance Change Switch Signal	ON/OFF status of the following distance setting switch used by ADA cruise control is displayed. (Model with EyeSight)	OFF (when OFF)	—
Cruise Control Cancel Switch Signal	Cruise control cancel switch signal of the cruise control system. Set to ON when the switch is operated. ECM input signal.	OFF (when OFF)	—
Fuel Pump Relay	Fuel pump relay drive signal. Set to “ON” when the drive signal is output. ECM output value.	ON	—
All Cylinders Fuel cut	Status under the fuel injection amount control where the fuel injection is cut off in all cylinders.	OFF	—
Shift Pattern Demand for Low Water Temperature	Shift pattern request sent from ECM to the transmission CM. When the water temperature is low, shift pattern change to the low speed side is requested to raise the catalyst temperature faster.	OFF	—
Oil level switch	Oil level switch signal. Set to “LOW level” when the amount of engine oil decreases. ECM input signal.	HIGH level	—
ELCM switching valve	ELCM switching valve drive signal. Set to “Close” when closing the switching valve. ECM output value.	Open	—
ELCM pump	ELCM pump drive signal. Set to “ON” when ELCM decompression pump is activated. ECM output value.	OFF	—
MI(MIL)	Malfunction indicator light illumination status. When judged as abnormal, an illumination command signal is sent from ECM to the combination meter.	OFF	—
Number of Diag. Code:	The number of trouble codes recorded in the ECM.	0	—
(Oxygen sensor #11)	Installation status of the front oxygen sensor for RH bank.	Support	—
(Oxygen sensor #12)	Installation status of the rear oxygen sensor for RH bank.	Support	—
Short term fuel trim #12	Air fuel ratio correction control value for the RH bank rear side.	0.0%	%

Display	Contents	Note (at idling)	Remarks
A/F Sensor #11	Air fuel ratio calculated from the output value of RH bank front A/F sensor. (Lambda)	1.001	—
A/F Sensor #11	Output voltage of the RH bank front A/F sensor.	2.2 V	V
A/F Sensor #11	Air fuel ratio calculated from the output value of RH bank front A/F sensor. (Lambda)	1.001	—
A/F Sensor #11	Front A/F sensor output current on the RH bank.	0.00	mA
Absolute Throttle Pos.#2	Shows the sub throttle sensor voltage value in % against the full-range 5 V throttle sensor output voltage.	32%	%
Accelerator Pedal Pos.#1	Shows the main accelerator sensor voltage value in % against the full-range 5 V.	13%	%
Accelerator Pedal Pos.#2	Shows the sub accelerator sensor voltage value in % against the full-range 5 V.	13%	%
Relative Accelerator Pos.	Accelerator opening angle with a full close point learning value taken into consideration.	0%	%
Misfire monitoring(Supp)	Shows the support status of whether misfire diagnosis is executed or not.	YES	—
Misfire monitoring(Rdy)	Status of the misfire diagnosis. YES or N/A: Diagnosis is completed or not supported. NO: Diagnosis is not completed.	YES	—
Fuel system monitoring(Supp)	Shows the support status of whether fuel system diagnosis is executed or not.	YES	—
Fuel system monitoring(Rdy)	Status of the fuel system diagnosis. YES or N/A: Diagnosis is completed or not supported. NO: Diagnosis is not completed.	YES	—
Component monitoring(Supp)	Shows the support status of component diagnosis.	YES	—
Component monitoring(Rdy)	Status of the component diagnosis. YES or N/A: Diagnosis is completed or not supported. NO: Diagnosis is not completed.	YES	—
Catalyst Diagnosis(Supp)	Shows the support status of catalyst diagnosis.	YES	—
Catalyst Diagnosis(Rdy)	Status of the catalyst diagnosis. YES or N/A: Diagnosis is completed or not supported. NO: Diagnosis is not completed.	NO	—
Heated catalyst(Supp)	Shows the support status of heated catalyst diagnosis.	NO	—
Heated catalyst(Rdy)	Status of the heated catalyst diagnosis. YES or N/A: Diagnosis is completed or not supported. NO: Diagnosis is not completed.	N/A	—
Evaporative purge system(Supp)	Shows the support status of evaporative purge system diagnosis.	NO	—
Evaporative purge system(Rdy)	Status of the evaporative purge system diagnosis. YES or N/A: Diagnosis is completed or not supported. NO: Diagnosis is not completed.	N/A	—
Secondary air system(Supp)	Shows the support status of the secondary air system diagnosis.	NO	—
Secondary air system(Rdy)	Status of the secondary air system diagnosis. YES or N/A: Diagnosis is completed or not supported. NO: Diagnosis is not completed.	N/A	—
A/C system refrigerant(Supp)	Shows the support status of A/C system refrigerant diagnosis.	NO	—
A/C system refrigerant(Rdy)	Status of the A/C system refrigerant diagnosis. YES or N/A: Diagnosis is completed or not supported. NO: Diagnosis is not completed.	N/A	—
Oxygen sensor(Supp)	Shows the support status of oxygen sensor diagnosis.	YES	—

Display	Contents	Note (at idling)	Remarks
Oxygen sensor(Rdy)	Status of the oxygen sensor diagnosis. YES or N/A: Diagnosis is completed or not supported. NO: Diagnosis is not completed.	NO	—
O2 Heater Diagnosis(Supp)	Shows the support status of oxygen sensor heater diagnosis.	YES	—
O2 Heater Diagnosis(Rdy)	Status of the oxygen sensor heater diagnosis. YES or N/A: Diagnosis is completed or not supported. NO: Diagnosis is not completed.	NO	—
EGR system(Supp)	Shows the support status of EGR diagnosis.	YES	—
EGR system(Rdy)	Status of the EGR diagnosis. YES or N/A: Diagnosis is completed or not supported. NO: Diagnosis is not completed.	NO	—
Misfire monitoring(Enable)	Shows whether or not the execution condition of misfire diagnosis is met. YES: Diagnosis can be executed. NO or N/A: Diagnosis cannot be executed or is not supported.	YES	—
Misfire monitoring(Comp)	Shows whether or not the continuous misfire diagnosis is completed. YES or N/A: Diagnosis is completed or not supported. NO: Diagnosis is not completed.	NO	—
Fuel system monitoring(Enable)	Shows whether or not the execution condition of fuel system diagnosis is met. YES: Diagnosis can be executed. NO or N/A: Diagnosis cannot be executed or is not supported.	YES	—
Fuel system monitoring(Comp)	Shows whether or not the fuel system diagnosis is completed. YES or N/A: Diagnosis is completed or not supported. NO: Diagnosis is not completed.	NO	—
Component monitoring(Enable)	Shows whether or not the execution condition of component diagnosis is met. YES: Diagnosis can be executed. NO or N/A: Diagnosis cannot be executed or is not supported.	YES	—
Component monitoring(Comp)	Shows whether or not the component diagnosis is completed. YES or N/A: Diagnosis is completed or not supported. NO: Diagnosis is not completed.	NO	—
Catalyst Diagnosis(Enable)	Shows whether or not the execution condition of catalyst diagnosis is met. YES: Diagnosis can be executed. NO or N/A: Diagnosis cannot be executed or is not supported.	YES	—
Catalyst Diagnosis(Comp)	Shows whether or not the catalyst diagnosis is completed. YES or N/A: Diagnosis is completed or not supported. NO: Diagnosis is not completed.	NO	—
Heated catalyst(Enable)	Shows whether or not the execution condition of heated catalyst diagnosis is met. YES: Diagnosis can be executed. NO or N/A: Diagnosis cannot be executed or is not supported.	N/A	—
Heated catalyst(Comp)	Shows whether or not the heated catalyst diagnosis is completed. YES or N/A: Diagnosis is completed or not supported. NO: Diagnosis is not completed.	N/A	—

Display	Contents	Note (at idling)	Remarks
Evaporative purge system(Enable)	Shows whether or not the execution condition of evaporative purge system diagnosis is met. YES: Diagnosis can be executed. NO or N/A: Diagnosis cannot be executed or is not supported.	N/A	—
Evaporative purge system(Comp)	Shows whether or not the evaporative purge system diagnosis is completed. YES or N/A: Diagnosis is completed or not supported. NO: Diagnosis is not completed.	N/A	—
Secondary air system(Enable)	Shows whether or not the execution condition of the secondary air system diagnosis is met. YES: Diagnosis can be executed. NO or N/A: Diagnosis cannot be executed or is not supported.	N/A	—
Secondary air system(Comp)	Shows whether or not the secondary air system diagnosis is completed. YES or N/A: Diagnosis is completed or not supported. NO: Diagnosis is not completed.	N/A	—
A/C system refrigerant(Enable)	Shows whether or not the execution condition of A/C system refrigerant diagnosis is met. YES: Diagnosis can be executed. NO or N/A: Diagnosis cannot be executed or is not supported.	N/A	—
A/C system refrigerant(Comp)	Shows whether or not the A/C system refrigerant diagnosis is completed. YES or N/A: Diagnosis is completed or not supported. NO: Diagnosis is not completed.	N/A	—
Oxygen sensor(Enable)	Shows whether or not the execution condition of oxygen sensor diagnosis is met. YES: Diagnosis can be executed. NO or N/A: Diagnosis cannot be executed or is not supported.	YES	—
Oxygen sensor(Comp)	Shows whether or not the oxygen sensor diagnosis is completed. YES or N/A: Diagnosis is completed or not supported. NO: Diagnosis is not completed.	NO	—
O2 Heater Diagnosis(Enable)	Shows whether or not the execution condition of oxygen heater diagnosis is met. YES: Diagnosis can be executed. NO or N/A: Diagnosis cannot be executed or is not supported.	YES	—
O2 Heater Diagnosis(Comp)	Shows whether or not the oxygen heater diagnosis is completed. YES or N/A: Diagnosis is completed or not supported. NO: Diagnosis is not completed.	NO	—
EGR system(Enable)	Shows whether or not the execution condition of EGR diagnosis is met. YES: Diagnosis can be executed. NO or N/A: Diagnosis cannot be executed or is not supported.	YES	—
EGR system(Comp)	Shows whether or not the EGR diagnosis is completed. YES or N/A: Diagnosis is completed or not supported. NO: Diagnosis is not completed.	NO	—
OBD System	Shows the OBD regulation to be followed. This is the information recorded in the ECM, and it does not mean that the unit automatically judges the compliance to the OBD regulations.	EOBD	—

3. READ FREEZE FRAME DATA FOR ENGINE (OBD MODE)

NOTE:
- For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.
- A list of the support data is shown in the following table.

Display	Contents	Remarks
Engine Speed	Calculated from crankshaft position sensor signal.	rpm
Mass Air Flow	Amount of intake air calculated from air flow sensor output value.	g/s or lb/m
Vehicle speed	Value calculated from vehicle speed sensor output value.	km/h or MPH
Throttle Opening Angle	Throttle opening angle in percentage. Calculated from throttle position sensor output value.	%
Ignition timing adv. #1	Ignition timing control value for No. 1 cylinder. Calculated from rotation speed, intake manifold pressure, intake air temperature, water temperature, and data from knock sensor etc.	°
Coolant Temperature	Value calculated from engine coolant temperature sensor output value.	°C or °F
Short term fuel trim B1	Air fuel ratio correction control value for the RH bank front side.	%
Long term fuel trim B1	Air fuel ratio learning control value for the RH bank front side.	%
Mani. Absolute Pressure	Value after subtracting atmospheric pressure from intake manifold absolute pressure. [(Intake manifold absolute pressure) – (atmospheric pressure)]	kPa, mmHg, inHg or psig
Oxygen sensor #12	Rear oxygen sensor output voltage value on the RH side.	V
ECU ACC	ECM input power supply voltage.	V
Target Equivalence Ratio	Target air fuel ratio. (Lambda) It usually becomes 1.0 aiming at a theoretical air fuel ratio.	—
Intake Air Temp.	Intake air temperature calculated from the intake air temperature sensor output value.	°C or °F
Ambient Temperature	Ambient temperature that ECM estimates by input values from the engine coolant temperature sensor or the intake air temperature sensor etc.	°C or °F
Ambient Temperature Sensor Signal	Data value of the ambient sensor input from the combination meter via CAN. Ambient temperature used for diagnosis.	°C or °F
Calculated load value	Current rate of air amount. Value assuming that the air amount at the current engine speed with the throttle fully open is 100%.	%
Absolute Load Value	Percentage of current intake air amount against the maximum air intake amount of the engine. For non-turbo engine, the value can be close to 95%, but will never be 100%. For turbo engine, this value may be close to 300% due to a boost pressure.	%
Atmospheric pressure	Atmospheric pressure calculated from atmospheric pressure sensor output value.	kPa, mmHg, inHg or psig
Actual Throttle Opening Angle	Actual throttle opening angle. Calculated by ECM based on the throttle sensor input value.	deg
Target Throttle Opening Angle	Control value of the target throttle opening angle calculated by ECM. Shows the target value of opening angle in percentage when 0% means fully closed and 100% means fully open.	%
Relative Throttle Pos.	Current throttle opening angle in percentage against the throttle voltage (full range) that has reflected the full close point learning value. The value will be approx. 70% at full open.	%
Fuel Level	Fuel level sensor output value. ECM input value. Total value of main and sub.	%
Evap Purge	Evaporative purge rate displayed by the OBD.	%

Display	Contents	Remarks
Fuel system for Bank 1	Feedback status of air fuel ratio for the RH bank. Open: Feedback is stopped Closed: Feedback control is being performed	—
Commanded EGR	EGR setting value is calculated by ECM and the target value is displayed.	%
EGR Error	Displays a difference (%) between the target EGR steps and the actual EGR steps. When the value is positive, it opens more than the target value. When the value is negative, it does not reach to the target value.	%
Ignition SW ON Count	Time stamp information. Number of times the ignition is ON since the vehicle was manufactured. The number of ignition ON is also recorded when a trouble code is recorded, so the comparison with that number will show you how many times the ignition has turned on since the diagnostic code was recorded.	times
Count	Time stamp information. Each unit individually counts the elapsed time since the ignition is turned ON. Master integrated unit and ECM synchronize with the master time. When synchronized: “Common” When not synchronized: “Originally” is displayed.	—
Time Count	Time stamp information. Elapsed time after ignition ON. When a trouble code is recorded, the elapsed time after ignition ON is also recorded.	ms
Time Since Engine Start	Elapsed time after starting the engine. Displays the elapsed time after engine start based on the OBD regulations.	sec
Type of fuel	Fuel information recorded in the ECM. Not the fuel information currently used.	—
AT drive status	Neutral condition. Information input from the inhibitor SW.	—
(Oxygen sensor #11)	Installation status of the front oxygen sensor for RH bank.	—
(Oxygen sensor #12)	Installation status of the rear oxygen sensor for RH bank.	—
Short term fuel trim #12	Air fuel ratio correction control value for the RH bank rear side.	%
Absolute Throttle Pos.#2	Shows the sub throttle sensor voltage value in % against the full-range 5 V throttle sensor output voltage.	%
Accelerator Pedal Pos.#1	Shows the main accelerator sensor voltage value in % against the full-range 5 V.	%
Accelerator Pedal Pos.#2	Shows the sub accelerator sensor voltage value in % against the full-range 5 V.	%
OBD System	Shows the OBD regulation to be followed. This is the information recorded in the ECM, and it does not mean that the unit automatically judges the compliance to the OBD regulations.	—

4. V.I.N REGISTRATION

1) On «Main Menu» display, select {Each System Check}.
2) On «System Selection Menu» display, select {Engine Control System}.
3) Click the [OK] button after the information of engine type has been displayed.
4) On the «Engine Diagnosis» display, select {Entry VIN}.
5) Perform the procedures shown on the display screen.

10. Read Diagnostic Trouble Code (DTC)

A: OPERATION

1. SUBARU SELECT MONITOR

NOTE:
• For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.
• For details concerning DTC, refer to “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>

2. GENERAL SCAN TOOL

Refer to data denoting emission-related powertrain DTC. For details concerning DTC, refer to “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>

NOTE:
Refer to general scan tool manufacturer’s instruction manual to access powertrain DTC (MODE $03).

11.Inspection Mode

A: PROCEDURE

Perform the diagnosis shown in the following DTC table.
When performing the diagnosis not listed in “List of Diagnostic Trouble Code (DTC)”, refer to the item on the drive cycle. <Ref. to EN(H4DO w/o HEV)(diag)-55, Drive Cycle.>

DTC	Item	Condition
B1570	Antenna	—
B1571	Reference Code Incompatibility	—
B1572	IMM Circuit Failure (Except Antenna Circuit)	—
B1574	Key Communication Failure	—
B1575	Incorrect Immobilizer Key	—
B1576	EGI Control Module EEPROM	—
B1577	IMM Control Module EEPROM	—
B1578	Meter Failure	—
P0010	"A" Camshaft Position Actuator Circuit/Open (Bank 1)	—
P0013	B Camshaft Position Actuator Circuit/Open (Bank 1)	—
P0020	"A" Camshaft Position Actuator Circuit/Open (Bank 2)	—
P0023	B Camshaft Position Actuator Circuit/Open (Bank 2)	—
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)	—
P0032	HO2S Heater Control Circuit High (Bank 1 Sensor 1)	—
P0037	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)	—
P0038	HO2S Heater Control Circuit High (Bank 1 Sensor 2)	—
P0072	Ambient Temperature Sensor Circuit "A" Low	—
P0073	Ambient Temperature Sensor Circuit "A" High	—
P0102	Mass or Volume Air Flow Circuit Low Input	—
P0103	Mass or Volume Air Flow Circuit High Input	—
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	—
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	—
P0112	Intake Air Temperature Sensor 1 Circuit Low	—
P0113	Intake Air Temperature Sensor 1 Circuit High	—
P0117	Engine Coolant Temperature Circuit Low	—
P0118	Engine Coolant Temperature Circuit High	—
P0122	Throttle/Pedal Position Sensor/Switch “A” Circuit Low	—
P0123	Throttle/Pedal Position Sensor/Switch “A” Circuit High	—
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	—
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	—
P0197	Engine Oil Temperature Sensor Low	—
P0198	Engine Oil Temperature Sensor High	—
P0201	Injector #1	—
P0202	Injector #2	—
P0203	Injector #3	—
P0204	Injector #4	—
P0222	Throttle/Pedal Position Sensor/Switch “B” Circuit Low	—
P0223	Throttle/Pedal Position Sensor/Switch “B” Circuit High	—
P0327	Knock Sensor 1 Circuit Low (Bank 1 or Single Sensor)	—
P0328	Knock Sensor 1 Circuit High (Bank 1 or Single Sensor)	—
P0335	Crankshaft Position Sensor “A” Circuit	—
P0336	Crankshaft Position Sensor “A” Circuit Range/Performance	—
P0340	Camshaft Position Sensor “A” Circuit (Bank 1 or Single Sensor)	—
P0341	Camshaft Position Sensor "A" Circuit Range/Performance (Bank 1 or Single Sensor)	—

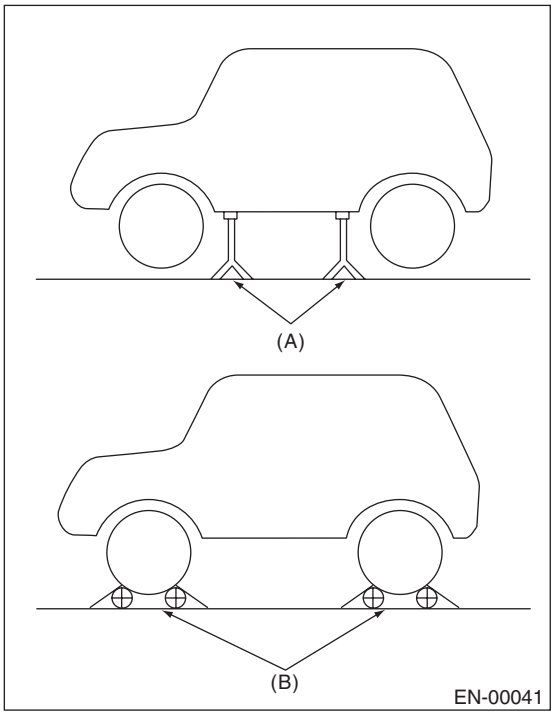
DTC	Item	Condition
P0345	Camshaft Position Sensor “A” Circuit (Bank 2)	—
P0346	Camshaft Position Sensor "A" Circuit Range/Performance (Bank 2)	—
P0351	Ignition Coil A Primary/Secondary Circuit	—
P0352	Ignition Coil B Primary/Secondary Circuit	—
P0353	Ignition Coil C Primary/Secondary Circuit	—
P0354	Ignition Coil D Primary/Secondary Circuit	—
P0365	Camshaft Position Sensor “B” Circuit (Bank 1)	—
P0366	Camshaft Position Sensor B Circuit Range/Performance (Bank 1)	—
P0390	Camshaft Position Sensor “B” Circuit (Bank 2)	—
P0391	Camshaft Position Sensor B Circuit Range/Performance (Bank 2)	—
P0452	Evaporative Emission System Pressure Sensor/Switch Low	—
P0453	Evaporative Emission System Pressure Sensor/Switch High	—
P0458	Evaporative Emission System Purge Control Valve Circuit Low	—
P0462	Fuel Level Sensor “A” Circuit Low	—
P0463	Fuel Level Sensor “A” Circuit High	—
P0512	Starter Request Circuit	—
P0516	Battery Temperature Sensor Circuit Low	—
P0517	Battery Temperature Sensor Circuit High	—
P0560	System Voltage	—
P0604	Internal Control Module Random Access Memory (RAM) Error	—
P0605	Internal Control Module Read Only Memory (ROM) Error	—
P0606	Control Module Processor	—
P060A	Internal Control Module Monitoring Processor Performance	—
P060B	Internal Control Module A/D Processing Performance	—
P0616	Starter Relay Circuit Low	—
P0617	Starter Relay Circuit High	—
P062F	Internal Control Module EEPROM Error	—
P0685	ECM/PCM Power Relay Control Circuit/Open	—
P081A	Starter Disable Circuit Low	—
P1160	Return Spring Failure	—
P1530	Battery Current Sensor Circuit Low	—
P1531	Battery Current Sensor Circuit High	—
P1532	Battery Charging System	—
P2006	Intake Manifold Runner Control Stuck Closed (Bank 1)	—
P2007	Intake Manifold Runner Control Stuck Closed (Bank 2)	—
P2009	Intake Manifold Runner Control Circuit Low (Bank 1)	—
P2012	Intake Manifold Runner Control Circuit Low (Bank 2)	—
P2101	Throttle Actuator Control Motor Circuit Range/Performance	—
P2102	Throttle Actuator Control Motor Circuit Low	—
P2103	Throttle Actuator Control Motor Circuit High	—
P2109	Throttle/Pedal Position Sensor “A” Minimum Stop Performance	—
P2119	Throttle Actuator Control Throttle Body Range/Performance	—
P2122	Throttle/Pedal Position Sensor/Switch “D” Circuit Low Input	—
P2123	Throttle/Pedal Position Sensor/Switch “D” Circuit High Input	—
P2127	Throttle/Pedal Position Sensor/Switch “E” Circuit Low Input	—
P2128	Throttle/Pedal Position Sensor/Switch “E” Circuit High Input	—
P2135	Throttle/Pedal Position Sensor/Switch “A”/“B” Voltage Correlation	—
P2138	Throttle/Pedal Position Sensor/Switch “D”/“E” Voltage Correlation	—
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	—
P2419	Evaporative Emission System Switching Valve Control Circuit Low	—

DTC	Item	Condition
P2530	Ignition Switch Run Position Circuit	—
U0073	Control Module Communication Bus Off	—
U0101	Lost Communication With TCM	—
U0122	Lost Communication With Vehicle Dynamics Control Module	—
U0155	Lost Communication With Instrument Panel Cluster (IPC) Control Module	—
U0402	Invalid Data Received From TCM	—
U0416	Invalid Data Received From Vehicle Dynamics Control Module	—
U0423	Invalid Data Received From Instrument Panel Cluster Control Module	—

1. PREPARATION FOR THE INSPECTION MODE

1) Check that the battery voltage is 12 V or more and fuel remains approx. half [20 — 40 L (5.3 — 10.6 US gal, 4.4 — 8.8 Imp gal)].
2) Lift up the vehicle using a garage jack and place it on rigid racks, or drive the vehicle onto free rollers.

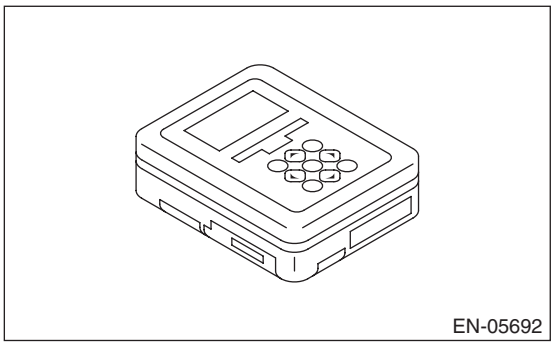
WARNING:
- **Before lifting up the vehicle, ensure parking brake is applied.**
- **Do not use a pantograph jack in place of a rigid rack.**
- **Secure a rope or wire to the front or rear towing hooks to prevent the lateral runout of front wheels.**
- **Before rotating the wheels, make sure that there is no one in front of the vehicle. Besides while the wheels are rotating, make sure that no one approaches the vehicle front side.**
- **Make sure that there is nothing around the wheels. For AWD model, pay attention to all four wheels.**
- **While servicing, do not depress or release the clutch pedal or accelerator pedal quickly regardless of the engine speed. Quick operation may cause the vehicle to drop off the free roller.**
- **To prevent the vehicle from slipping due to vibration, do not place anything between rigid rack and the vehicle.**



(A) Rigid rack
(B) Free roller

2. SUBARU SELECT MONITOR

1) Check that no DTC remains after clearing memory. <Ref. to EN(H4DO w/o HEV)(diag)-65, Clear Memory Mode.>
2) Warm up the engine.
3) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4DO w/o HEV)(diag)-8, PREPARATION TOOL, General Description.>

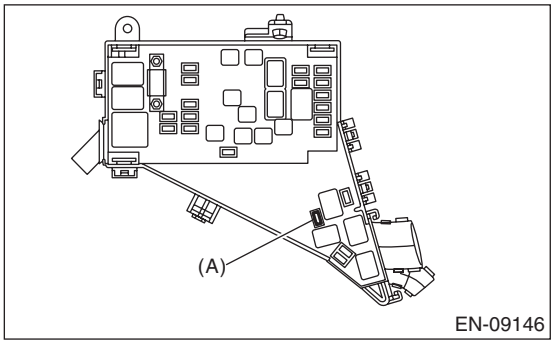

EN-05692

4) Prepare PC with Subaru Select Monitor installed.
5) Connect the USB cable to SDI (Subaru Diagnosis Interface) and USB port on the personal computer (dedicated port for the Subaru Select Monitor).

NOTE:
The dedicated port for the Subaru Select Monitor means the USB port which was used to install the Subaru Select Monitor.

6) Connect the diagnosis cable to SDI.
7) Install the delivery (test) mode fuse (A).

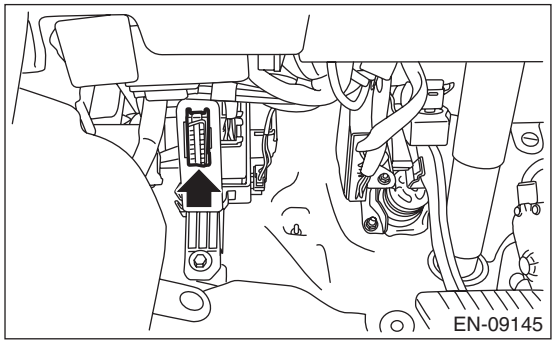
CAUTION:
Do not use any fuses that are installed on the vehicle.



EN-09146

8) Connect SDI to data link connector located in the lower portion of the instrument panel (on the driver's side).

CAUTION:
Do not connect the scan tools except for Subaru Select Monitor and general scan tool.


EN-09145

9) Start the PC.
10) Turn the ignition switch to ON (engine OFF) and run the "PC application for Subaru Select Monitor".
11) On «Main Menu» display, select {Each System Check}.
12) On «System Selection Menu» display, select {Engine Control System}.
13) Click the [OK] button after the information of engine type has been displayed.
14) On «Engine Diagnosis» display, select {Dealer Check Mode Procedure}.
15) When the "Perform Inspection (Dealer Check) Mode ?" is shown on the screen, click the [Next] button.
16) Perform subsequent procedures as instructed on the display screen.

- If trouble still remains in the memory, the corresponding DTC appears on the display screen.

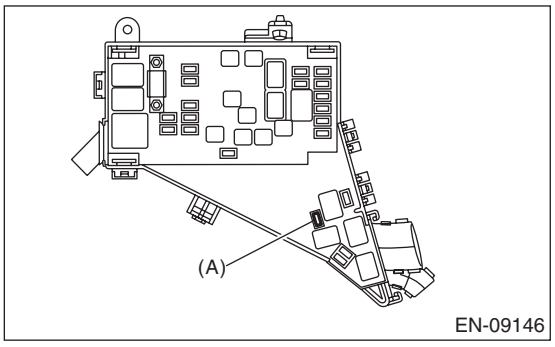
NOTE:

- For detailed operation procedures, refer to "PC application help for Subaru Select Monitor".
- For details concerning DTC, refer to "List of Diagnostic Trouble Code (DTC)".
  <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>
- Release the parking brake.
- The rotating speed difference between front and rear wheels may illuminate the warning light, but this does not indicate a malfunction. When engine control system diagnosis is finished, perform the VDC memory clearance procedure of self-diagnosis function. <Ref. to VDC(diag)-25, Clear Memory Mode.>

3. GENERAL SCAN TOOL

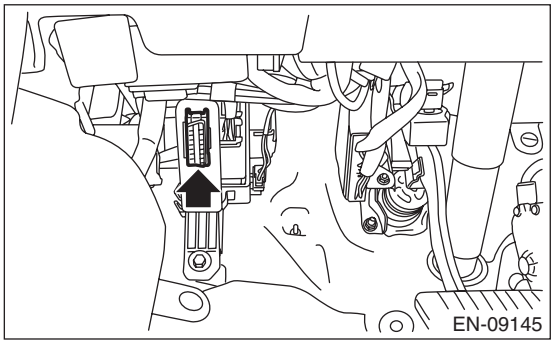
1) Check that no DTC remains after clearing memory. <Ref. to EN(H4DO w/o HEV)(diag)-65, Clear Memory Mode.>
2) Warm up the engine.
3) Install the delivery (test) mode fuse (A).

CAUTION:
Do not use any fuses that are installed on the vehicle.



4) Connect the general scan tool to data link connector located in the lower portion of the instrument panel (on the driver's side).

CAUTION:
Do not connect the scan tools except for Subaru Select Monitor and general scan tool.



5) Start the engine.

NOTE:
• Ensure the selector lever is placed in the "P" range before starting. (CVT model)
• Depress the clutch pedal when starting engine. (MT model)
6) Turn the neutral position switch to ON using select lever or shift lever.
7) Depress the brake pedal to turn the brake switch ON. (CVT model)
8) Keep the engine speed in 2,500 — 3,000 rpm range for 40 seconds.
9) Place the select lever or shift lever in "D" position (CVT model) or "1st gear" (MT model) and drive the vehicle at 5 to 10 km/h (3 to 6 MPH).

NOTE:
• For AWD model, release the parking brake.
• The rotating speed difference between front and rear wheels may illuminate the ABS warning light, but this does not indicate a malfunction. When engine control system diagnosis is finished, perform the VDC memory clearance procedure of self-diagnosis function. <Ref. to VDC(diag)-25, Clear Memory Mode.>
10) Using the general scan tool, check for DTC and record the result(s).

NOTE:
• For detailed operation procedures, refer to the general scan tool operation manual.
• For details concerning DTC, refer to "List of Diagnostic Trouble Code (DTC)".
<Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>

12.Drive Cycle

A: PROCEDURE

It is necessary to perform the drive cycle listed below if DTC is not found in the Inspection Mode. It is possible to complete diagnosis of the DTC by performing the indicated drive cycle. After the repair for the DTC, perform a necessary drive cycle and make sure the function recovers and the DTC is recorded.

1. PREPARATION FOR DRIVE CYCLE

1) Check that the battery voltage is 12 V or more and fuel remains approx. half [20 — 40 L (5.3 — 10.6 US gal, 4.4 — 8.8 Imp gal)].
2) After performing the diagnostics and Clear Memory Mode, check that no DTC remains. <Ref. to EN(H4DO w/o HEV)(diag)-65, Clear Memory Mode.>
3) Check the delivery (test) mode fuse is removed.

NOTE:
• Perform the drive cycle after warming up the engine except when the engine coolant temperature at engine start is specified.
• Perform the drive cycle twice if the DTC in the list is marked with *. After completing the first drive cycle, stop the engine and perform second diagnosis in same condition.

2. DRIVE CYCLE A

DTC	Item	Condition
*P0128	Coolant Thermostat (Engine Coolant Temperature Below Thermostat Regulating Temperature)	—
*P0141	O2 Sensor Heater Circuit (Bank1 Sensor2)	—
*P014C	O2 Sensor Slow Response - Rich to Lean (Bank 1 Sensor 1)	—
*P014D	O2 Sensor Slow Response - Lean to Rich (Bank 1 Sensor 1)	—
*P015A	O2 Sensor Delayed Response - Rich to Lean (Bank 1 Sensor 1)	—
*P015B	O2 Sensor Delayed Response - Lean to Rich (Bank 1 Sensor 1)	—
*P0171	System Too Lean (Bank 1)	Complete diagnosis with drive cycle B or C as well.
*P0172	System Too Rich (Bank 1)	Complete diagnosis with drive cycle B or C as well.
*P0300	Random/Multiple Cylinder Misfire Detected	Complete diagnosis with drive cycle B or C as well.
*P0301	Cylinder 1 Misfire Detected	Complete diagnosis with drive cycle B or C as well.
*P0302	Cylinder 2 Misfire Detected	Complete diagnosis with drive cycle B or C as well.
*P0303	Cylinder 3 Misfire Detected	Complete diagnosis with drive cycle B or C as well.
*P0304	Cylinder 4 Misfire Detected	Complete diagnosis with drive cycle B or C as well.
*P0420	Catalyst System Efficiency Below Threshold (Bank 1)	—
*P0459	Evaporative Emission System Purge Control Valve Circuit High	—
*P2096	Post Catalyst Fuel Trim System Too Lean (Bank 1)	Complete diagnosis with drive cycle B or C as well.
*P2097	Post Catalyst Fuel Trim System Too Rich (Bank 1)	Complete diagnosis with drive cycle B or C as well.
P2195	O2 Sensor Signal Biased/Stuck Lean (Bank 1 Sensor 1)	—
P2196	O2 Sensor Signal Biased/Stuck Rich (Bank 1 Sensor 1)	—

Diagnostic procedure:
1) Drive for 20 minutes or more at a constant speed of 80 km/h (50 MPH) or more.
2) Stop the vehicle and idle for one minute.

3. DRIVE CYCLE B

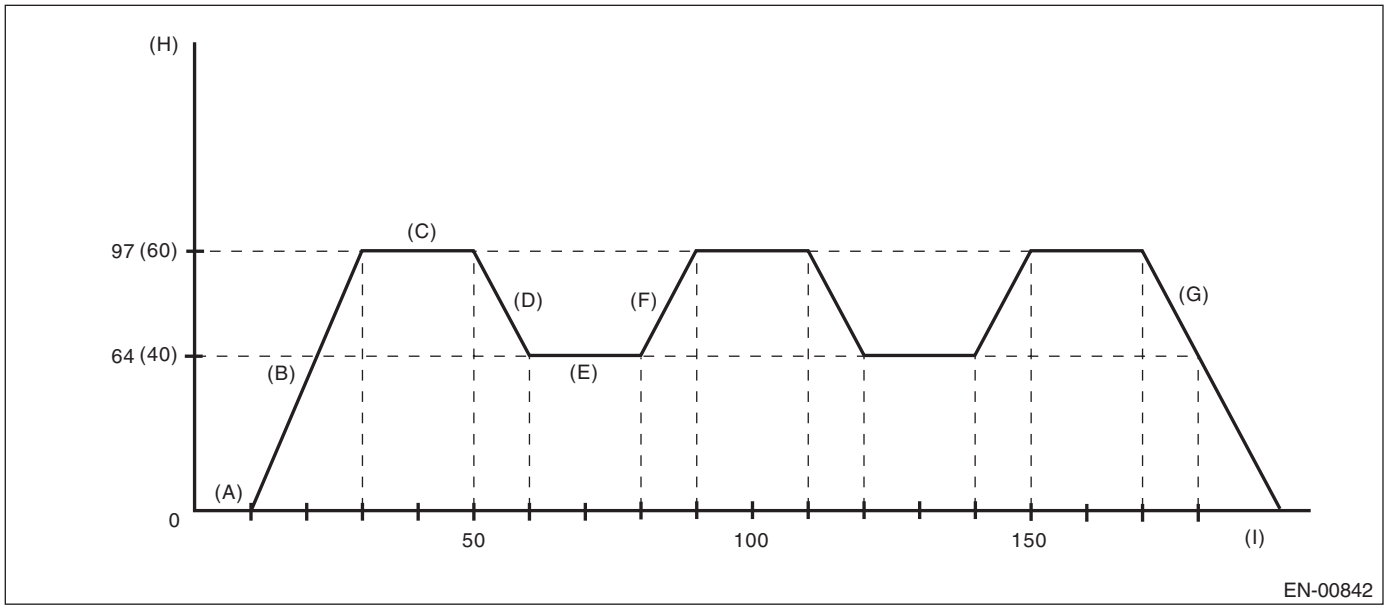
DTC	Item	Condition
*P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	«Coolant Temp.» at engine start: Less than –15°C (5°F)
P0137	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	—
P0138	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	—
*P0171	System Too Lean (Bank 1)	Complete diagnosis with drive cycle A or C as well.
*P0172	System Too Rich (Bank 1)	Complete diagnosis with drive cycle A or C as well.
*P0300	Random/Multiple Cylinder Misfire Detected	Complete diagnosis with drive cycle A or C as well.
*P0301	Cylinder 1 Misfire Detected	Complete diagnosis with drive cycle A or C as well.
*P0302	Cylinder 2 Misfire Detected	Complete diagnosis with drive cycle A or C as well.
*P0303	Cylinder 3 Misfire Detected	Complete diagnosis with drive cycle A or C as well.
*P0304	Cylinder 4 Misfire Detected	Complete diagnosis with drive cycle A or C as well.
P0500	Vehicle Speed Sensor “A”	—
*P0506	Idle Air Control System RPM Lower Than Expected	—
*P0507	Idle Air Control System RPM Higher Than Expected	—
P0700	Transmission Control System (MIL Request)	—
*P2096	Post Catalyst Fuel Trim System Too Lean (Bank 1)	Complete diagnosis with drive cycle A or C as well.
*P2097	Post Catalyst Fuel Trim System Too Rich (Bank 1)	Complete diagnosis with drive cycle A or C as well.
*P219A	Bank 1 Air-Fuel Ratio Imbalance	Complete diagnosis with drive cycle C as well.

Diagnostic procedure:
1) Drive at 10 km/h (6 MPH) or more.
2) Stop the vehicle and idle for ten minutes.

4. DRIVE CYCLE C

DTC	Item	Condition
*P000A	A Camshaft Position Slow Response (Bank 1)	—
*P000B	B Camshaft Position Slow Response (Bank 1)	—
*P000C	A Camshaft Position Slow Response (Bank 2)	—
*P000D	B Camshaft Position Slow Response (Bank 2)	—
P0011	Intake Camshaft Position - Timing Over-Advanced or System Performance (Bank 1)	—
P0014	Exhaust AVCS System 1 (Range/Performance)	—
P0021	Intake Camshaft Position - Timing Over-Advanced or System Performance (Bank 2)	—
P0024	Exhaust AVCS System 2 (Range/Performance)	—
*P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	—
*P0068	MAP/MAF - Throttle Position Correlation	—
*P0101	Mass or Volume Air Flow Circuit Range/Performance	—
P0134	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	—
*P013A	O2 Sensor Slow Response - Rich to Lean (Bank 1 Sensor 2)	—
*P013B	O2 Sensor Slow Response - Lean to Rich (Bank 1 Sensor 2)	—
*P013E	O2 Sensor Delayed Response - Rich to Lean (Bank 1 Sensor 2)	—
*P013F	O2 Sensor Delayed Response - Lean to Rich (Bank 1 Sensor 2)	—
*P0171	System Too Lean (Bank 1)	Complete diagnosis with drive cycle A or B as well.
*P0172	System Too Rich (Bank 1)	Complete diagnosis with drive cycle A or B as well.
*P0300	Random/Multiple Cylinder Misfire Detected	Complete diagnosis with drive cycle A or B as well.
*P0301	Cylinder 1 Misfire Detected	Complete diagnosis with drive cycle A or B as well.
*P0302	Cylinder 2 Misfire Detected	Complete diagnosis with drive cycle A or B as well.
*P0303	Cylinder 3 Misfire Detected	Complete diagnosis with drive cycle A or B as well.
*P0304	Cylinder 4 Misfire Detected	Complete diagnosis with drive cycle A or B as well.
*P0400	Exhaust Gas Recirculation Flow	—
*P0441	Evaporative Emission Cont. Sys. Incorrect Purge Flow	—
P0851	Park/Neutral Switch Input Circuit Low	—
P0852	Park/Neutral Switch Input Circuit High	—
*P1449	Evaporative Emission Cont. Sys. Air Filter Clog	—
P1492	EGR Solenoid Valve Signal #1 Circuit Malfunction (Low Input)	—
P1493	EGR Solenoid Valve Signal #1 Circuit Malfunction (High Input)	—
P1494	EGR Solenoid Valve Signal #2 Circuit Malfunction (Low Input)	—
P1495	EGR Solenoid Valve Signal #2 Circuit Malfunction (High Input)	—
P1496	EGR Solenoid Valve Signal #3 Circuit Malfunction (Low Input)	—
P1497	EGR Solenoid Valve Signal #3 Circuit Malfunction (High Input)	—
P1498	EGR Solenoid Valve Signal #4 Circuit Malfunction (Low Input)	—
P1499	EGR Solenoid Valve Signal #4 Circuit Malfunction (High Input)	—
P2004	Intake Manifold Runner Control Stuck Open (Bank 1)	—
P2005	Intake Manifold Runner Control Stuck Open (Bank 2)	—
*P2096	Post Catalyst Fuel Trim System Too Lean (Bank 1)	Complete diagnosis with drive cycle A or B as well.
*P2097	Post Catalyst Fuel Trim System Too Rich (Bank 1)	Complete diagnosis with drive cycle A or B as well.
*P219A	Bank 1 Air-Fuel Ratio Imbalance	Complete diagnosis with drive cycle B as well.
P2270	O2 Sensor Signal Biased/Stuck Lean (Bank 1 Sensor 2)	—
P2271	O2 Sensor Signal Biased/Stuck Rich (Bank 1 Sensor 2)	—

Diagnostic procedure:
Drive according to the drive pattern described below.



(A)	Shift the select lever to “P” range or the shift lever to the neutral position, and let the engine idle for 10 seconds or more.	(D)	Decelerate with fully closed throttle to 64 km/h (40 MPH) or less.	(G)	Stop vehicle with the throttle fully closed.
(B)	Accelerate to 97 km/h (60 MPH) or more within 20 seconds.	(E)	Drive for 20 seconds or more at 64 km/h (40 MPH) or less.	(H)	Vehicle speed km/h (MPH)
(C)	Drive for 20 seconds or more at 97 km/h (60 MPH) or more.	(F)	Accelerate to 97 km/h (60 MPH) or more within 10 seconds.	(I)	Sec.

5. DRIVE CYCLE E

DTC	Item	Condition
*P0461	Fuel Level Sensor “A” Circuit Range/Performance	—

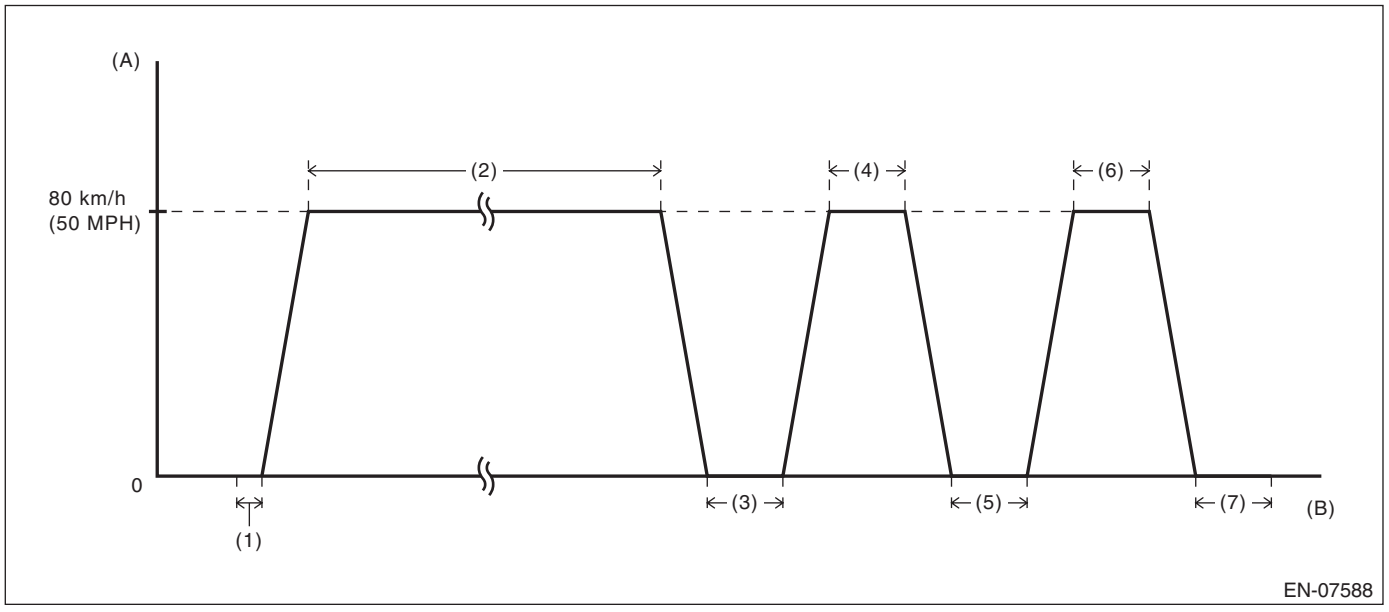
Diagnostic procedure:
1) Make sure that the battery voltage is 10.9 V or more.
2) Perform the Clear Memory Mode. <Ref. to EN(H4DO w/o HEV)(diag)-65, Clear Memory Mode.>
3) Drive for approximately 30 L (7.9 US gal, 6.6 Imp gal) of fuel.

NOTE:
• It is acceptable to drive the vehicle intermittently.
• Do not disconnect the battery terminals while diagnosing. (Data will be cleared by disconnecting the battery terminals.)

6. DRIVE CYCLE F

DTC	Item	Condition
*P0111	Intake Air Temperature Sensor Range/Performance Problem	• 6 hours have elapsed since ignition switch is OFF under a completely warmed up condition. • For models with block heater, at least 6 hours must have elapsed without operating the block heater.
*P0196	Engine Oil Temperature Sensor Circuit Range/Performance	• 6 hours have elapsed since ignition switch is OFF under a completely warmed up condition. • For models with block heater, at least 6 hours must have elapsed without operating the block heater.

Diagnostic procedure:
1) Make sure that the engine coolant temperature is less than 30°C (86°F).
2) Drive according to the drive pattern described below.



(A) Vehicle speed
(B) Elapsed time
(1) Idle the engine for 10 seconds or more after engine start.
(2) Drive for 8 minutes or more at a constant speed of 80 km/h (50 MPH) or more.
(3) Stop the vehicle and idle for 30 seconds or more.
(4) Drive for 30 seconds or more at a constant speed of 80 km/h (50 MPH) or more.
(5) Stop the vehicle and idle for 30 seconds or more.
(6) Drive for 30 seconds or more at a constant speed of 80 km/h (50 MPH) or more.
(7) Stop the vehicle and idle for 30 seconds.

NOTE:
• There is no given transition time between idling and cruising.
• Driving at constant speed only on a downhill causes smaller engine load and may result in failure to obtain a right diagnostic result.
• When the engine stops while performing drive cycle F, perform it again from the state of procedure 1).

7. DRIVE CYCLE H

DTC	Item	Condition
P0071	Ambient Temperature Sensor Circuit "A" Range/Performance	• 6 hours have elapsed since ignition switch is OFF under a completely warmed up condition. • For models with block heater, at least 6 hours must have elapsed without operating the block heater.
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	• 6 hours have elapsed since ignition switch is OFF under a completely warmed up condition. • For models with block heater, at least 6 hours must have elapsed without operating the block heater.
P0451	Evaporative Emission System Pressure Sensor/Switch Range/Performance	60 seconds have elapsed since ignition switch is OFF.
*P050A	Cold Start Idle Air Control System Performance	—
*P050B	Cold Start Ignition Timing Performance	—

1) Perform the Clear Memory Mode. <Ref. to EN(H4DO w/o HEV)(diag)-65, Clear Memory Mode.>
2) With the ignition switch ON, read the value in «Coolant Temp.» and «Intake Air Temp.». <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.>
3) If the values from step 2) satisfy the following conditions, idle the engine for one minute.

Condition:
|Engine coolant temperature — Intake air temperature| ≤ 5°C (9°F)

NOTE:
• If the conditions are not satisfied, turn the ignition switch to OFF and wait until the parameters are satisfied.
• For CVT models, hold the select lever to “P” range or “N” range at idling, and for MT models, the shift lever in the neutral position at idling.

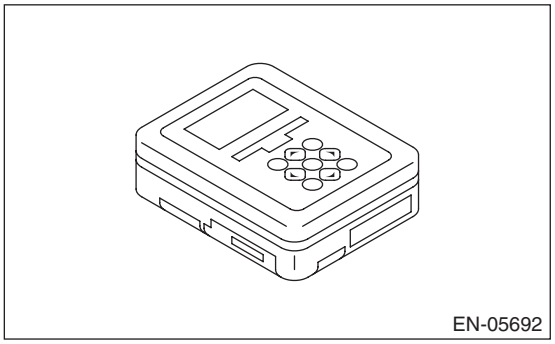
8. DRIVE CYCLE I

DTC	Item	Condition
*P0455	Evaporative Emission System Leak Detected (Large Leak)	«Coolant Temp.»: 5 — 45°C (41 — 113°F) «Intake Air Temp.»: 5 — 50°C (41 — 122°F)
*P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)	
*P1451	Evaporative Emission Cont. Sys.	
*P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	
*P2404	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	
*P2420	Evaporative Emission System Switching Valve Control Circuit High	

CAUTION:
Be careful of the state of the battery when performing the DRIVE CYCLE I consecutively. Performing the DRIVE CYCLE I consecutively without the engine running may cause a low battery voltage and battery discharge.

NOTE:
• If it is necessary to perform DRIVE CYCLE I consecutively, drive the vehicle under the following conditions to release accumulated evaporating gas. Performing the DRIVE CYCLE I consecutively without starting the engine causes a large amount of evaporating gas to accumulate in the canister, which hinders an accurate diagnosis.
  • After engine is warmed up
  • Drive for 10 minutes or more at a speed of 48 km/h (30 MPH) or more (duration of drive can be an accumulation)
• To obtain an accurate diagnostic result, perform the procedures according to the following points.
  • Do not refuel gas immediately before performing DRIVE CYCLE I. There will be a large amount of evaporating gas immediately after refuel, which may cause a less accurate diagnostic performance.
  • Do not shake the vehicle while performing DRIVE CYCLE I. Shaking the vehicle causes evaporating gas to increase inside the fuel tank, which may cause a less accurate diagnostic performance.
  • Do not perform any service operation including installation or removal of parts or connectors while performing DRIVE CYCLE I. Performing service operation could affect on the functions of related parts, which may cause a less accurate diagnostic performance.

1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4DO w/o HEV)(diag)-8, PREPARATION TOOL, General Description.>

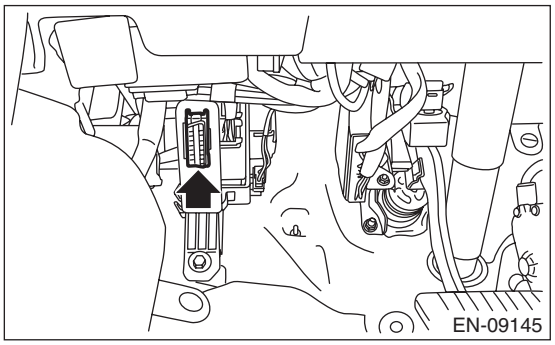

EN-05692

2) Prepare PC with Subaru Select Monitor installed.
3) Connect the USB cable to SDI (Subaru Diagnosis Interface) and USB port on the personal computer (dedicated port for the Subaru Select Monitor).

NOTE:
The dedicated port for the Subaru Select Monitor means the USB port which was used to install the Subaru Select Monitor.
4) Connect the diagnosis cable to SDI.

5) Connect SDI to data link connector located in the lower portion of the instrument panel (on the driver's side).

CAUTION:
Do not connect the scan tools except for Subaru Select Monitor and general scan tool.



6) Start the PC.
7) Turn the ignition switch to ON (engine OFF) and run the "PC application for Subaru Select Monitor".
8) On «Main Menu» display, select {Each System Check}.
9) On «System Selection Menu» display, select {Engine Control System}.
10) Click the [OK] button after the information of engine type has been displayed.
11) On «Engine Diagnosis» display, select {OBD System}.
12) On «OBD Menu» display, select {Evaporative System Leak Test}.
13) On «Evaporative System Leak Test» display, select {Evaporative System Leak Test}.
14) On «Evaporative System Leak Test is running. Press Cancel to exit this function.» display, click the [OK] button to perform evaporative system leak test.
15) When «Conditions have been enabled to control this function. Turn the ignition switch off to terminate the test.» display appears, wait for 30 minutes without clicking the [OK] button.

CAUTION:
Do not leave the vehicle for an extended period of time after the test is complete. This may cause early deterioration of the battery or discharged battery.

NOTE:
• Clicking the [OK] button bring the «Evaporative System Leak Test» display back, although the test is continuing.
• The Subaru Select Monitor screen does not change after the evaporative system leak test is complete or when the test is aborted by turning off the ignition switch.
• If the «Test conditions are not correct» display appears, check that the values of «Coolant Temp.» and «Intake Air Temp.» are within the specified range using Subaru Select Monitor. If the conditions are satisfied, make the necessary preparation for the drive cycle again. <Ref. to EN(H4DO w/o HEV)(diag)-55, PREPARATION FOR DRIVE CYCLE, PROCEDURE, Drive Cycle.>
16) After 30 minutes passed from the start of step 14), click the [OK] button to return to the «Evaporative System Leak Test» display.
17) Click buttons until the «OBD Menu» display appears, then select {Result of on-board monitor test}.
18) In the {Result of on-board monitor test}, check TID $C1 — $CA of MID $3C.

Result of on-board monitor test

Display	Details	Remarks
$0000 is stored in all Val.	During the evaporative system leak test, the test conditions were not met and the test was cancelled.	Once the test conditions are met, perform the test again.
All Val. are stored with values and OK is set to all the results.	Evaporative system leak test is completed correctly.	While the ignition switch is ON, read temporary codes using the Subaru Select Monitor.
Some results were no good.	The evaporative system leak test completed successfully but the results were faulty.	While the ignition switch is ON, read temporary codes using the Subaru Select Monitor.

19) When the evaporative system leak test is completed correctly, read the temporary codes with the ignition switch turned to ON position. If the DTC is recorded, check the appropriate DTC. <Ref. to EN(H4DO w/o HEV)(diag)-49, OPERATION, Read Diagnostic Trouble Code (DTC).>

NOTE:
The temporary code will be cleared by turning ignition switch to OFF.

9. DRIVE CYCLE J

DTC	Item	Condition
P2610	ECM/PCM Internal Engine Off Timer Performance	—

1) Idle the engine for 15 minutes or more.
2) Turn the ignition switch to OFF.
3) After 10 hours passed from the start of step 2), read the temporary code using the Subaru Select Monitor. <Ref. to EN(H4DO w/o HEV)(diag)-49, OPERATION, Read Diagnostic Trouble Code (DTC).>

10.DRIVE CYCLE N

DTC	Item	Condition
P0016	Crankshaft Position - Camshaft Position Correlation (Bank1)	«Coolant Temp.»: 80°C (176°F) or more
P0017	Crank and Cam Timing B System Failure (Bank 1)	
P0018	Crankshaft Position - Camshaft Position Correlation (Bank2)	
P0019	Crank and Cam Timing B System Failure (Bank 2)	

WARNING:
When performing drive cycle N on the road, pay great attention to traffic conditions and place top priority on safety drive.
1) Using Subaru Select Monitor or general scan tool, confirm the data in the condition field of the table.

NOTE:
- Subaru Select Monitor

For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DO w/o HEV)(diag)-37, DISPLAY ENGINE CURRENT DATA, OPERATION, Subaru Select Monitor.>
- General scan tool

For detailed operation procedures, refer to the general scan tool operation manual.
2) Race up the engine at approx. 2500 rpm of engine speed for 40 seconds or more from a status where the conditions in the table are established.
3) Start the vehicle and accelerate up to 50 km/h (31.1 MPH) or more.
4) When the vehicle speed reaches 50 km/h (31.1 MPH) or more, release the accelerator pedal, brake pedal and clutch pedal (MT model) and decelerate without shifting operation. At this time, select an appropriate gear in advance so that the engine speed keeps between 2500 rpm and 1900 rpm for 5 seconds or more.

NOTE:
- As long as the engine speed keeps between 2500 rpm and 1900 rpm for 5 seconds or more, it does not matter how much speed the vehicle runs.

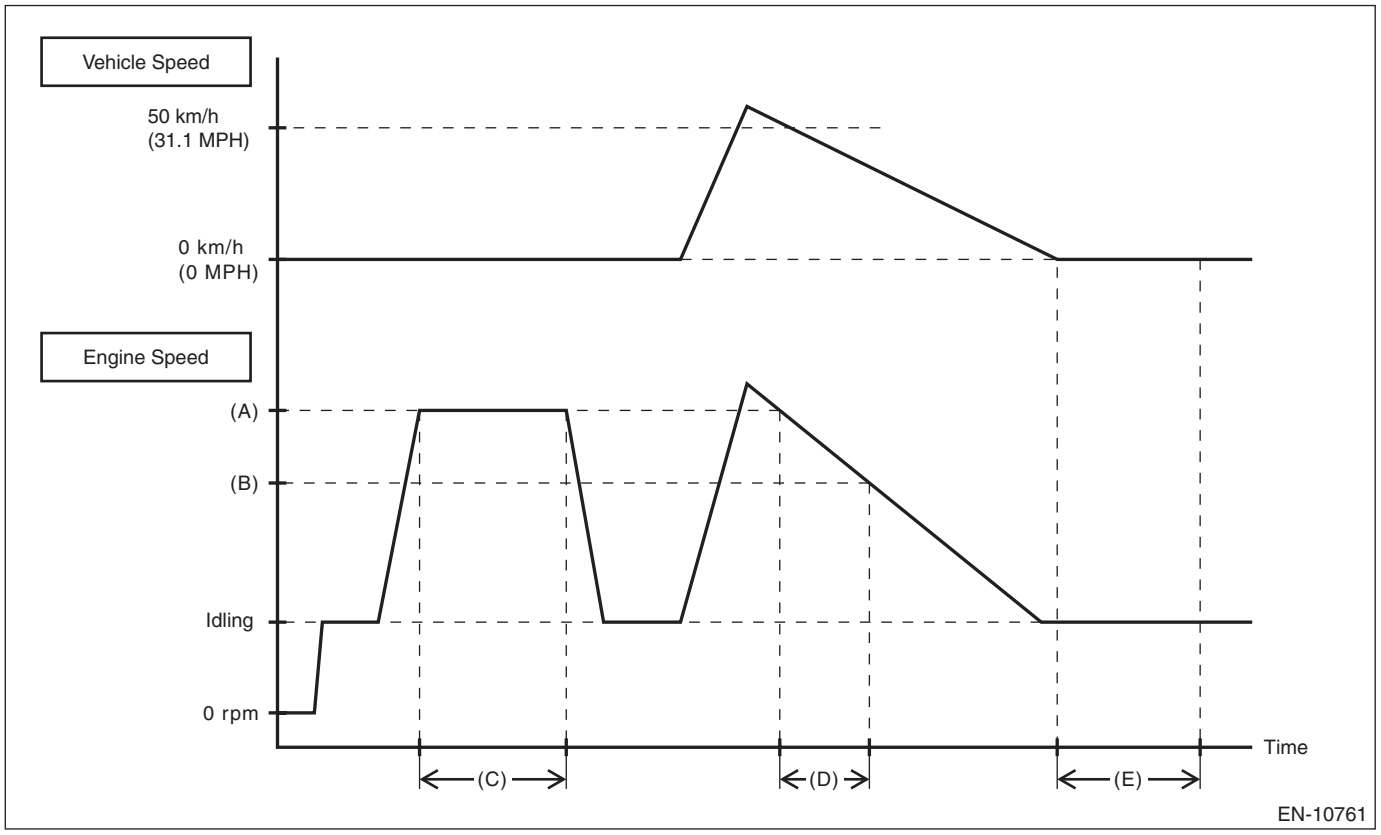
Example) On downhill, this could be performed at low vehicle speed and in lower gear.
- To keep continuous time longer, turn electrical load (A/C, etc.) to OFF or drive on downhill because the engine speed decreases more slowly.

5) Stop the vehicle at a safe place and let it idle for 5 minutes or more.

NOTE:
There is no special rule for driving operation until the vehicle is stopped at a safe place.

6) Read temporary DTC codes using Subaru Select Monitor or general scan tool at idling.

NOTE:
• Refer to “Read Diagnostic Trouble Code (DTC)” for detailed operation procedure. <Ref. to EN(H4DO w/o HEV)(diag)-49, Read Diagnostic Trouble Code (DTC).>
• In step 6), if no DTC is shown on the screen of Subaru Select Monitor or general scan tool, the trouble has been solved.



(A) 2500 rpm
(B) 1900 rpm
(C) 40 seconds or more
(D) 5 seconds or more
(E) 5 minutes or more

13.Clear Memory Mode

A: OPERATION

1. SUBARU SELECT MONITOR

NOTE:
• Initial diagnosis of electronic throttle control is performed after memory clearance. Wait for 10 seconds or more after turning the ignition switch to ON, and then start the engine.
• For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.

2. GENERAL SCAN TOOL

For clear memory procedures using the general scan tool, refer to “General Scan Tool Instruction Manual”.

NOTE:
Initial diagnosis of electronic throttle control is performed after memory clearance. Wait for 10 seconds or more after turning the ignition switch to ON, and then start the engine.

14. System Operation Check Mode

A: OPERATION

CAUTION:
After executing the system operation check mode, execute the Clear Memory Mode. <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>

NOTE:
For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.

15.Malfunction Indicator Light

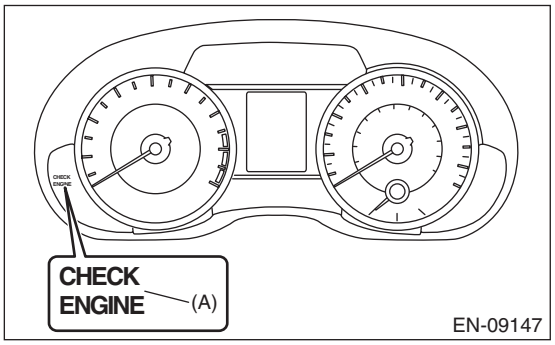
A: PROCEDURE

1. Activation of malfunction indicator light <Ref. to EN(H4DO w/o HEV)(diag)-67, ACTIVATION OF MALFUNCTION INDICATOR LIGHT, Malfunction Indicator Light.>
↓
2. Malfunction indicator light does not come on <Ref. to EN(H4DO w/o HEV)(diag)-69, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON, Malfunction Indicator Light.>
↓
3. Malfunction indicator light does not go off <Ref. to EN(H4DO w/o HEV)(diag)-69, MALFUNCTION INDICATOR LIGHT DOES NOT GO OFF, Malfunction Indicator Light.>
↓
4. Malfunction indicator light does not blink <Ref. to EN(H4DO w/o HEV)(diag)-70, MALFUNCTION INDICATOR LIGHT DOES NOT BLINK, Malfunction Indicator Light.>
↓
5. Malfunction indicator light remains blinking <Ref. to EN(H4DO w/o HEV)(diag)-72, MALFUNCTION INDICATOR LIGHT REMAINS BLINKING, Malfunction Indicator Light.>

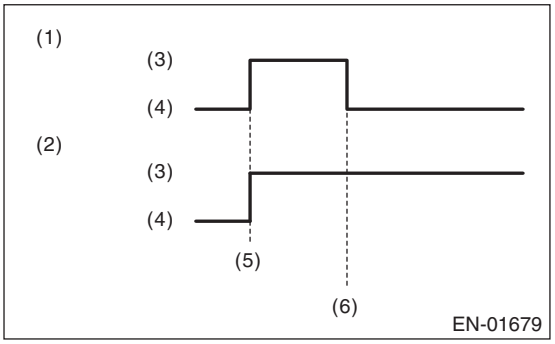
B: ACTIVATION OF MALFUNCTION INDICATOR LIGHT

1) When the ignition switch is turned to ON (engine OFF), the malfunction indicator light (A) in the combination meter illuminates.

NOTE:
If the malfunction indicator light does not illuminate, perform diagnostics of the malfunction indicator light circuit or the combination meter circuit. <Ref. to EN(H4DO w/o HEV)(diag)-69, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON, Malfunction Indicator Light.>

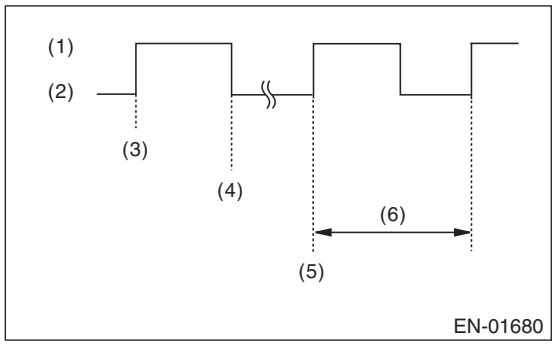


2) After starting the engine, the malfunction indicator light goes out. If it does not go off, any of the engine and emission control system has malfunction.



(1) No faulty
(2) Trouble occurs
(3) ON
(4) OFF
(5) Ignition switch ON
(6) Engine start

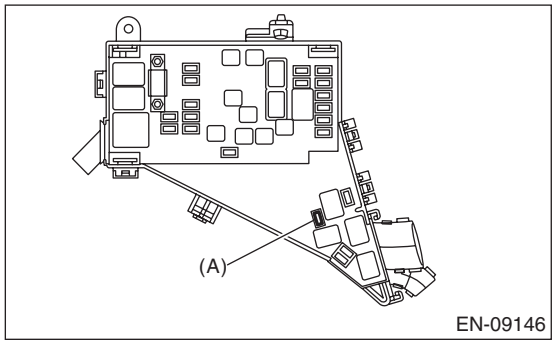
3) If the diagnostic system detects a misfire which could damage the catalyst, the malfunction indicator light will blink at a cycle of 1 Hz.



(1) ON
(2) OFF
(3) Ignition switch ON
(4) Engine start
(5) Misfire start
(6) 1 second

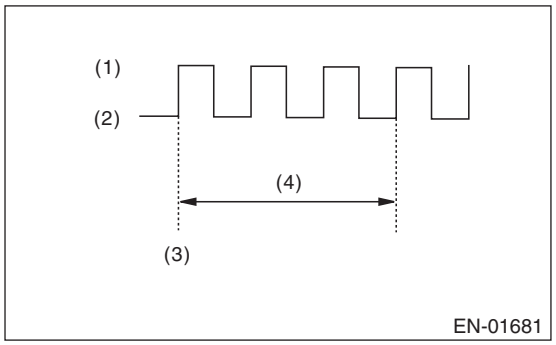
4) Install the delivery (test) mode fuse (A) with ignition switch to OFF.

CAUTION:
Do not use any fuses that are installed on the vehicle.



(1) When the ignition switch is turned to ON (engine OFF), the malfunction indicator light illuminates.
(2) After the engine starts, malfunction indicator light blinks in a cycle of 0.5 Hz. (During diagnosis)

(3) Malfunction indicator light blinks at a cycle of 3 Hz after diagnosis if there is no trouble. Malfunction indicator light illuminates if faulty.



(1) ON
(2) OFF
(3) Ignition switch ON
(4) 1 second

C: MALFUNCTION INDICATOR LIGHT DOES NOT COME ON

TROUBLE SYMPTOM:
When the ignition switch is turned to ON (engine OFF), malfunction indicator light does not illuminate.

NOTE:
Refer to IDI section for diagnostic procedure. <Ref. to IDI(diag)-2, Basic Diagnostic Procedure.>

D: MALFUNCTION INDICATOR LIGHT DOES NOT GO OFF

TROUBLE SYMPTOM:
Although malfunction indicator light comes on when the engine runs, DTC is not shown on the Subaru Select Monitor or general scan tool display.

Step	Check	Yes	No
1 **CHECK DTC.**	Is DTC of engine or LAN system displayed? <Ref. to EN(H4DO w/o HEV)(diag)-49, OPERATION, Read Diagnostic Trouble Code (DTC).>	Check the appropriate DTC using the “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).> <Ref. to LAN(w/o HEV)(diag)-64, List of Diagnostic Trouble Code (DTC).>	Check the combination meter system. <Ref. to IDI(diag)-2, Basic Diagnostic Procedure.>

E: MALFUNCTION INDICATOR LIGHT DOES NOT BLINK

DIAGNOSIS:

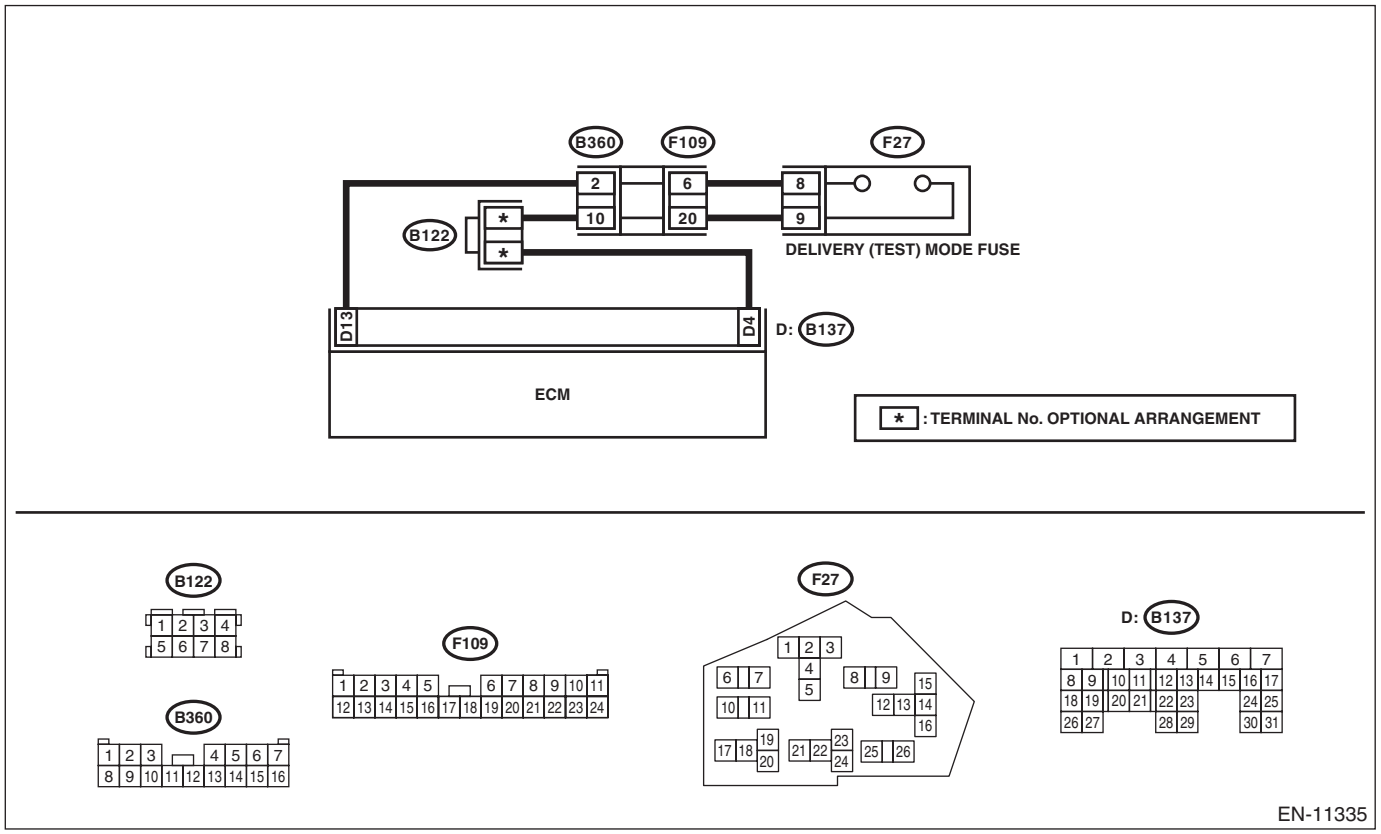
- The malfunction indicator light circuit is open or shorted.
- The delivery (test) mode fuse circuit is open.

TROUBLE SYMPTOM:

Malfunction indicator light does not blink during Inspection Mode.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>

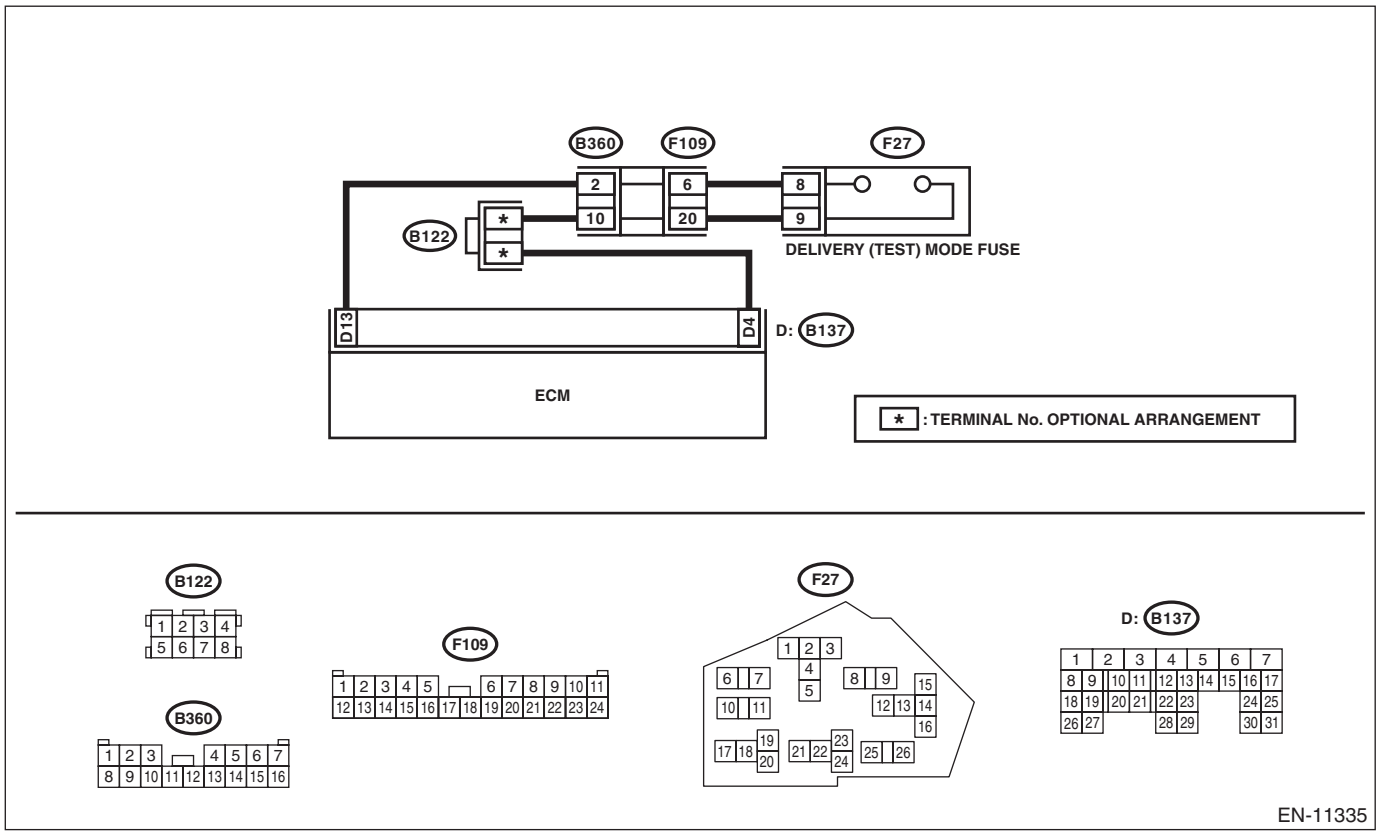


Step		Check	Yes	No
1	**CHECK STATUS OF MALFUNCTION INDICATOR LIGHT.** 1) Turn the ignition switch to OFF. 2) Check the delivery (test) mode fuse is removed. 3) Turn the ignition switch to ON. (engine OFF)	Does the malfunction indicator light illuminate?	Go to step **2**.	Repair the malfunction indicator light circuit. <Ref. to EN(H4DO w/o HEV)(diag)-69, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON, Malfunction Indicator Light.>

Step		Check	Yes	No
2	**CHECK HARNESS BETWEEN ECM AND DELIVERY (TEST) MODE FUSE.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Install the delivery (test) mode fuse. **CAUTION:** **Do not use any fuses that are installed on the vehicle.** 4) Measure the resistance of harness between ECM connectors. ***Connector & terminal*** ***(B137) No. 13 — (B137) No. 4:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector • Poor contact of each connector between ECM connector
3	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM connector.	Is there poor contact of ECM connector?	Repair the poor contact of ECM connector.	Replace the ECM. <Ref. to FU(H4DO(w/o HEV))-100, Engine Control Module (ECM).>

F: MALFUNCTION INDICATOR LIGHT REMAINS BLINKING

DIAGNOSIS:
The delivery (test) mode fuse circuit is short-circuited to ground.
TROUBLE SYMPTOM:
Malfunction indicator light blinks when delivery (test) mode fuse is not connected.
WIRING DIAGRAM:
Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



EN-11335

	Step	Check	Yes	No
1	**CHECK DELIVERY (TEST) MODE CONNECTOR.** 1) Check the delivery (test) mode fuse is removed. 2) Turn the ignition switch to ON.	Does the malfunction indicator light blink?	Go to step **2**.	System is normal. NOTE: Malfunction indicator light blinks at a cycle of 3 Hz when delivery (test) mode fuse is attached.
2	**CHECK HARNESS BETWEEN ECM AND DELIVERY (TEST) MODE FUSE.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 34 — Chassis ground:***	Is the resistance 1 MΩ or more?	Replace the ECM. <Ref. to FU(H4DO(w/o HEV))-100, Engine Control Module (ECM).>	Repair the short circuit to ground in the harness between the ECM connector and delivery (test) mode fuse.

16.Diagnostics for Engine Starting Failure

A: PROCEDURE

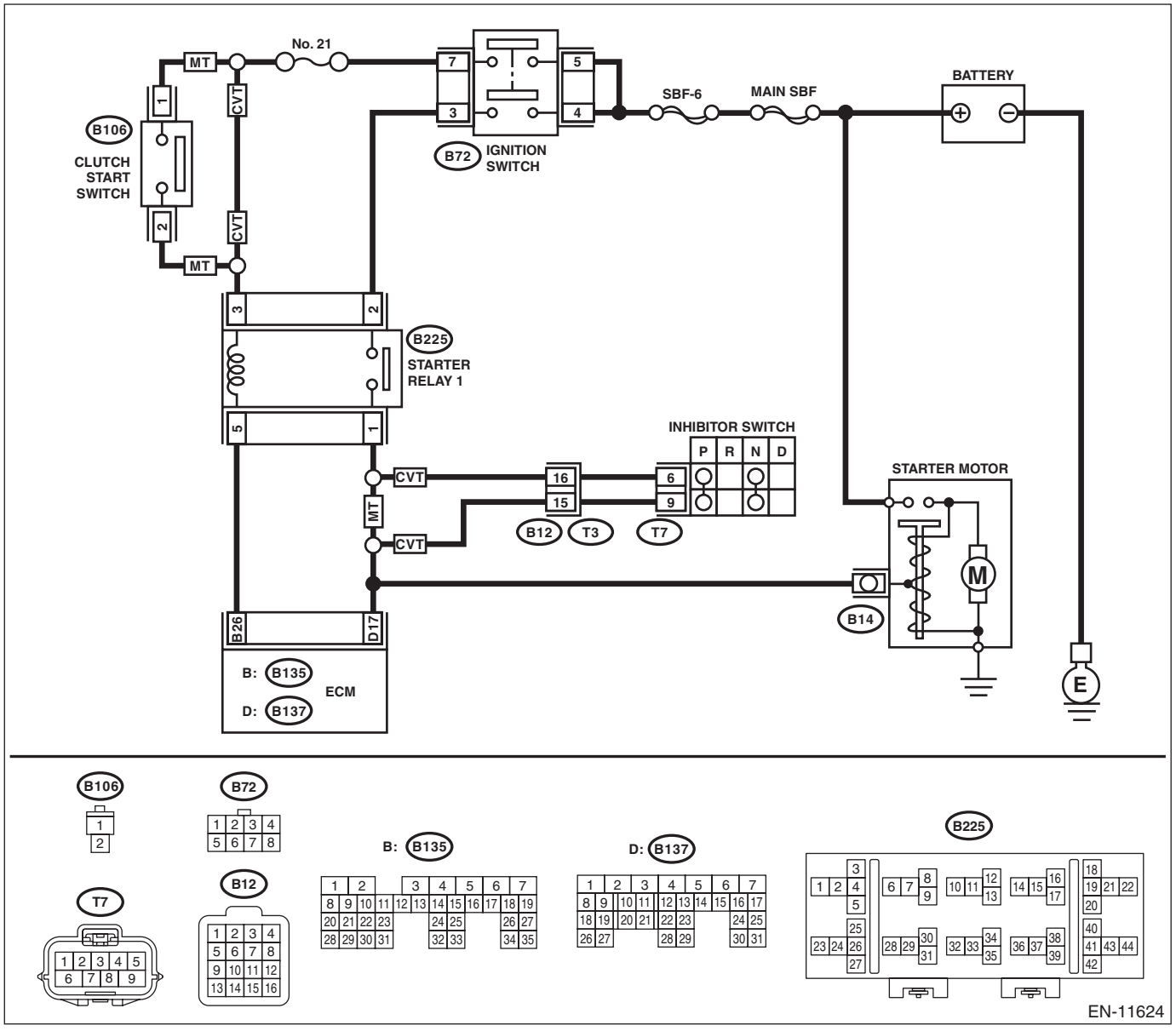
1. Check of the fuel amount
↓
2. Inspection of starter motor circuit <Ref. to EN(H4DO w/o HEV)(diag)-74, STARTER MOTOR CIRCUIT, Diagnostics for Engine Starting Failure.>
↓
3. Inspection of ECM power supply and ground line <Ref. to EN(H4DO w/o HEV)(diag)-85, CHECK POWER SUPPLY AND GROUND LINE OF ENGINE CONTROL MODULE (ECM), Diagnostics for Engine Starting Failure.>
↓
4. Inspection of ignition control system <Ref. to EN(H4DO w/o HEV)(diag)-87, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>
↓
5. Inspection of fuel pump circuit <Ref. to EN(H4DO w/o HEV)(diag)-89, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>
↓
6. Inspection of fuel injector circuit <Ref. to EN(H4DO w/o HEV)(diag)-92, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.>

B: STARTER MOTOR CIRCUIT

1. MODEL WITHOUT PUSH BUTTON START

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, Inspection Mode.>.

WIRING DIAGRAM:
Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



Step		Check	Yes	No
1	**CHECK BATTERY.** Check the battery. <Ref. to SC(H4DO(w/o HEV))-52, Battery.>	Is the battery OK?	Go to step **2**.	Charge or replace the battery. <Ref. to SC(H4DO(w/o HEV))-52, Battery.>
2	**CHECK OPERATION OF STARTER MOTOR.**	Does the starter motor operate?	Go to step **3**.	Go to step **4**.

	Step	Check	Yes	No
3	**CHECK DTC.**	Is DTC displayed? <Ref. to EN(H4DO w/o HEV)(diag)-49, OPERATION, Read Diagnostic Trouble Code (DTC).>	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Check ignition control system. <Ref. to EN(H4DO w/o HEV)(diag)-87, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>
4	**CHECK INPUT SIGNAL FOR STARTER MOTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from starter motor. 3) Turn the ignition switch to START. 4) Measure the voltage between the starter motor connector and the engine ground. ***Connector & terminal*** ***(B14) No. 1 (+) — Engine ground (–):*** NOTE: • For CVT model, place the select lever in "P" range or "N" range. • For MT model, depress the clutch pedal.	Is the voltage 10 V or more?	Check the starter motor. <Ref. to SC(H4DO(w/o HEV))-8, Starter.>	Go to step **5**.
5	**CHECK HARNESS BETWEEN BATTERY AND IGNITION SWITCH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ignition switch. 3) Measure the power supply voltage between ignition switch connector and chassis ground. ***Connector & terminal*** ***(B72) No. 4 (+) — Chassis ground (–):*** ***(B72) No. 5 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **6**.	Repair the power supply circuit.
6	**CHECK IGNITION SWITCH.** Measure the resistance between ignition switch terminals after turning the ignition switch to START position. ***Terminals*** ***No. 3 — No. 4:*** ***No. 5 — No. 7:***	Is the resistance less than 1 Ω?	Go to step **7**.	Replace the ignition switch. <Ref. to SL-70, REPLACEMENT, Ignition Key Lock.>
7	**CHECK INPUT VOLTAGE OF STARTER RELAY 1.** 1) Turn the ignition switch to OFF. 2) Remove the starter relay 1. 3) Connect the connector to ignition switch. 4) Measure the voltage between starter relay 1 connector and chassis ground after turning the ignition switch to START position. ***Connector & terminal*** ***(B225) No. 2 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **8**.	Repair the open circuit of harness between starter relay 1 and ignition switch connector.
8	**CHECK HARNESS BETWEEN ECM AND STARTER RELAY 1 CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM connector and starter relay 1 connector. ***Connector & terminal*** ***(B135) No. 26 — (B225) No. 5:***	Is the resistance less than 1 Ω?	Go to step **9**.	Repair the open circuit of harness between ECM connector and starter relay 1 connector.

	Step	Check	Yes	No
9	**CHECK STARTER RELAY 1.** 1) Connect the battery to starter relay 1 terminals No. 3 and No. 5. 2) Measure the resistance between starter relay 1 terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance less than 1 Ω?	Go to step **10**.	Replace the starter relay 1. <Ref. to EN(H4DO w/o HEV)(diag)-9, Electrical Component Location.>
10	**CHECK TRANSMISSION TYPE.**	Is the transmission type CVT?	Go to step **11**.	Go to step **15**.
11	**CHECK INPUT VOLTAGE OF STARTER RELAY 1.** Measure the voltage between starter relay 1 connector and chassis ground after turning the ignition switch to START position. ***Connector & terminal*** ***(B225) No. 3 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **12**.	Check the following item and repair if necessary. • Blown out of fuse • Open or short circuit to ground in harness between starter relay 1 and ignition switch connector
12	**CHECK HARNESS BETWEEN STARTER RELAY 1 AND INHIBITOR SWITCH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from inhibitor switch. 3) Measure the resistance of harness between starter relay 1 connector and inhibitor switch connector. ***Connector & terminal*** ***(B225) No. 1 — (T7) No. 6:***	Is the resistance less than 1 Ω?	Go to step **13**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between starter relay 1 connector and inhibitor switch connector • Poor contact of coupling connector
13	**CHECK HARNESS BETWEEN INHIBITOR SWITCH AND STARTER MOTOR.** Measure the resistance of harness between the inhibitor switch connector and starter motor. ***Connector & terminal*** ***(T7) No. 9 — (B14) No. 1:***	Is the resistance less than 1 Ω?	Go to step **14**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between inhibitor switch connector and starter motor • Poor contact of coupling connector
14	**CHECK INHIBITOR SWITCH.** 1) Place the select lever in “P” range and “N” range. 2) Measure the resistance between inhibitor switch terminals. ***Terminals*** ***No. 6 — No. 9:***	Is the resistance less than 1 Ω?	Check the engine control module (ECM) power supply and ground line. <Ref. to EN(H4DO w/o HEV)(diag)-85, CHECK POWER SUPPLY AND GROUND LINE OF ENGINE CONTROL MODULE (ECM), Diagnostics for Engine Starting Failure.>	Replace the inhibitor switch. <Ref. to CVT(TR580)-96, Inhibitor Switch.>

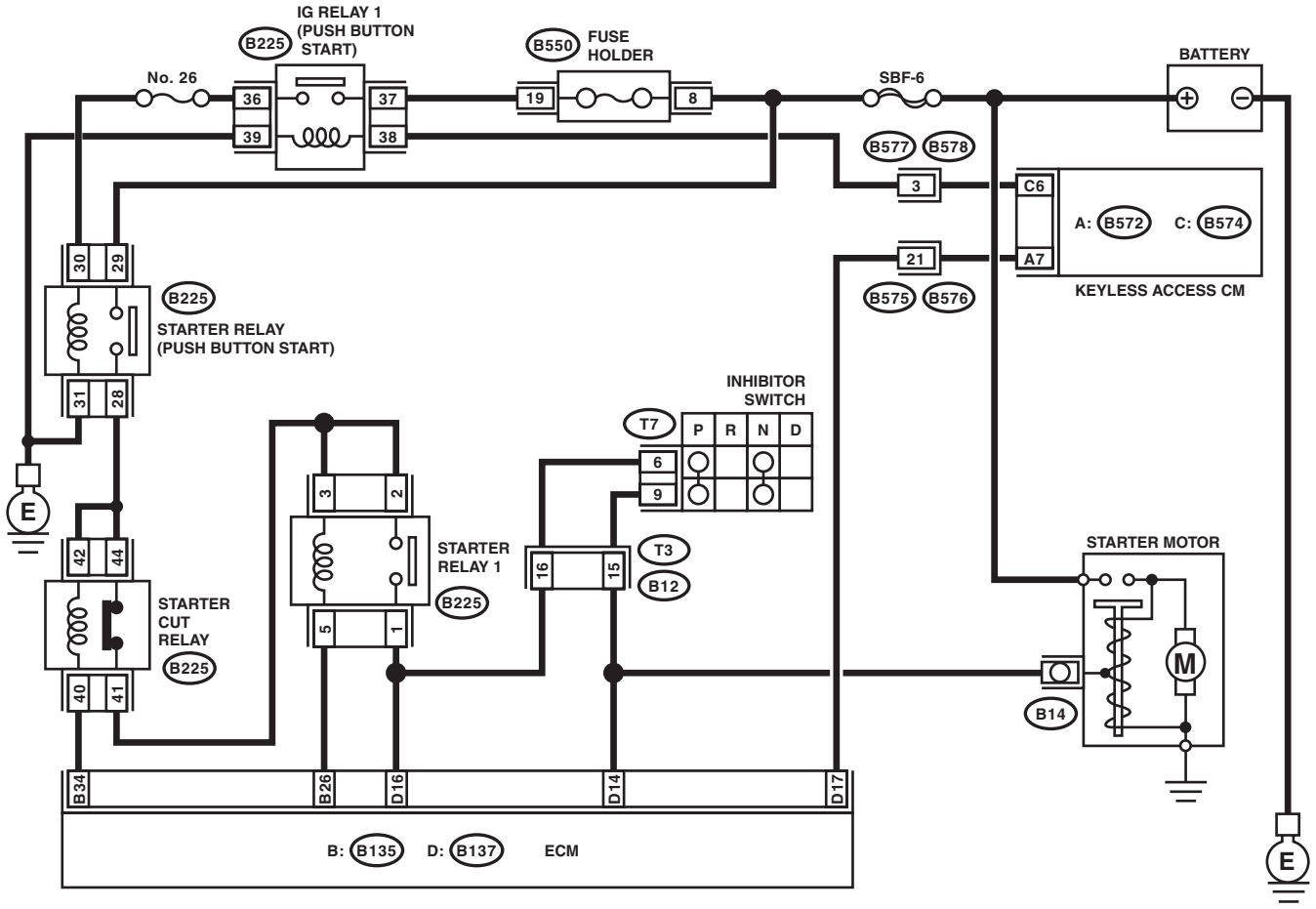
	Step	Check	Yes	No
15	**CHECK INPUT VOLTAGE OF CLUTCH START SWITCH.** 1) Disconnect the connector from clutch start switch. 2) Turn the ignition switch to START. 3) Measure the voltage between the clutch start switch connector and chassis ground. ***Connector & terminal*** ***(B106) No. 1 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **16**.	Check the following item and repair if necessary. • Blown out of fuse • Open or short circuit to ground in harness between ignition switch connector and clutch start switch connector
16	**CHECK CLUTCH START SWITCH.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between clutch start switch terminals while keeping the clutch pedal depressed. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance less than 1 Ω?	Go to step **17**.	Replace the clutch start switch. <Ref. to CL-28, Clutch Switch.>
17	**CHECK HARNESS BETWEEN STARTER RELAY 1 AND CLUTCH START SWITCH.** Measure the resistance of harness between starter relay 1 and clutch start switch connector. ***Connector & terminal*** ***(B225) No. 3 — (B106) No. 2:***	Is the resistance less than 1 Ω?	Go to step **18**.	Repair the open circuit in harness between starter relay 1 and clutch start switch connector.
18	**CHECK HARNESS BETWEEN STARTER RELAY 1 AND STARTER MOTOR.** Measure the resistance of harness between starter relay 1 connector and starter motor. ***Connector & terminal*** ***(B225) No. 1 — (B14) No. 1:***	Is the resistance less than 1 Ω?	Check the engine control module (ECM) power supply and ground line. <Ref. to EN(H4DO w/o HEV)(diag)-85, CHECK POWER SUPPLY AND GROUND LINE OF ENGINE CONTROL MODULE (ECM), Diagnostics for Engine Starting Failure.>	Repair the open circuit of the harness between starter relay 1 connector and starter motor.

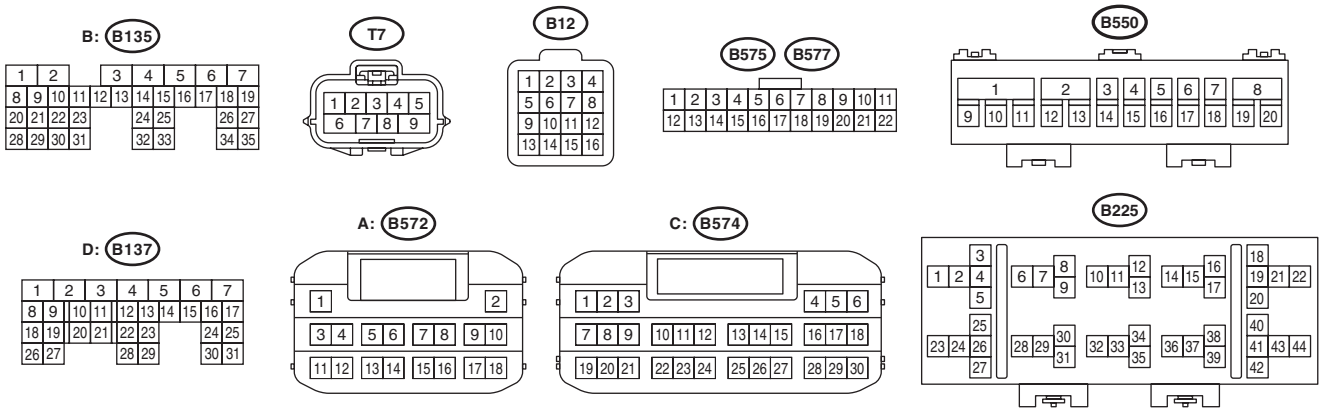
2. MODEL WITH PUSH BUTTON START

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(HEV)-114, WITH PUSH BUTTON START, WIRING DIAGRAM, Engine Electrical System.>





EN-11364

	Step	Check	Yes	No
1	**CHECK DTC.**	Is DTC displayed? <Ref. to EN(H4DO w/o HEV)(diag)-49, OPERATION, Read Diagnostic Trouble Code (DTC).>	Check the appropriate DTC using the “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK NEUTRAL POSITION SWITCH SIGNAL.** 1) Read the value of «Neutral Position Switch» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to “Current Data Display For Engine”. <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> 2) Turn the ignition to ON. 3) Place the select lever in “P” range or “N” range.	Is «Neutral» displayed?	Go to step **3**.	Go to step **8**.
3	**CHECK BATTERY.** Check the battery. <Ref. to SC(H4DO(HEV))-39, Battery.>	Is the battery OK?	Go to step **4**.	Charge or replace the battery. <Ref. to SC(H4DO(HEV))-39, Battery.>
4	**CHECK OPERATION OF STARTER MOTOR.**	Does the starter motor operate?	Check ignition control system. <Ref. to EN(H4DO w/o HEV)(diag)-87, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Go to step **5**.
5	**CHECK PUSH BUTTON IGNITION SWITCH.** Press the push button ignition switch twice with the ignition OFF (ACC OFF). NOTE: Release the brake pedal.	Does the ignition turn to ON?	Go to step **6**.	Check the push button start system. <Ref. to KPS(diag)-109, POWER SUPPLY SWITCHING SYSTEM, INSPECTION, General Diagnostic Table.>
6	**CHECK PUSH BUTTON IGNITION SWITCH.** 1) Depress the brake pedal. NOTE: Shift the select lever to “P” range. 2) Check the push button ignition switch indicator.	Does the indicator turn to green?	Go to step **7**.	Check the push button start system. <Ref. to KPS(diag)-142, ENGINE DOES NOT START, INSPECTION, Diagnostics with Phenomenon.>

	Step	Check	Yes	No
7	**CHECK START SWITCH SIGNAL.** 1) Read the waveform of «Starter SW» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "Current Data Display For Engine". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> 2) Press the push button ignition switch once with the brake pedal depressed.	Does waveform of the «Starter SW» occur?	Go to step **11**.	Go to step **8**.
8	**CHECK HARNESS BETWEEN ECM AND KEYLESS ACCESS CM.** 1) Turn the ignition to OFF. 2) Disconnect the connectors from ECM and keyless access CM. 3) Measure the resistance of harness between ECM connector and keyless access CM. ***Connector & terminal*** ***(B137) No. 17 — (B572) No. 7:***	Is the resistance less than 1 Ω?	Go to step **9**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM connector and keyless access CM connector • Poor contact of coupling connector
9	**CHECK HARNESS BETWEEN ECM AND KEYLESS ACCESS CM.** Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B137) No. 17 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **10**.	Repair the short circuit to ground in harness between ECM connector and keyless access CM connector.
10	**CHECK START SWITCH SIGNAL.** 1) Connect the connector to ECM and keyless access CM. 2) Read the waveform of start switch signal using an oscilloscope. 3) Press the push button ignition switch once with the brake pedal depressed. ***Connector & terminal*** ***(B137) No. 17 (+) — Chassis ground (–):***	Does waveform of the start switch signal occur?	Repair the poor contact of ECM connector.	Repair the poor contact of keyless access CM connector.
11	**CHECK INPUT SIGNAL FOR STARTER MOTOR.** 1) Turn the ignition to OFF. 2) Disconnect the connector from starter motor. 3) Place the select lever in "P" range or "N" range. 4) Press the push button ignition switch once with the brake pedal depressed. 5) Measure the voltage between the starter motor connector and the engine ground. ***Connector & terminal*** ***(B14) No. 1 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Check the starter motor. <Ref. to SC(H4DO(HEV))-10, Starter.>	Go to step **12**.
12	**CHECK HARNESS BETWEEN BATTERY AND STARTER MOTOR.** 1) Turn the ignition to OFF. 2) Measure the voltage between starter motor terminal B and engine ground. ***Terminals*** ***Terminal B (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **13**.	Repair the power supply circuit.

	Step	Check	Yes	No
13	**CHECK IG RELAY 1 (PUSH BUTTON START) POWER SUPPLY.** 1) Remove the IG relay 1 (push button start). 2) Turn the ignition to ON. 3) Measure the voltage between the IG relay 1 (push button start) connector and chassis ground. ***Connector & terminal*** ***(B225) No. 37 (+) — Chassis ground (–):*** ***(B225) No. 38 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **14**.	Check the following item and repair or replace if necessary. • Blown out of fuse • Open circuit or short circuit to ground in harness between IG relay 1 (push button start) connector and keyless access CM connector • Open circuit or short circuit to ground in harness between IG relay 1 (push button start) connector and 12 volt auxiliary battery • Poor contact of coupling connector
14	**CHECK HARNESS BETWEEN IG RELAY 1 (PUSH BUTTON START) CONNECTOR AND CHASSIS GROUND.** 1) Turn the ignition to OFF. 2) Measure the resistance of harness between the IG relay 1 (push button start) connector and chassis ground. ***Connector & terminal*** ***(B225) No. 39 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **15**.	Repair the open circuit in harness between the IG relay 1 (push button start) connector and chassis ground.
15	**CHECK IG RELAY 1 (PUSH BUTTON START).** 1) Connect the battery to IG relay 1 (push button start) terminals No. 38 and No. 39. 2) Measure the resistance between IG relay 1 (push button start) terminals. ***Terminals*** ***No. 36 — No. 37:***	Is the resistance less than 1 Ω?	Go to step **16**.	Replace the IG relay 1 (push button start). <Ref. to SL-119, IG Relay1 (Push Button Start).>

	Step	Check	Yes	No
16	**CHECK STARTER RELAY (PUSH BUTTON START) POWER SUPPLY.** 1) Install the IG relay 1 (push button start). 2) Remove the starter relay (push button start). 3) Turn the ignition to ON. 4) Measure the voltage between starter relay (push button start) connector and chassis ground. ***Connector & terminal*** ***(B225) No. 29 (+) — Chassis ground (–):*** ***(B225) No. 30 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **17**.	Check the following item and repair or replace if necessary. • Blown out of fuse (F/B No. 26) • Open circuit or short circuit to ground in harness between starter relay (push button start) connector and IG relay 1 (push button start) connector • Open circuit or short circuit to ground in harness between starter relay (push button start) connector and 12 volt auxiliary battery
17	**CHECK HARNESS BETWEEN STARTER RELAY (PUSH BUTTON START) CONNECTOR AND CHASSIS GROUND.** 1) Turn the ignition to OFF. 2) Measure the resistance of harness between starter relay (push button start) connector and chassis ground. ***Connector & terminal*** ***(B225) No. 31 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **18**.	Repair the open circuit in harness between starter relay (push button start) connector and chassis ground.
18	**CHECK STARTER RELAY (PUSH BUTTON START).** 1) Connect the battery to starter relay (push button start) terminals No. 30 and No. 31. 2) Measure the resistance between starter relay (push button start) terminals. ***Terminals*** ***No. 28 — No. 29:***	Is the resistance less than 1 Ω?	Go to step **19**.	Replace the starter relay (push button start). <Ref. to SL-117, Starter Relay (Push Button Start).>
19	**CHECK HARNESS BETWEEN STARTER RELAY (PUSH BUTTON START) CONNECTOR AND STARTER CUT RELAY CONNECTOR.** 1) Remove the starter cut relay. 2) Measure the resistance of harness between starter relay (push button start) connector and starter cut relay connector. ***Connector & terminal*** ***(B225) No. 28 — (B225) No. 42:*** ***(B225) No. 28 — (B225) No. 44:***	Is the resistance less than 1 Ω?	Go to step **20**.	Repair the open circuit in harness between starter relay (push button start) connector and starter cut relay connector.
20	**CHECK HARNESS BETWEEN ECM AND STARTER CUT RELAY CONNECTOR.** 1) Disconnect the connector from ECM. 2) Measure the resistance between starter cut relay connector and chassis ground. ***Connector & terminal*** ***(B225) No. 40 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **21**.	Repair the short circuit to ground in harness between ECM connector and starter cut relay connector.

	Step	Check	Yes	No
21	**CHECK STARTER CUT RELAY.** Measure the resistance between starter cut relay terminals. ***Terminals*** ***No. 41 — No. 44:***	Is the resistance less than 1 Ω?	Go to step **22**.	Replace the starter cut relay. <Ref. to SL-124, Starter Cut Relay.>
22	**CHECK HARNESS BETWEEN STARTER CUT RELAY CONNECTOR AND STARTER RELAY 1 CONNECTOR.** 1) Remove the starter relay 1. 2) Measure the resistance of harness between starter cut relay connector and starter relay 1 connector. ***Connector & terminal*** ***(B225) No. 41 — (B225) No. 2:*** ***(B225) No. 41 — (B225) No. 3:***	Is the resistance less than 1 Ω?	Go to step **23**.	Repair the open circuit of harness between starter cut relay connector and starter relay 1 connector.
23	**CHECK HARNESS BETWEEN ECM AND STARTER RELAY 1 CONNECTOR.** Measure the resistance of harness between ECM connector and starter relay 1 connector. ***Connector & terminal*** ***(B135) No. 26 — (B225) No. 5:***	Is the resistance less than 1 Ω?	Go to step **24**.	Repair the open circuit of harness between ECM connector and starter relay 1 connector.
24	**CHECK STARTER RELAY 1.** 1) Connect the battery to starter relay 1 terminals No. 3 and No. 5. 2) Measure the resistance between starter relay 1 terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance less than 1 Ω?	Go to step **25**.	Replace the starter relay 1. <Ref. to EN(H4DO w/o HEV)(diag)-9, LOCATION, Electrical Component Location.>
25	**CHECK HARNESS BETWEEN STARTER RELAY 1 CONNECTOR AND INHIBITOR SWITCH CONNECTOR.** 1) Disconnect the connector from inhibitor switch. 2) Measure the resistance of harness between starter relay 1 connector and inhibitor switch connector. ***Connector & terminal*** ***(B225) No. 1 — (T7) No. 6:***	Is the resistance less than 1 Ω?	Go to step **26**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between starter relay 1 connector and inhibitor switch connector • Poor contact of coupling connector
26	**CHECK INHIBITOR SWITCH.** 1) Place the select lever in “P” range and “N” range. 2) Measure the resistance between inhibitor switch terminals. ***Terminals*** ***No. 6 — No. 9:***	Is the resistance less than 1 Ω?	Go to step **27**.	Replace the inhibitor switch. <Ref. to CVT(TH58A)-97, Inhibitor Switch.>
27	**CHECK HARNESS BETWEEN ECM AND INHIBITOR SWITCH CONNECTOR.** 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM connector and inhibitor switch connector. ***Connector & terminal*** ***(B137) No. 16 — (T7) No. 6:***	Is the resistance less than 1 Ω?	Go to step **28**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and inhibitor switch connector • Poor contact of coupling connector

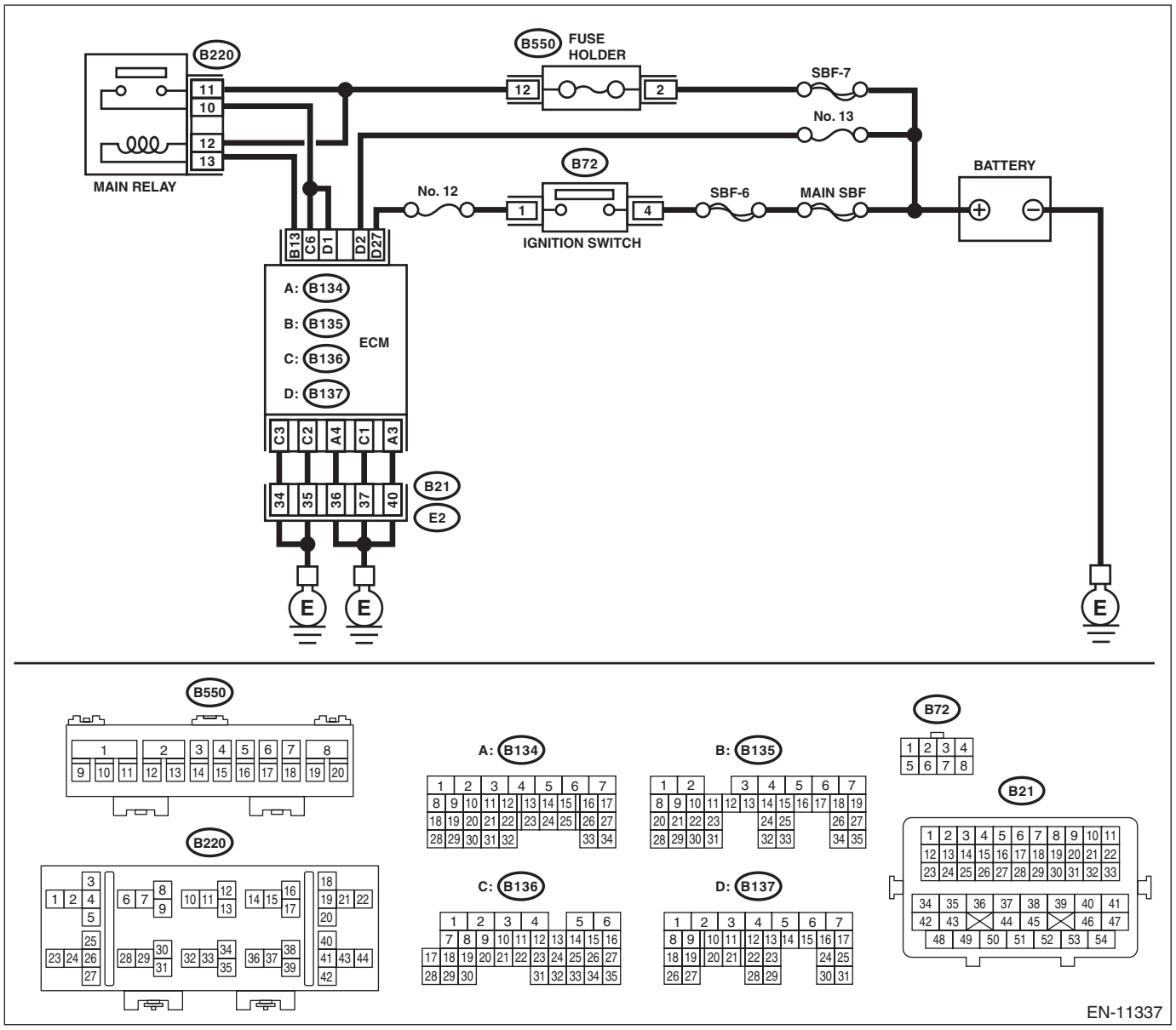
	Step	Check	Yes	No
28	**CHECK HARNESS BETWEEN INHIBITOR SWITCH AND STARTER MOTOR.** Measure the resistance of harness between the inhibitor switch connector and starter motor. ***Connector & terminal*** ***(T7) No. 9 — (B14) No. 1:***	Is the resistance less than 1 Ω?	Check the engine control module (ECM) power supply and ground line. <Ref. to EN(H4DO w/o HEV)(diag)-85, CHECK POWER SUPPLY AND GROUND LINE OF ENGINE CONTROL MODULE (ECM), Diagnostics for Engine Starting Failure.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between inhibitor switch connector and starter motor connector • Poor contact of coupling connector

C: CHECK POWER SUPPLY AND GROUND LINE OF ENGINE CONTROL MODULE (ECM)

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



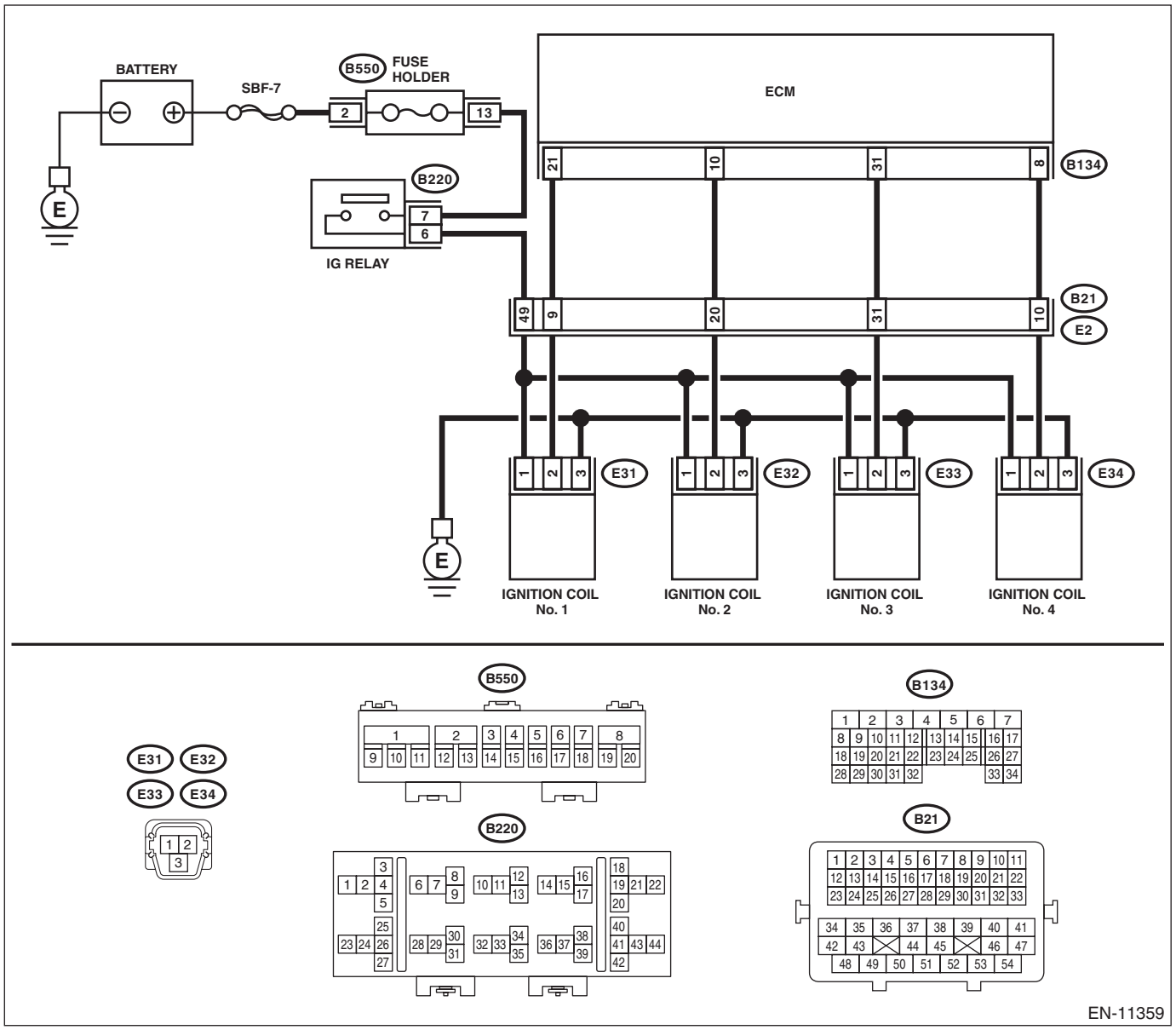
Step		Check	Yes	No
1	**CHECK MAIN RELAY.** 1) Turn the ignition switch to OFF. 2) Remove the main relay. 3) Connect the battery to main relay terminals No. 12 and No. 13. 4) Measure the resistance between main relay terminals. ***Terminals*** ***No. 10 — No. 11:***	Is the resistance less than 1 Ω?	Go to step **2**.	Replace the main relay. <Ref. to FU(H4DO(w/o HEV))-102, Main Relay.>

	Step	Check	Yes	No
2	**CHECK GROUND CIRCUIT FOR ECM.** 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 3 — Chassis ground:*** ***(B134) No. 4 — Chassis ground:*** ***(B136) No. 1 — Chassis ground:*** ***(B136) No. 2 — Chassis ground:*** ***(B136) No. 3 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM connector and engine ground terminal • Poor contact of coupling connector
3	**CHECK INPUT VOLTAGE OF ECM.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B137) No. 2 (+) — Chassis ground (–):*** ***(B137) No. 27 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **4**.	Repair the open or ground short circuit of harness of power supply circuit.
4	**CHECK INPUT VOLTAGE OF MAIN RELAY.** Measure the voltage between main relay connector and chassis ground. ***Connector & terminal*** ***(B220) No. 11 (+) — Chassis ground (–):*** ***(B220) No. 12 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **5**.	Repair the open or ground short circuit of harness of power supply circuit.
5	**CHECK INPUT VOLTAGE OF ECM.** 1) Turn the ignition switch to OFF. 2) Install the main relay. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 13 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **6**.	Repair the open circuit of harness between ECM connector and main relay connector.
6	**CHECK INPUT VOLTAGE OF ECM.** 1) Turn the ignition switch to OFF. 2) Connect the connector to ECM. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 6 (+) — Chassis ground (–):*** ***(B137) No. 1 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Check ignition control system. <Ref. to EN(H4DO w/o HEV)(diag)-87, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and main relay connector • Poor contact of main relay connector • Poor contact of ECM connector

D: IGNITION CONTROL SYSTEM

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, Inspection Mode.>.

WIRING DIAGRAM:
Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



Step		Check	Yes	No
1	**CHECK SPARK PLUG CONDITION.** 1) Remove the spark plug. <Ref. to IG(H4DO(w/o HEV))-4, REMOVAL, Spark Plug.> 2) Check the spark plug condition. <Ref. to IG(H4DO(w/o HEV))-7, INSPECTION, Spark Plug.>	Is the spark plug condition normal?	Go to step **2**.	Replace the spark plug. <Ref. to IG(H4DO(w/o HEV))-4, Spark Plug.>

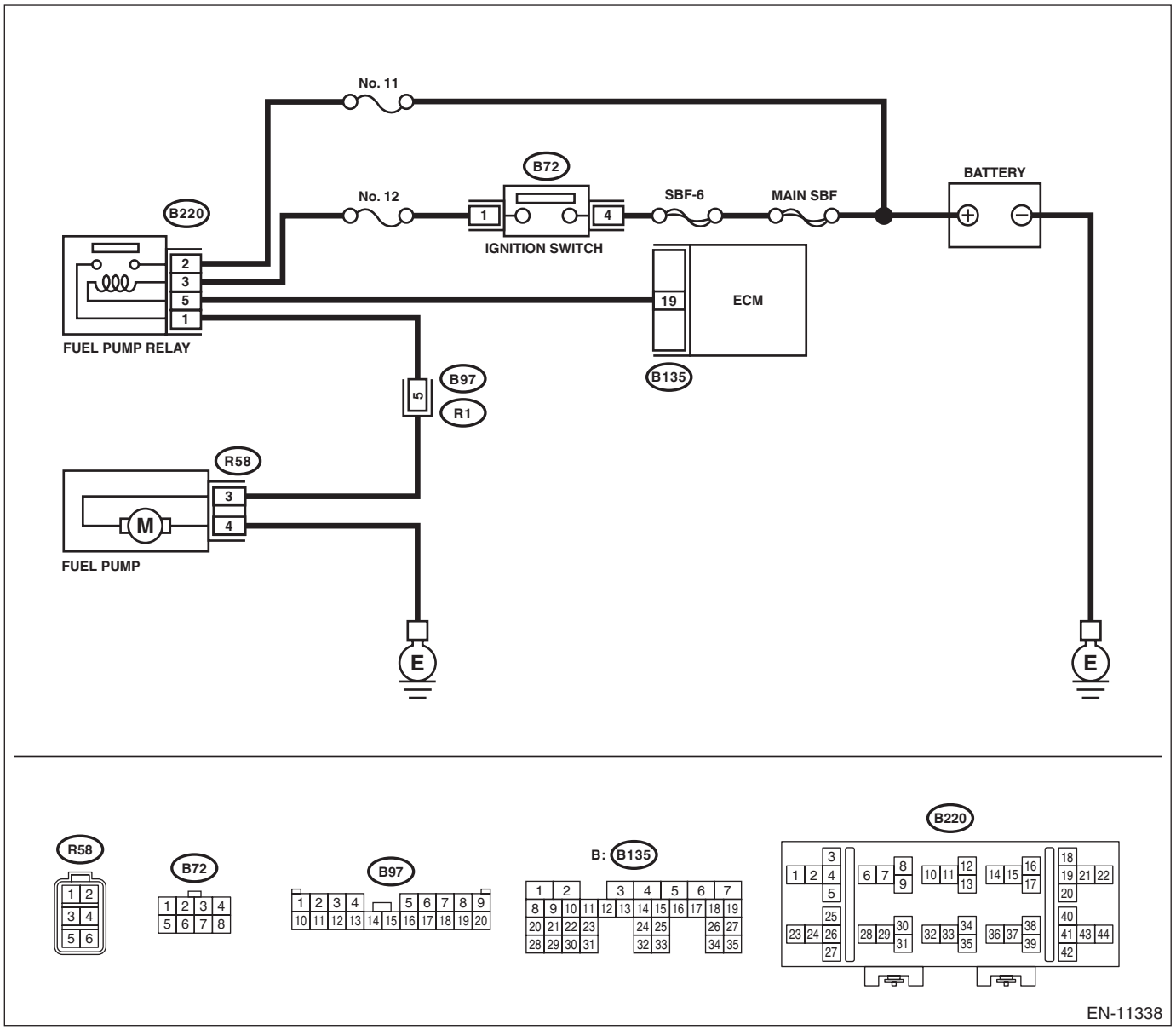
	Step	Check	Yes	No
2	**CHECK IGNITION SYSTEM FOR SPARKS.** 1) Connect the spark plug to ignition coil. 2) Release the fuel pressure. <Ref. to FU(H4DO(w/o HEV))-109, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.> 3) Contact the spark plug thread portion to engine. 4) While opening the throttle valve fully, crank the engine to check that spark occurs at each cylinder.	Does spark occur at each cylinder?	Check fuel pump system. <Ref. to EN(H4DO w/o HEV)(diag)-89, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>	Go to step **3**.
3	**CHECK IGNITION COIL POWER SUPPLY CIRCUIT.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ignition coil. 3) Turn the ignition switch to ON. 4) Measure the voltage between ignition coil connector and engine ground. ***Connector & terminal*** ***(E31) No. 1 (+) — Engine ground (–):*** ***(E32) No. 1 (+) — Engine ground (–):*** ***(E33) No. 1 (+) — Engine ground (–):*** ***(E34) No. 1 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit or short circuit to ground in harness of power supply circuit • Poor contact of coupling connector • Blown out of fuse
4	**CHECK HARNESS OF IGNITION COIL GROUND CIRCUIT.** 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between ignition coil connector and engine ground. ***Connector & terminal*** ***(E31) No. 3 — Engine ground:*** ***(E32) No. 3 — Engine ground:*** ***(E33) No. 3 — Engine ground:*** ***(E34) No. 3 — Engine ground:***	Is the resistance less than 5 Ω?	Go to step **5**.	Repair the open circuit in harness between ignition coil connector and engine grounding terminal.
5	**CHECK HARNESS BETWEEN ECM AND IGNITION COIL CONNECTOR.** 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM connector and ignition coil connector. ***Connector & terminal*** ***(B134) No. 21 — (E31) No. 2:*** ***(B134) No. 10 — (E32) No. 2:*** ***(B134) No. 31 — (E33) No. 2:*** ***(B134) No. 8 — (E34) No. 2:***	Is the resistance less than 1 Ω?	Go to step **6**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM connector and the ignition coil connector • Poor contact of coupling connector
6	**CHECK HARNESS BETWEEN ECM AND IGNITION COIL CONNECTOR.** Measure the resistance of harness between ECM connector and engine ground. ***Connector & terminal:*** ***(B134) No. 21 — Engine ground:*** ***(B134) No. 10 — Engine ground:*** ***(B134) No. 31 — Engine ground:*** ***(B134) No. 8 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **7**.	Repair the ground short circuit of harness between ECM connector and ignition coil connector.
7	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM connector.	Is there poor contact of ECM connector?	Repair the poor contact of ECM connector.	Replace the ignition coil. <Ref. to IG(H4DO(w/o HEV))-12, Ignition Coil.>

E: FUEL PUMP CIRCUIT

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



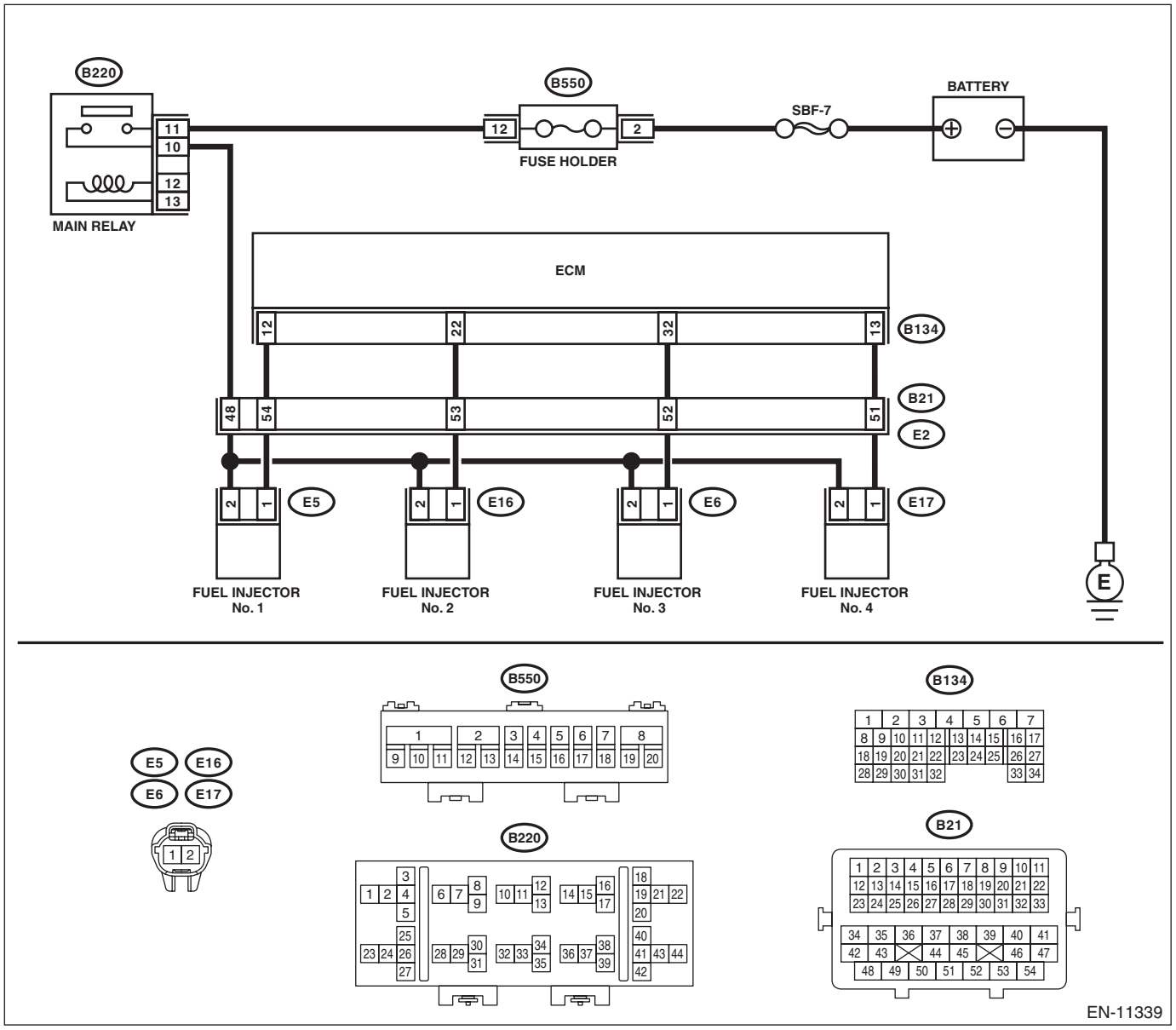
	Step	Check	Yes	No
1	**CHECK OPERATING SOUND OF FUEL PUMP.** Check if the fuel pump operates for two seconds when turning the ignition switch to ON. NOTE: Fuel pump operation can be executed using the Subaru Select Monitor. For detailed procedures, refer to "SYSTEM OPERATION CHECK MODE". <Ref. to EN(H4DO w/o HEV)(diag)-66, System Operation Check Mode.>	Does the fuel pump emit operating sound?	Check the fuel injector circuit. <Ref. to EN(H4DO w/o HEV)(diag)-92, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.>	Go to step **2**.
2	**CHECK GROUND CIRCUIT OF FUEL PUMP.** 1) Turn the ignition switch to OFF. 2) Remove the fuel pump access hole lid. 3) Disconnect the connector from fuel pump. 4) Measure the resistance of harness between fuel pump and chassis ground. ***Connector & terminal*** ***(R58) No. 4 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **3**.	Repair the open circuit in harness between fuel pump connector and chassis ground terminal.
3	**CHECK POWER SUPPLY TO FUEL PUMP.** 1) Turn the ignition switch to ON. 2) Measure the voltage of power supply circuit between fuel pump connector and chassis ground. ***Connector & terminal*** ***(R58) No. 3 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Replace the fuel pump. <Ref. to FU(H4DO(w/o HEV))-137, Fuel Pump.>	Go to step **4**.
4	**CHECK HARNESS BETWEEN FUEL PUMP CONNECTOR AND FUEL PUMP RELAY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Remove the fuel pump relay. 3) Measure the resistance of harness between fuel pump connector and fuel pump relay connector. ***Connector & terminal*** ***(R58) No. 3 — (B220) No. 1:***	Is the resistance less than 1 Ω?	Go to step **5**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between fuel pump connector and fuel pump relay connector • Poor contact of coupling connector
5	**CHECK HARNESS BETWEEN FUEL PUMP CONNECTOR AND FUEL PUMP RELAY CONNECTOR.** Measure the resistance between fuel pump connector and chassis ground. ***Connector & terminal*** ***(R58) No. 3 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **6**.	Repair the short circuit to ground in harness between fuel pump connector and fuel pump relay connector.
6	**CHECK FUEL PUMP RELAY.** 1) Connect the battery to fuel pump relay terminals No. 3 and No. 5. 2) Measure the resistance between fuel pump relay terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance less than 1 Ω?	Go to step **7**.	Replace the fuel pump relay. <Ref. to FU(H4DO(w/o HEV))-104, Fuel Pump Relay.>
7	**CHECK HARNESS BETWEEN ECM AND FUEL PUMP RELAY CONNECTOR.** 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM connector and fuel pump relay connector. ***Connector & terminal*** ***(B135) No. 19 — (B220) No. 5:***	Is the resistance less than 1 Ω?	Go to step **8**.	Repair the open circuit of harness between ECM connector and fuel pump relay connector.

	Step	Check	Yes	No
8	**CHECK POWER SUPPLY OF FUEL PUMP RELAY.** 1) Turn the ignition switch to ON. 2) Measure the voltage between fuel pump relay connector and chassis ground. ***Connector & terminal*** ***(B220) No. 2 (+) — Chassis ground (–):*** ***(B220) No. 3 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the poor contact of ECM connector.	Repair the open or ground short circuit of harness of power supply circuit.

F: FUEL INJECTOR CIRCUIT

CAUTION:
- **Check or repair only faulty parts.**
- **After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.**

WIRING DIAGRAM:
Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



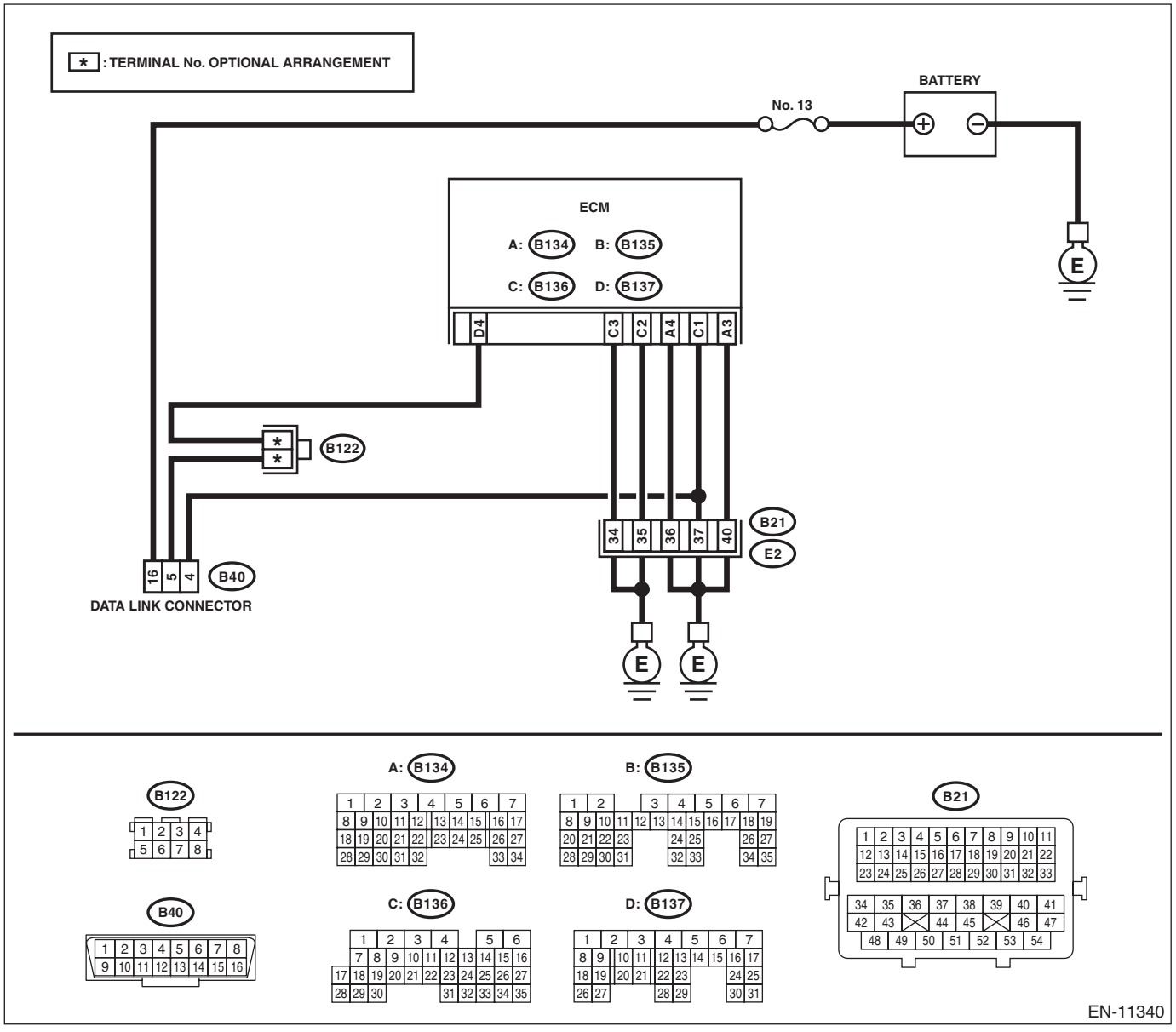
Step		Check	Yes	No
1	**CHECK OPERATION OF EACH FUEL INJECTOR.** While cranking the engine, check each fuel injector emits operating sound. Use a sound scope or attach a screwdriver to the injector to listen to sounds for this check.	Does the fuel injector emit operating sound?	Check the fuel pressure. <Ref. to ME(H4DO(w/o HEV))-35, INSPECTION, Fuel Pressure.>	Go to step **2**.

	Step	Check	Yes	No
2	**CHECK POWER SUPPLY TO EACH FUEL INJECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector. 3) Turn the ignition switch to ON. 4) Measure the power supply voltage between fuel injector terminal and engine ground. ***Connector & terminal*** ***#1 (E5) No. 2 (+) — Engine ground (–):*** ***#2 (E16) No. 2 (+) — Engine ground (–):*** ***#3 (E6) No. 2 (+) — Engine ground (–):*** ***#4 (E17) No. 2 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between main relay connector and fuel injector connector • Poor contact of main relay connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM connector and fuel injector connector. ***Connector & terminal*** ***#1 (B134) No. 12 — (E5) No. 1:*** ***#2 (B134) No. 22 — (E16) No. 1:*** ***#3 (B134) No. 32 — (E6) No. 1:*** ***#4 (B134) No. 13 — (E17) No. 1:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and fuel injector connector • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***#1 (B134) No. 12 — Chassis ground:*** ***#2 (B134) No. 22 — Chassis ground:*** ***#3 (B134) No. 32 — Chassis ground:*** ***#4 (B134) No. 13 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the short circuit to ground in harness between ECM connector and fuel injector connector.
5	**CHECK EACH FUEL INJECTOR.** Measure the resistance between each fuel injector terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 5 — 20 Ω?	Go to step **6**.	Replace the faulty fuel injector. <Ref. to FU(H4DO(w/o HEV))-79, Fuel Injector.>
6	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM connector.	Is there poor contact of ECM connector?	Repair the poor contact of ECM connector.	Inspection using “General Diagnostic Table” <Ref. to EN(H4DO w/o HEV)(diag)-379, INSPECTION, General Diagnostic Table.>

17.Diagnostic Procedure for Subaru Select Monitor Communication

A: COMMUNICATION FOR INITIALIZING IMPOSSIBLE

DIAGNOSIS:
Open or short circuit in data link connector
TROUBLE SYMPTOM:
Subaru Select Monitor communication failure
WIRING DIAGRAM:
Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



Step		Check	Yes	No
1	**CHECK POWER SUPPLY CIRCUIT.** Connect the SDI (Subaru Diagnosis Interface) or general scan tool to data link connector.	Does SDI or general scan tool turn ON?	Go to step **4**.	Go to step **2**.

	Step	Check	Yes	No
2	**CHECK POWER SUPPLY CIRCUIT.** Measure the voltage between data link connector and chassis ground. ***Connector & terminal*** ***(B40) No. 16 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **3**.	Repair the power supply circuit. NOTE: In this case, repair the following item: • Open or ground short circuit of harness between battery and data link connector • Blown out of fuse (M/B No. 13)
3	**CHECK HARNESS BETWEEN DATA LINK CONNECTOR AND CHASSIS GROUND.** 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between data link connector and chassis ground. ***Connector & terminal*** ***(B40) No. 4 — Chassis ground:*** ***(B40) No. 5 — Chassis ground:***	Is the resistance less than 5 Ω?	Repair the poor contact of data link connector.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and data link connector • Open circuit of harness between ECM connector and engine ground • Poor contact of ECM connector • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN ECM AND DATA LINK CONNECTOR.** Measure the resistance between data link connector and chassis ground. ***Connector & terminal*** ***(B40) No. 7 — Chassis ground:***	Is the resistance 1 MΩ or more?	Repair the poor contact of the ECM or data link connector.	Repair the short circuit to ground in harness between ECM connector and data link connector.

18.List of Diagnostic Trouble Code (DTC)

A: LIST

DTC	Item	Note
B1570	Antenna	<Ref. to IM(diag)-16, DTC B1570 ANTENNA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
B1571	Reference Code Incompatibility	<Ref. to IM(diag)-18, DTC B1571 REFERENCE CODE INCOMPATIBILITY, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
B1572	IMM Circuit Failure (Except Antenna Circuit)	<Ref. to IM(diag)-19, DTC B1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
B1574	Key Communication Failure	<Ref. to IM(diag)-22, DTC B1574 KEY COMMUNICATION FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
B1575	Incorrect Immobilizer Key	<Ref. to IM(diag)-22, DTC B1575 INCORRECT IMMOBILIZER KEY, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
B1576	EGI Control Module EEPROM	<Ref. to IM(diag)-23, DTC B1576 EGI CONTROL MODULE EEPROM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
B1577	IMM Control Module EEPROM	<Ref. to IM(diag)-23, DTC B1577 IMM CONTROL MODULE EEPROM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
B1578	Meter Failure	<Ref. to IM(diag)-24, DTC B1578 METER FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P000A	A Camshaft Position Slow Response (Bank 1)	<Ref. to EN(H4DO w/o HEV)(diag)-105, DTC P000A A CAMSHAFT POSITION SLOW RESPONSE (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P000B	B Camshaft Position Slow Response (Bank 1)	<Ref. to EN(H4DO w/o HEV)(diag)-105, DTC P000B B CAMSHAFT POSITION SLOW RESPONSE (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P000C	A Camshaft Position Slow Response (Bank 2)	<Ref. to EN(H4DO w/o HEV)(diag)-105, DTC P000C A CAMSHAFT POSITION SLOW RESPONSE (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P000D	B Camshaft Position Slow Response (Bank 2)	<Ref. to EN(H4DO w/o HEV)(diag)-105, DTC P000D B CAMSHAFT POSITION SLOW RESPONSE (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0010	"A" Camshaft Position Actuator Circuit/Open (Bank 1)	<Ref. to EN(H4DO w/o HEV)(diag)-106, DTC P0010 "A" CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0011	Intake Camshaft Position - Timing Over-Advanced or System Performance (Bank 1)	<Ref. to EN(H4DO w/o HEV)(diag)-108, DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0013	B Camshaft Position Actuator Circuit/Open (Bank 1)	<Ref. to EN(H4DO w/o HEV)(diag)-109, DTC P0013 B CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0014	Exhaust AVCS System 1 (Range/Performance)	<Ref. to EN(H4DO w/o HEV)(diag)-111, DTC P0014 EXHAUST AVCS SYSTEM 1 (RANGE/PERFORMANCE), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0016	Crankshaft Position - Camshaft Position Correlation (Bank1)	<Ref. to EN(H4DO w/o HEV)(diag)-112, DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0017	Crank and Cam Timing B System Failure (Bank 1)	<Ref. to EN(H4DO w/o HEV)(diag)-114, DTC P0017 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0018	Crankshaft Position - Camshaft Position Correlation (Bank2)	<Ref. to EN(H4DO w/o HEV)(diag)-116, DTC P0018 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0019	Crank and Cam Timing B System Failure (Bank 2)	<Ref. to EN(H4DO w/o HEV)(diag)-118, DTC P0019 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC	Item	Note
P0020	"A" Camshaft Position Actuator Circuit/Open (Bank 2)	<Ref. to EN(H4DO w/o HEV)(diag)-120, DTC P0020 "A" CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0021	Intake Camshaft Position - Timing Over-Advanced or System Performance (Bank 2)	<Ref. to EN(H4DO w/o HEV)(diag)-122, DTC P0021 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0023	B Camshaft Position Actuator Circuit/Open (Bank 2)	<Ref. to EN(H4DO w/o HEV)(diag)-123, DTC P0023 B CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0024	Exhaust AVCS System 2 (Range/Performance)	<Ref. to EN(H4DO w/o HEV)(diag)-125, DTC P0024 EXHAUST AVCS SYSTEM 2 (RANGE/PERFORMANCE), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	<Ref. to EN(H4DO w/o HEV)(diag)-126, DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)	<Ref. to EN(H4DO w/o HEV)(diag)-128, DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0032	HO2S Heater Control Circuit High (Bank 1 Sensor 1)	<Ref. to EN(H4DO w/o HEV)(diag)-130, DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0037	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)	<Ref. to EN(H4DO w/o HEV)(diag)-132, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0038	HO2S Heater Control Circuit High (Bank 1 Sensor 2)	<Ref. to EN(H4DO w/o HEV)(diag)-134, DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0068	MAP/MAF - Throttle Position Correlation	<Ref. to EN(H4DO w/o HEV)(diag)-136, DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0071	Ambient Temperature Sensor Circuit "A" Range/Performance	<Ref. to EN(H4DO w/o HEV)(diag)-137, DTC P0071 AMBIENT TEMPERATURE SENSOR CIRCUIT "A" RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0072	Ambient Temperature Sensor Circuit "A" Low	<Ref. to EN(H4DO w/o HEV)(diag)-139, DTC P0072 AMBIENT TEMPERATURE SENSOR CIRCUIT "A" LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0073	Ambient Temperature Sensor Circuit "A" High	<Ref. to EN(H4DO w/o HEV)(diag)-139, DTC P0073 AMBIENT TEMPERATURE SENSOR CIRCUIT "A" HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0101	Mass or Volume Air Flow Circuit Range/Performance	<Ref. to EN(H4DO w/o HEV)(diag)-140, DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0102	Mass or Volume Air Flow Circuit Low Input	<Ref. to EN(H4DO w/o HEV)(diag)-141, DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0103	Mass or Volume Air Flow Circuit High Input	<Ref. to EN(H4DO w/o HEV)(diag)-143, DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0107	Manifold Absolute Pressure/ Barometric Pressure Circuit Low Input	<Ref. to EN(H4DO w/o HEV)(diag)-145, DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0108	Manifold Absolute Pressure/ Barometric Pressure Circuit High Input	<Ref. to EN(H4DO w/o HEV)(diag)-147, DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0111	Intake Air Temperature Sensor Range/Performance Problem	<Ref. to EN(H4DO w/o HEV)(diag)-149, DTC P0111 INTAKE AIR TEMPERATURE SENSOR RANGE/PERFORMANCE PROBLEM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0112	Intake Air Temperature Sensor 1 Circuit Low	<Ref. to EN(H4DO w/o HEV)(diag)-150, DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC	Item	Note
P0113	Intake Air Temperature Sensor 1 Circuit High	<Ref. to EN(H4DO w/o HEV)(diag)-152, DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	<Ref. to EN(H4DO w/o HEV)(diag)-154, DTC P0116 ENGINE COOLANT TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0117	Engine Coolant Temperature Circuit Low	<Ref. to EN(H4DO w/o HEV)(diag)-155, DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0118	Engine Coolant Temperature Circuit High	<Ref. to EN(H4DO w/o HEV)(diag)-157, DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0122	Throttle/Pedal Position Sensor/Switch “A” Circuit Low	<Ref. to EN(H4DO w/o HEV)(diag)-159, DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0123	Throttle/Pedal Position Sensor/Switch “A” Circuit High	<Ref. to EN(H4DO w/o HEV)(diag)-161, DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	<Ref. to EN(H4DO w/o HEV)(diag)-163, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0128	Coolant Thermostat (Engine Coolant Temperature Below Thermostat Regulating Temperature)	<Ref. to EN(H4DO w/o HEV)(diag)-164, DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	<Ref. to EN(H4DO w/o HEV)(diag)-165, DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	<Ref. to EN(H4DO w/o HEV)(diag)-167, DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0134	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	<Ref. to EN(H4DO w/o HEV)(diag)-169, DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0137	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	<Ref. to EN(H4DO w/o HEV)(diag)-171, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0138	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	<Ref. to EN(H4DO w/o HEV)(diag)-173, DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P013A	O2 Sensor Slow Response - Rich to Lean (Bank 1 Sensor 2)	<Ref. to EN(H4DO w/o HEV)(diag)-175, DTC P013A O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P013B	O2 Sensor Slow Response - Lean to Rich (Bank 1 Sensor 2)	<Ref. to EN(H4DO w/o HEV)(diag)-177, DTC P013B O2 SENSOR SLOW RESPONSE - LEAN TO RICH (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P013E	O2 Sensor Delayed Response - Rich to Lean (Bank 1 Sensor 2)	<Ref. to EN(H4DO w/o HEV)(diag)-177, DTC P013E O2 SENSOR DELAYED RESPONSE - RICH TO LEAN (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P013F	O2 Sensor Delayed Response - Lean to Rich (Bank 1 Sensor 2)	<Ref. to EN(H4DO w/o HEV)(diag)-177, DTC P013F O2 SENSOR DELAYED RESPONSE - LEAN TO RICH (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0141	O2 Sensor Heater Circuit (Bank1 Sensor2)	<Ref. to EN(H4DO w/o HEV)(diag)-177, DTC P0141 O2 SENSOR HEATER CIRCUIT (BANK1 SENSOR2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P014C	O2 Sensor Slow Response - Rich to Lean (Bank 1 Sensor 1)	<Ref. to EN(H4DO w/o HEV)(diag)-178, DTC P014C O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC	Item	Note
P014D	O2 Sensor Slow Response - Lean to Rich (Bank 1 Sensor 1)	<Ref. to EN(H4DO w/o HEV)(diag)-178, DTC P014D O2 SENSOR SLOW RESPONSE - LEAN TO RICH (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P015A	O2 Sensor Delayed Response - Rich to Lean (Bank 1 Sensor 1)	<Ref. to EN(H4DO w/o HEV)(diag)-178, DTC P015A O2 SENSOR DELAYED RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P015B	O2 Sensor Delayed Response - Lean to Rich (Bank 1 Sensor 1)	<Ref. to EN(H4DO w/o HEV)(diag)-178, DTC P015B O2 SENSOR DELAYED RESPONSE - LEAN TO RICH (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0171	System Too Lean (Bank 1)	<Ref. to EN(H4DO w/o HEV)(diag)-178, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0172	System Too Rich (Bank 1)	<Ref. to EN(H4DO w/o HEV)(diag)-179, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0196	Engine Oil Temperature Sensor Circuit Range/Performance	<Ref. to EN(H4DO w/o HEV)(diag)-181, DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0197	Engine Oil Temperature Sensor Low	<Ref. to EN(H4DO w/o HEV)(diag)-182, DTC P0197 ENGINE OIL TEMPERATURE SENSOR LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0198	Engine Oil Temperature Sensor High	<Ref. to EN(H4DO w/o HEV)(diag)-184, DTC P0198 ENGINE OIL TEMPERATURE SENSOR HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0201	Injector #1	<Ref. to EN(H4DO w/o HEV)(diag)-186, DTC P0201 INJECTOR #1, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0202	Injector #2	<Ref. to EN(H4DO w/o HEV)(diag)-188, DTC P0202 INJECTOR #2, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0203	Injector #3	<Ref. to EN(H4DO w/o HEV)(diag)-188, DTC P0203 INJECTOR #3, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0204	Injector #4	<Ref. to EN(H4DO w/o HEV)(diag)-188, DTC P0204 INJECTOR #4, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0222	Throttle/Pedal Position Sensor/ Switch “B” Circuit Low	<Ref. to EN(H4DO w/o HEV)(diag)-189, DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0223	Throttle/Pedal Position Sensor/ Switch “B” Circuit High	<Ref. to EN(H4DO w/o HEV)(diag)-191, DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0300	Random/Multiple Cylinder Misfire Detected	<Ref. to EN(H4DO w/o HEV)(diag)-193, DTC P0300 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0301	Cylinder 1 Misfire Detected	<Ref. to EN(H4DO w/o HEV)(diag)-197, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0302	Cylinder 2 Misfire Detected	<Ref. to EN(H4DO w/o HEV)(diag)-197, DTC P0302 CYLINDER 2 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0303	Cylinder 3 Misfire Detected	<Ref. to EN(H4DO w/o HEV)(diag)-197, DTC P0303 CYLINDER 3 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0304	Cylinder 4 Misfire Detected	<Ref. to EN(H4DO w/o HEV)(diag)-198, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0327	Knock Sensor 1 Circuit Low (Bank 1 or Single Sensor)	<Ref. to EN(H4DO w/o HEV)(diag)-202, DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0328	Knock Sensor 1 Circuit High (Bank 1 or Single Sensor)	<Ref. to EN(H4DO w/o HEV)(diag)-204, DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0335	Crankshaft Position Sensor “A” Circuit	<Ref. to EN(H4DO w/o HEV)(diag)-206, DTC P0335 CRANKSHAFT POSITION SENSOR “A” CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0336	Crankshaft Position Sensor “A” Circuit Range/Performance	<Ref. to EN(H4DO w/o HEV)(diag)-208, DTC P0336 CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC	Item	Note
P0340	Camshaft Position Sensor “A” Circuit (Bank 1 or Single Sensor)	<Ref. to EN(H4DO w/o HEV)(diag)-209, DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0341	Camshaft Position Sensor "A" Circuit Range/Performance (Bank 1 or Single Sensor)	<Ref. to EN(H4DO w/o HEV)(diag)-211, DTC P0341 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0345	Camshaft Position Sensor “A” Circuit (Bank 2)	<Ref. to EN(H4DO w/o HEV)(diag)-212, DTC P0345 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0346	Camshaft Position Sensor "A" Circuit Range/Performance (Bank 2)	<Ref. to EN(H4DO w/o HEV)(diag)-214, DTC P0346 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0351	Ignition Coil A Primary/Secondary Circuit	<Ref. to EN(H4DO w/o HEV)(diag)-215, DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0352	Ignition Coil B Primary/Secondary Circuit	<Ref. to EN(H4DO w/o HEV)(diag)-217, DTC P0352 IGNITION COIL B PRIMARY/SECONDARY CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0353	Ignition Coil C Primary/Secondary Circuit	<Ref. to EN(H4DO w/o HEV)(diag)-217, DTC P0353 IGNITION COIL C PRIMARY/SECONDARY CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0354	Ignition Coil D Primary/Secondary Circuit	<Ref. to EN(H4DO w/o HEV)(diag)-217, DTC P0354 IGNITION COIL D PRIMARY/SECONDARY CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0365	Camshaft Position Sensor “B” Circuit (Bank 1)	<Ref. to EN(H4DO w/o HEV)(diag)-218, DTC P0365 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0366	Camshaft Position Sensor B Circuit Range/Performance (Bank 1)	<Ref. to EN(H4DO w/o HEV)(diag)-220, DTC P0366 CAMSHAFT POSITION SENSOR B CIRCUIT RANGE/PERFORMANCE (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0390	Camshaft Position Sensor “B” Circuit (Bank 2)	<Ref. to EN(H4DO w/o HEV)(diag)-221, DTC P0390 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0391	Camshaft Position Sensor B Circuit Range/Performance (Bank 2)	<Ref. to EN(H4DO w/o HEV)(diag)-223, DTC P0391 CAMSHAFT POSITION SENSOR B CIRCUIT RANGE/PERFORMANCE (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0400	Exhaust Gas Recirculation Flow	<Ref. to EN(H4DO w/o HEV)(diag)-224, DTC P0400 EXHAUST GAS RECIRCULATION FLOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	<Ref. to EN(H4DO w/o HEV)(diag)-225, DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0441	Evaporative Emission Cont. Sys. Incorrect Purge Flow	<Ref. to EN(H4DO w/o HEV)(diag)-230, DTC P0441 EVAPORATIVE EMISSION CONT. SYS. INCORRECT PURGE FLOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0451	Evaporative Emission System Pressure Sensor/Switch Range/Performance	<Ref. to EN(H4DO w/o HEV)(diag)-231, DTC P0451 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0452	Evaporative Emission System Pressure Sensor/Switch Low	<Ref. to EN(H4DO w/o HEV)(diag)-232, DTC P0452 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0453	Evaporative Emission System Pressure Sensor/Switch High	<Ref. to EN(H4DO w/o HEV)(diag)-234, DTC P0453 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0455	Evaporative Emission System Leak Detected (Large Leak)	<Ref. to EN(H4DO w/o HEV)(diag)-236, DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)	<Ref. to EN(H4DO w/o HEV)(diag)-237, DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC	Item	Note
P0458	Evaporative Emission System Purge Control Valve Circuit Low	<Ref. to EN(H4DO w/o HEV)(diag)-238, DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0459	Evaporative Emission System Purge Control Valve Circuit High	<Ref. to EN(H4DO w/o HEV)(diag)-241, DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0461	Fuel Level Sensor “A” Circuit Range/Performance	<Ref. to EN(H4DO w/o HEV)(diag)-243, DTC P0461 FUEL LEVEL SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0462	Fuel Level Sensor “A” Circuit Low	<Ref. to EN(H4DO w/o HEV)(diag)-243, DTC P0462 FUEL LEVEL SENSOR “A” CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0463	Fuel Level Sensor “A” Circuit High	<Ref. to EN(H4DO w/o HEV)(diag)-244, DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0500	Vehicle Speed Sensor “A”	<Ref. to EN(H4DO w/o HEV)(diag)-244, DTC P0500 VEHICLE SPEED SENSOR “A”, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0506	Idle Air Control System RPM Lower Than Expected	<Ref. to EN(H4DO w/o HEV)(diag)-245, DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0507	Idle Air Control System RPM Higher Than Expected	<Ref. to EN(H4DO w/o HEV)(diag)-246, DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P050A	Cold Start Idle Air Control System Performance	<Ref. to EN(H4DO w/o HEV)(diag)-247, DTC P050A COLD START IDLE AIR CONTROL SYSTEM PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P050B	Cold Start Ignition Timing Performance	<Ref. to EN(H4DO w/o HEV)(diag)-255, DTC P050B COLD START IGNITION TIMING PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0512	Starter Request Circuit	<Ref. to EN(H4DO w/o HEV)(diag)-256, DTC P0512 STARTER REQUEST CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0516	Battery Temperature Sensor Circuit Low	<Ref. to EN(H4DO w/o HEV)(diag)-259, DTC P0516 BATTERY TEMPERATURE SENSOR CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0517	Battery Temperature Sensor Circuit High	<Ref. to EN(H4DO w/o HEV)(diag)-261, DTC P0517 BATTERY TEMPERATURE SENSOR CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0560	System Voltage	<Ref. to EN(H4DO w/o HEV)(diag)-263, DTC P0560 SYSTEM VOLTAGE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0604	Internal Control Module Random Access Memory (RAM) Error	<Ref. to EN(H4DO w/o HEV)(diag)-265, DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0605	Internal Control Module Read Only Memory (ROM) Error	<Ref. to EN(H4DO w/o HEV)(diag)-265, DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0606	Control Module Processor	<Ref. to EN(H4DO w/o HEV)(diag)-266, DTC P0606 CONTROL MODULE PROCESSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P060A	Internal Control Module Monitoring Processor Performance	<Ref. to EN(H4DO w/o HEV)(diag)-267, DTC P060A INTERNAL CONTROL MODULE MONITORING PROCESSOR PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P060B	Internal Control Module A/D Processing Performance	<Ref. to EN(H4DO w/o HEV)(diag)-267, DTC P060B INTERNAL CONTROL MODULE A/D PROCESSING PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0616	Starter Relay Circuit Low	<Ref. to EN(H4DO w/o HEV)(diag)-268, DTC P0616 STARTER RELAY CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0617	Starter Relay Circuit High	<Ref. to EN(H4DO w/o HEV)(diag)-270, DTC P0617 STARTER RELAY CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P062F	Internal Control Module EEPROM Error	<Ref. to EN(H4DO w/o HEV)(diag)-271, DTC P062F INTERNAL CONTROL MODULE EEPROM ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC	Item	Note
P0685	ECM/PCM Power Relay Control Circuit/Open	<Ref. to EN(H4DO w/o HEV)(diag)-272, DTC P0685 ECM/PCM POWER RELAY CONTROL CIRCUIT/OPEN, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0700	Transmission Control System (MIL Request)	<Ref. to EN(H4DO w/o HEV)(diag)-273, DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P081A	Starter Disable Circuit Low	<Ref. to EN(H4DO w/o HEV)(diag)-274, DTC P081A STARTER DISABLE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0851	Park/Neutral Switch Input Circuit Low (AT Model)	<Ref. to EN(H4DO w/o HEV)(diag)-277, DTC P0851 PARK/NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0851	Neutral Switch Input Circuit Low (MT Model)	<Ref. to EN(H4DO w/o HEV)(diag)-279, DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0852	Park/Neutral Switch Input Circuit High (AT Model)	<Ref. to EN(H4DO w/o HEV)(diag)-281, DTC P0852 PARK/NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0852	Neutral Switch Input Circuit High (MT Model)	<Ref. to EN(H4DO w/o HEV)(diag)-283, DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1160	Return Spring Failure	<Ref. to EN(H4DO w/o HEV)(diag)-284, DTC P1160 RETURN SPRING FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1449	Evaporative Emission Cont. Sys. Air Filter Clog	<Ref. to EN(H4DO w/o HEV)(diag)-285, DTC P1449 EVAPORATIVE EMISSION CONT. SYS. AIR FILTER CLOG, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1451	Evaporative Emission Cont. Sys.	<Ref. to EN(H4DO w/o HEV)(diag)-286, DTC P1451 EVAPORATIVE EMISSION CONT. SYS., Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1492	EGR Solenoid Valve Signal #1 Circuit Malfunction (Low Input)	<Ref. to EN(H4DO w/o HEV)(diag)-287, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1493	EGR Solenoid Valve Signal #1 Circuit Malfunction (High Input)	<Ref. to EN(H4DO w/o HEV)(diag)-287, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1494	EGR Solenoid Valve Signal #2 Circuit Malfunction (Low Input)	<Ref. to EN(H4DO w/o HEV)(diag)-287, DTC P1494 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1495	EGR Solenoid Valve Signal #2 Circuit Malfunction (High Input)	<Ref. to EN(H4DO w/o HEV)(diag)-287, DTC P1495 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1496	EGR Solenoid Valve Signal #3 Circuit Malfunction (Low Input)	<Ref. to EN(H4DO w/o HEV)(diag)-287, DTC P1496 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1497	EGR Solenoid Valve Signal #3 Circuit Malfunction (High Input)	<Ref. to EN(H4DO w/o HEV)(diag)-287, DTC P1497 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1498	EGR Solenoid Valve Signal #4 Circuit Malfunction (Low Input)	<Ref. to EN(H4DO w/o HEV)(diag)-288, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1499	EGR Solenoid Valve Signal #4 Circuit Malfunction (High Input)	<Ref. to EN(H4DO w/o HEV)(diag)-291, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1530	Battery Current Sensor Circuit Low	<Ref. to EN(H4DO w/o HEV)(diag)-294, DTC P1530 BATTERY CURRENT SENSOR CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1531	Battery Current Sensor Circuit High	<Ref. to EN(H4DO w/o HEV)(diag)-296, DTC P1531 BATTERY CURRENT SENSOR CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC	Item	Note
P1532	Battery Charging System	<Ref. to EN(H4DO w/o HEV)(diag)-298, DTC P1532 BATTERY CHARGING SYSTEM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2004	Intake Manifold Runner Control Stuck Open (Bank 1)	<Ref. to EN(H4DO w/o HEV)(diag)-301, DTC P2004 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2005	Intake Manifold Runner Control Stuck Open (Bank 2)	<Ref. to EN(H4DO w/o HEV)(diag)-301, DTC P2005 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2006	Intake Manifold Runner Control Stuck Closed (Bank 1)	<Ref. to EN(H4DO w/o HEV)(diag)-302, DTC P2006 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2007	Intake Manifold Runner Control Stuck Closed (Bank 2)	<Ref. to EN(H4DO w/o HEV)(diag)-303, DTC P2007 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2009	Intake Manifold Runner Control Circuit Low (Bank 1)	<Ref. to EN(H4DO w/o HEV)(diag)-304, DTC P2009 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2012	Intake Manifold Runner Control Circuit Low (Bank 2)	<Ref. to EN(H4DO w/o HEV)(diag)-306, DTC P2012 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2096	Post Catalyst Fuel Trim System Too Lean (Bank 1)	<Ref. to EN(H4DO w/o HEV)(diag)-308, DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2097	Post Catalyst Fuel Trim System Too Rich (Bank 1)	<Ref. to EN(H4DO w/o HEV)(diag)-314, DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2101	Throttle Actuator Control Motor Circuit Range/Performance	<Ref. to EN(H4DO w/o HEV)(diag)-320, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2102	Throttle Actuator Control Motor Circuit Low	<Ref. to EN(H4DO w/o HEV)(diag)-325, DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2103	Throttle Actuator Control Motor Circuit High	<Ref. to EN(H4DO w/o HEV)(diag)-327, DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2109	Throttle/Pedal Position Sensor “A” Minimum Stop Performance	<Ref. to EN(H4DO w/o HEV)(diag)-328, DTC P2109 THROTTLE/PEDAL POSITION SENSOR “A” MINIMUM STOP PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2119	Throttle Actuator Control Throttle Body Range/Performance	<Ref. to EN(H4DO w/o HEV)(diag)-328, DTC P2119 THROTTLE ACTUATOR CONTROL THROTTLE BODY RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2122	Throttle/Pedal Position Sensor/ Switch “D” Circuit Low Input	<Ref. to EN(H4DO w/o HEV)(diag)-329, DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2123	Throttle/Pedal Position Sensor/ Switch “D” Circuit High Input	<Ref. to EN(H4DO w/o HEV)(diag)-331, DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2127	Throttle/Pedal Position Sensor/ Switch “E” Circuit Low Input	<Ref. to EN(H4DO w/o HEV)(diag)-333, DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2128	Throttle/Pedal Position Sensor/ Switch “E” Circuit High Input	<Ref. to EN(H4DO w/o HEV)(diag)-335, DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2135	Throttle/Pedal Position Sensor/ Switch “A”/“B” Voltage Correlation	<Ref. to EN(H4DO w/o HEV)(diag)-337, DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A”/“B” VOLTAGE CORRELATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC	Item	Note
P2138	Throttle/Pedal Position Sensor/ Switch “D”/“E” Voltage Correlation	<Ref. to EN(H4DO w/o HEV)(diag)-340, DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2195	O2 Sensor Signal Biased/Stuck Lean (Bank 1 Sensor 1)	<Ref. to EN(H4DO w/o HEV)(diag)-342, DTC P2195 O2 SENSOR SIGNAL BIASED/ STUCK LEAN (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2196	O2 Sensor Signal Biased/Stuck Rich (Bank 1 Sensor 1)	<Ref. to EN(H4DO w/o HEV)(diag)-344, DTC P2196 O2 SENSOR SIGNAL BIASED/ STUCK RICH (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P219A	Bank 1 Air-Fuel Ratio Imbalance	<Ref. to EN(H4DO w/o HEV)(diag)-346, DTC P219A BANK 1 AIR-FUEL RATIO IMBALANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2270	O2 Sensor Signal Biased/Stuck Lean (Bank 1 Sensor 2)	<Ref. to EN(H4DO w/o HEV)(diag)-357, DTC P2270 O2 SENSOR SIGNAL BIASED/ STUCK LEAN (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2271	O2 Sensor Signal Biased/Stuck Rich (Bank 1 Sensor 2)	<Ref. to EN(H4DO w/o HEV)(diag)-359, DTC P2271 O2 SENSOR SIGNAL BIASED/ STUCK RICH (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	<Ref. to EN(H4DO w/o HEV)(diag)-361, DTC P2401 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP CONTROL CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	<Ref. to EN(H4DO w/o HEV)(diag)-364, DTC P2402 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP CONTROL CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2404	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	<Ref. to EN(H4DO w/o HEV)(diag)-366, DTC P2404 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP SENSE CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2419	Evaporative Emission System Switching Valve Control Circuit Low	<Ref. to EN(H4DO w/o HEV)(diag)-370, DTC P2419 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2420	Evaporative Emission System Switching Valve Control Circuit High	<Ref. to EN(H4DO w/o HEV)(diag)-373, DTC P2420 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2530	Ignition Switch Run Position Circuit	<Ref. to EN(H4DO w/o HEV)(diag)-375, DTC P2530 IGNITION SWITCH RUN POSITION CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2610	ECM/PCM Internal Engine Off Timer Performance	<Ref. to EN(H4DO w/o HEV)(diag)-377, DTC P2610 ECM/PCM INTERNAL ENGINE OFF TIMER PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U0073	Control Module Communication Bus Off	<Ref. to EN(H4DO w/o HEV)(diag)-378, DTC U0073 CONTROL MODULE COMMUNICATION BUS OFF, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U0101	Lost Communication With TCM	<Ref. to EN(H4DO w/o HEV)(diag)-378, DTC U0101 LOST COMMUNICATION WITH TCM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U0122	Lost Communication With Vehicle Dynamics Control Module	<Ref. to EN(H4DO w/o HEV)(diag)-378, DTC U0122 LOST COMMUNICATION WITH VEHICLE DYNAMICS CONTROL MODULE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U0155	Lost Communication With Instrument Panel Cluster (IPC) Control Module	<Ref. to EN(H4DO w/o HEV)(diag)-378, DTC U0155 LOST COMMUNICATION WITH INSTRUMENT PANEL CLUSTER (IPC) CONTROL MODULE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U0402	Invalid Data Received From TCM	<Ref. to EN(H4DO w/o HEV)(diag)-378, DTC U0402 INVALID DATA RECEIVED FROM TCM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U0416	Invalid Data Received From Vehicle Dynamics Control Module	<Ref. to EN(H4DO w/o HEV)(diag)-378, DTC U0416 INVALID DATA RECEIVED FROM VEHICLE DYNAMICS CONTROL MODULE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U0423	Invalid Data Received From Instrument Panel Cluster Control Module	<Ref. to EN(H4DO w/o HEV)(diag)-378, DTC U0423 INVALID DATA RECEIVED FROM INSTRUMENT PANEL CLUSTER CONTROL MODULE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

19.Diagnostic Procedure with Diagnostic Trouble Code (DTC)

A: DTC P000A A CAMSHAFT POSITION SLOW RESPONSE (BANK 1)

NOTE:
For the diagnostic procedure, refer to DTC P0011. <Ref. to EN(H4DO w/o HEV)(diag)-108, DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

B: DTC P000B B CAMSHAFT POSITION SLOW RESPONSE (BANK 1)

NOTE:
For the diagnostic procedure, refer to DTC P0014. <Ref. to EN(H4DO w/o HEV)(diag)-111, DTC P0014 EXHAUST AVCS SYSTEM 1 (RANGE/PERFORMANCE), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

C: DTC P000C A CAMSHAFT POSITION SLOW RESPONSE (BANK 2)

NOTE:
For the diagnostic procedure, refer to DTC P0021. <Ref. to EN(H4DO w/o HEV)(diag)-122, DTC P0021 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

D: DTC P000D B CAMSHAFT POSITION SLOW RESPONSE (BANK 2)

NOTE:
For the diagnostic procedure, refer to DTC P0024. <Ref. to EN(H4DO w/o HEV)(diag)-125, DTC P0024 EXHAUST AVCS SYSTEM 2 (RANGE/PERFORMANCE), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

E: DTC P0010 "A" CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 1)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-15, DTC P0010 "A" CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

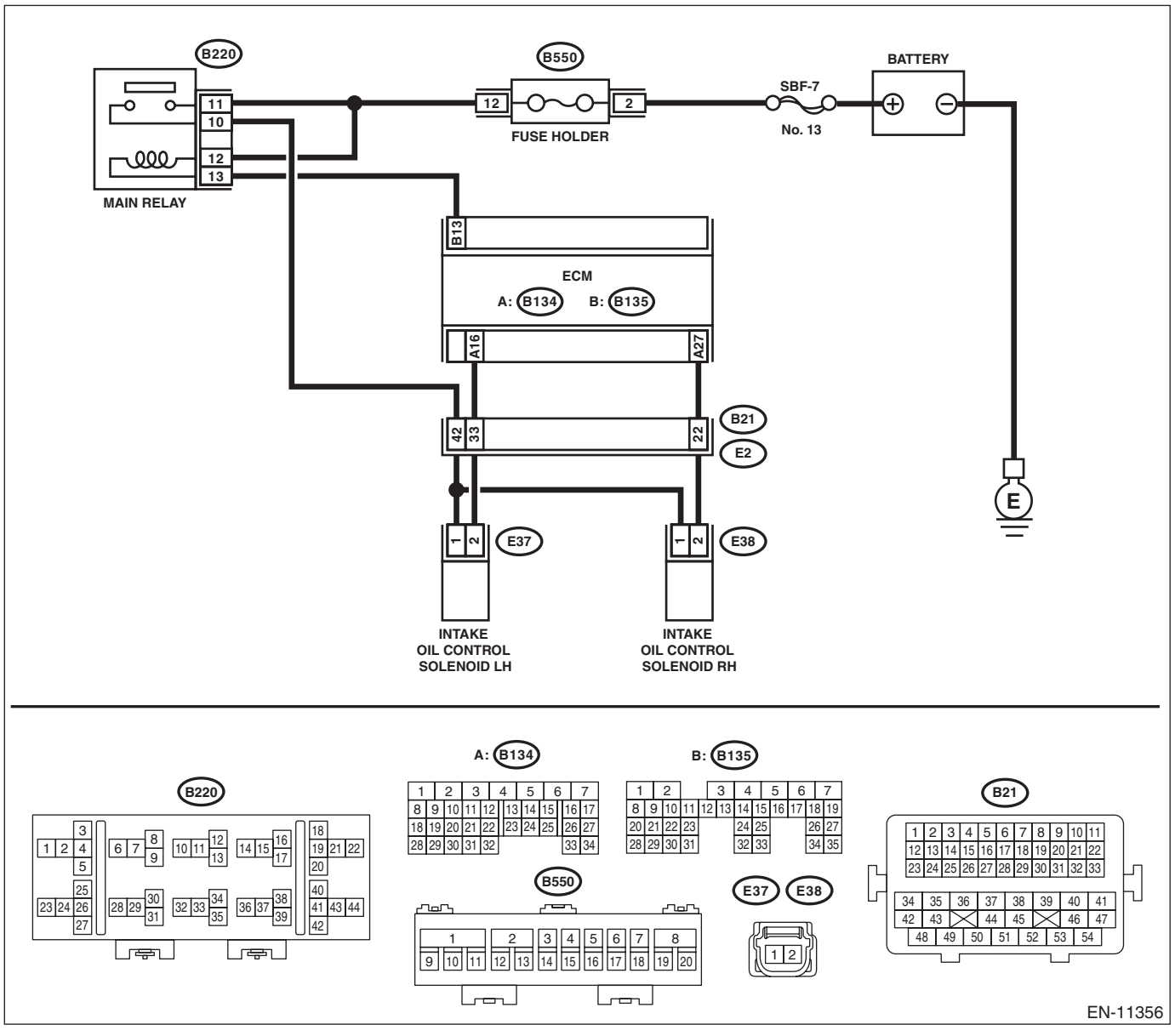
Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-16, Power Supply Circuit.>



	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL OF ECM.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 17 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **2**.	Go to step **3**.
2	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM connector.	Is there poor contact of ECM connector?	Repair the poor contact of ECM connector.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
3	**CHECK POWER SUPPLY TO THE INTAKE OIL CONTROL SOLENOID RH.** Measure the voltage between intake oil control solenoid RH connector and engine ground. ***Connector & terminal*** ***(E38) No. 1 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **4**.	Repair the power supply circuit.
4	**CHECK HARNESS BETWEEN ECM AND INTAKE OIL CONTROL SOLENOID RH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and intake oil control solenoid RH. 3) Measure the resistance between intake oil control solenoid RH connector and engine ground. ***Connector & terminal*** ***(E38) No. 2 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the short circuit to ground in harness between ECM connector and intake oil control solenoid RH connector.
5	**CHECK HARNESS BETWEEN ECM AND INTAKE OIL CONTROL SOLENOID RH CONNECTOR.** Measure the resistance of harness between ECM connector and intake oil control solenoid RH. ***Connector & terminal*** ***(B134) No. 17 — (E38) No. 2:***	Is the resistance less than 1 Ω?	Go to step **6**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and intake oil control solenoid RH connector • Poor contact of coupling connector
6	**CHECK INTAKE OIL CONTROL SOLENOID RH.** Measure the resistance between intake oil control solenoid RH terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 6 — 12 Ω?	Repair the poor contact of intake oil control solenoid RH connector.	Replace the intake oil control solenoid RH. <Ref. to FU(H4DO(HEV))-56, Oil Control Solenoid.>

F: DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-16, DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Engine stalls.
- Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine and let it idle. 2) Read the value of «VVT Adv. Ang. Amount R» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.>	Is the value of «VVT Adv. Ang. Amount R» approx. 0 deg?	Go to step **2**.	Check the following item and repair or replace if necessary. • Intake cam sprocket (clog or dirt of oil routing, setting of spring) • Intake camshaft (dirt, damage of camshaft)
2	**CHECK CURRENT DATA.** 1) Drive with acceleration and deceleration at 80 km/h (50 MPH) or less. NOTE: Drive to an extent that the duty output of oil flow control solenoid valve increases. 2) Read the values of «OCV Duty R» and «VVT Adv. Ang. Amount R» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.>	When the value of «OCV Duty R» increases more than 10%, is the value of «VVT Adv. Ang. Amount R» approx. 0 deg?	Check the following item and repair or replace if necessary. • Intake cam sprocket (clog or dirt of oil routing, setting of spring) • Intake camshaft (dirt, damage of camshaft)	Perform the following procedures, and clean the oil routing. Replace the engine oil and idle the engine for 5 minutes, and then replace the oil filter and engine oil. <Ref. to LU(H4DO(w/o HEV))-13, REPLACEMENT, Engine Oil.> <Ref. to LU(H4DO(w/o HEV))-29, Engine Oil Filter.>

G: DTC P0013 B CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 1)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-17, DTC P0013 B CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

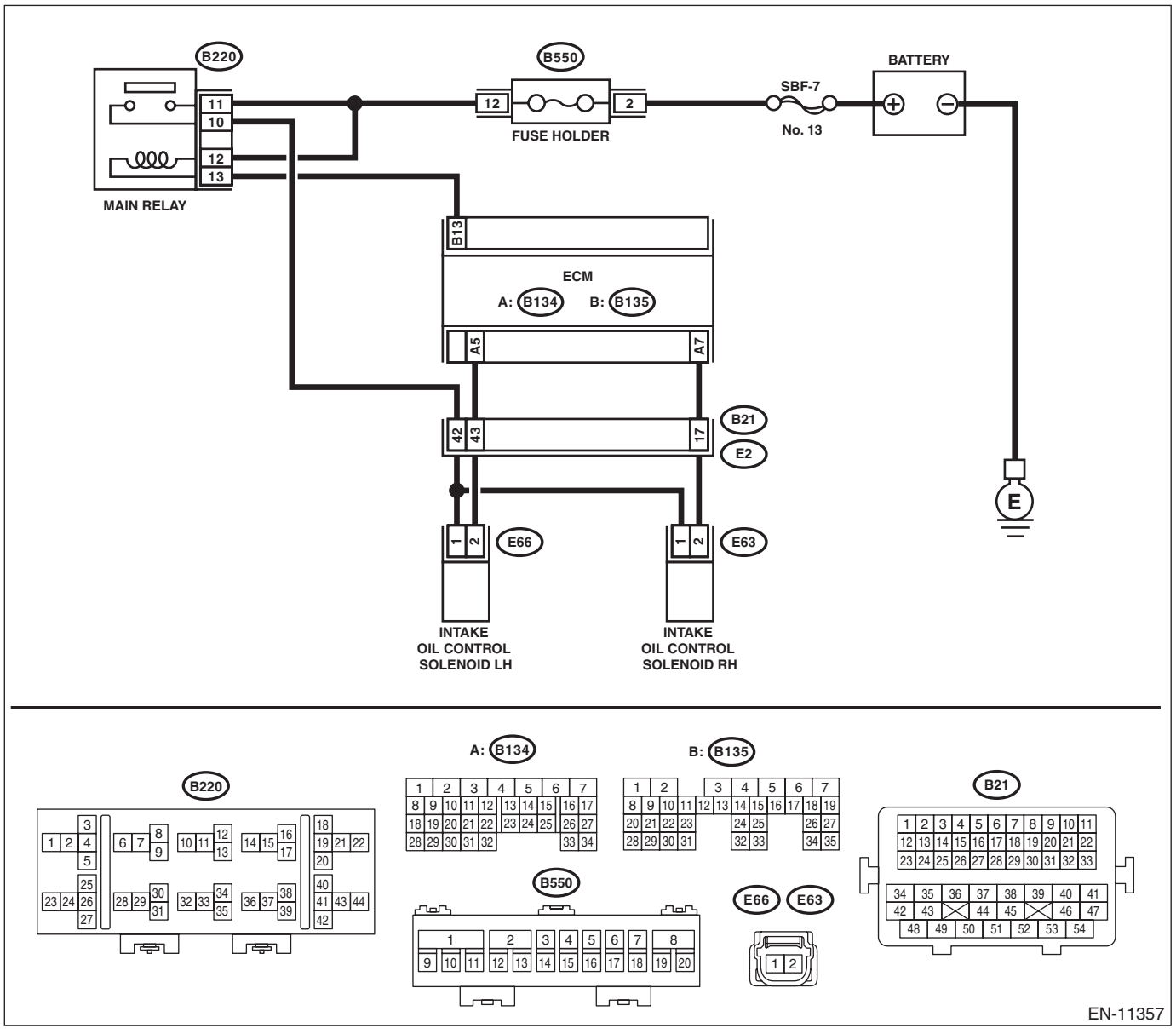
Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-16, Power Supply Circuit.>



	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL OF ECM.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 7 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **2**.	Go to step **3**.
2	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM connector.	Is there poor contact of ECM connector?	Repair the poor contact of ECM connector.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
3	**CHECK POWER SUPPLY TO THE EXHAUST OIL CONTROL SOLENOID RH.** Measure the voltage between exhaust oil control solenoid RH connector and engine ground. ***Connector & terminal*** ***(E63) No. 1 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **4**.	Repair the power supply circuit.
4	**CHECK HARNESS BETWEEN ECM AND EXHAUST OIL CONTROL SOLENOID RH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and exhaust oil control solenoid RH. 3) Measure the resistance between exhaust oil control solenoid RH connector and engine ground. ***Connector & terminal*** ***(E63) No. 2 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the short circuit to ground in harness between ECM connector and exhaust oil control solenoid RH connector.
5	**CHECK HARNESS BETWEEN ECM AND EXHAUST OIL CONTROL SOLENOID RH CONNECTOR.** Measure the resistance of harness between ECM connector and exhaust oil control solenoid RH. ***Connector & terminal*** ***(B134) No. 7 — (E63) No. 2:***	Is the resistance less than 1 Ω?	Go to step **6**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and exhaust oil control solenoid RH connector • Poor contact of coupling connector
6	**CHECK EXHAUST OIL CONTROL SOLENOID RH.** Measure the resistance between exhaust oil control solenoid RH terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 6 — 12 Ω?	Repair the poor contact of exhaust oil control solenoid RH connector.	Replace the exhaust oil control solenoid RH. <Ref. to FU(H4DO(w/o HEV))-64, Oil Control Solenoid.>

H: DTC P0014 EXHAUST AVCS SYSTEM 1 (RANGE/PERFORMANCE)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-18, DTC P0014 EXHAUST AVCS SYSTEM 1 (RANGE/PERFORMANCE), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Engine stalls.
- Improper idling

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine and let it idle. 2) Read the value of «Exh. VVT Retard Ang. R» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.>	Is the value of «Exh. VVT Retard Ang. R» approx. 0 deg?	Go to step **2**.	Check the following item and repair or replace if necessary. • Exhaust cam sprocket (clog or dirt of oil routing, setting of spring) • Exhaust camshaft (dirt, damage of camshaft)
2	**CHECK CURRENT DATA.** 1) Drive with acceleration and deceleration at 80 km/h (50 MPH) or less. NOTE: Drive to an extent that the duty output of oil flow control solenoid valve increases. 2) Read the values of «Exh. OCV Duty R» and «Exh. VVT Retard Ang. R» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.>	When the value of «Exh. OCV Duty R» increases more than 10%, is the value of «Exh. VVT Retard Ang. R» approx. 0 deg?	Check the following item and repair or replace if necessary. • Exhaust cam sprocket (clog or dirt of oil routing, setting of spring) • Exhaust camshaft (dirt, damage of camshaft)	Perform the following procedures, and clean the oil routing. Replace the engine oil and idle the engine for 5 minutes, and then replace the oil filter and engine oil. <Ref. to LU(H4DO(w/o HEV))-13, REPLACEMENT, Engine Oil.> <Ref. to LU(H4DO(w/o HEV))-29, Engine Oil Filter.>

I: DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-19, DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Engine stalls.
- Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Are DTCs other than P0016, P0017, P0018 or P0019 displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK INTAKE OIL CONTROL SOLENOID RH.** Check the intake oil control solenoid RH. <Ref. to FU(H4DO(w/o HEV))-67, INSPECTION, Oil Control Solenoid.>	Is intake oil control solenoid RH normal?	Go to step **3**.	Replace the intake oil control solenoid RH. <Ref. to FU(H4DO(w/o HEV))-64, Oil Control Solenoid.>
3	**CHECK INSTALLATION CONDITION OF TIMING CHAIN.** Using ST and by turning the crankshaft, align the alignment marks of crank sprocket, intake cam sprocket and exhaust cam sprocket. <Ref. to ME(H4DO(w/o HEV))-169, Timing Chain Assembly.> ST 18252AA000 CRANKSHAFT SOCKET	Is timing chain installed to the appropriate position?	Go to step **4**.	Correct the installation condition of timing chain. <Ref. to ME(H4DO(w/o HEV))-169, Timing Chain Assembly.>
4	**CHECK CAM CARRIER FILTER.** Check the filter installed to cam carrier. <Ref. to ME(H4DO(w/o HEV))-257, INSPECTION, Cam Carrier.>	Is filter of cam carrier normal?	Replace the intake cam sprocket RH. <Ref. to ME(H4DO(w/o HEV))-191, Cam Sprocket.> After the operation is complete, go to the next step. Go to step **5**.	Replace the filter of cam carrier. <Ref. to ME(H4DO(w/o HEV))-220, Cam Carrier.>

	Step	Check	Yes	No
5	**CHECK CURRENT DATA.** 1) Clear the memory using the Subaru Select Monitor or general scan tool. <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.> 2) Start the engine and warm up completely. 3) Using Subaru Select Monitor, read the value of «VVT Initial Position Learning Value #1» and «VVT Adv. Ang. Amount R» when idling condition is stable for 30 seconds or more. NOTE: For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> 4) Calculate the read value according to the following formula. At this time, ignore the unit. |«VVT Initial Position Learning Value #1» – (60 + «VVT Adv. Ang. Amount R»)|	Is the calculation result less than 10?	Go to step **6**.	Replace the ECM. <Ref. to FU(H4DO(w/o HEV))-100, Engine Control Module (ECM).>
6	**CHECK DTC.** 1) Clear the memory using the Subaru Select Monitor or general scan tool. <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.> 2) Perform drive cycle N. <Ref. to EN(H4DO w/o HEV)(diag)-63, DRIVE CYCLE N, PROCEDURE, Drive Cycle.>	Is the same DTC as current diagnosis displayed?	Replace the ECM. <Ref. to FU(H4DO(w/o HEV))-100, Engine Control Module (ECM).>	End.

J: DTC P0017 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 1)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-20, DTC P0017 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Engine stalls.
- Improper idling

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Are DTCs other than P0016, P0017, P0018 or P0019 displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK EXHAUST OIL CONTROL SOLENOID RH.** Check the exhaust oil control solenoid RH. <Ref. to FU(H4DO(w/o HEV))-67, INSPECTION, Oil Control Solenoid.>	Is exhaust oil control solenoid RH normal?	Go to step **3**.	Replace the exhaust oil control solenoid RH. <Ref. to FU(H4DO(w/o HEV))-64, Oil Control Solenoid.>
3	**CHECK INSTALLATION CONDITION OF TIMING CHAIN.** Using ST and by turning the crankshaft, align the alignment marks of crank sprocket, intake cam sprocket and exhaust cam sprocket. <Ref. to ME(H4DO(w/o HEV))-169, Timing Chain Assembly.> ST 18252AA000 CRANKSHAFT SOCKET	Is timing chain installed to the appropriate position?	Go to step **4**.	Correct the installation condition of timing chain. <Ref. to ME(H4DO(w/o HEV))-169, Timing Chain Assembly.>
4	**CHECK CAM CARRIER FILTER.** Check the filter installed to cam carrier. <Ref. to ME(H4DO(w/o HEV))-257, INSPECTION, Cam Carrier.>	Is filter of cam carrier normal?	Replace the exhaust cam sprocket RH. <Ref. to ME(H4DO(w/o HEV))-191, Cam Sprocket.> After the operation is complete, go to the next step. Go to step **5**.	Replace the filter of cam carrier. <Ref. to ME(H4DO(w/o HEV))-220, Cam Carrier.>

	Step	Check	Yes	No
5	**CHECK CURRENT DATA.** 1) Clear the memory using the Subaru Select Monitor or general scan tool. <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.> 2) Start the engine and warm up completely. 3) Using Subaru Select Monitor, read the value of «VVT Ex Initial Position Learning Value #1» and «Exh. VVT Retard Ang. R» when idling condition is stable for 30 seconds or more. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> 4) Calculate the read value according to the following formula. At this time, ignore the unit. |«VVT Ex Initial Position Learning Value #1» – (90 – «Exh. VVT Retard Ang. R»)|	Is the calculation result less than 10?	Go to step **6**.	Replace the ECM. <Ref. to FU(H4DO(w/o HEV))-100, Engine Control Module (ECM).>
6	**CHECK DTC.** 1) Clear the memory using the Subaru Select Monitor or general scan tool. <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.> 2) Perform drive cycle N. <Ref. to EN(H4DO w/o HEV)(diag)-63, DRIVE CYCLE N, PROCEDURE, Drive Cycle.>	Is the same DTC as current diagnosis displayed?	Replace the ECM. <Ref. to FU(H4DO(w/o HEV))-100, Engine Control Module (ECM).>	End.

K: DTC P0018 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK2)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-21, DTC P0018 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Engine stalls.
- Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Are DTCs other than P0016, P0017, P0018 or P0019 displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK INTAKE OIL CONTROL SOLENOID LH.** Check the intake oil control solenoid LH. <Ref. to FU(H4DO(w/o HEV))-67, INSPECTION, Oil Control Solenoid.>	Is intake oil control solenoid LH normal?	Go to step **3**.	Replace the intake oil control solenoid LH. <Ref. to FU(H4DO(w/o HEV))-64, Oil Control Solenoid.>
3	**CHECK INSTALLATION CONDITION OF TIMING CHAIN.** Using ST and by turning the crankshaft, align the alignment marks of crank sprocket, intake cam sprocket and exhaust cam sprocket. <Ref. to ME(H4DO(w/o HEV))-169, Timing Chain Assembly.> ST 18252AA000 CRANKSHAFT SOCKET	Is timing chain installed to the appropriate position?	Go to step **4**.	Correct the installation condition of timing chain. <Ref. to ME(H4DO(w/o HEV))-169, Timing Chain Assembly.>
4	**CHECK CAM CARRIER FILTER.** Check the filter installed to cam carrier. <Ref. to ME(H4DO(w/o HEV))-257, INSPECTION, Cam Carrier.>	Is filter of cam carrier normal?	Replace the intake cam sprocket LH. <Ref. to ME(H4DO(w/o HEV))-191, Cam Sprocket.> After the operation is complete, go to the next step. Go to step **5**.	Replace the filter of cam carrier. <Ref. to ME(H4DO(w/o HEV))-220, Cam Carrier.>

	Step	Check	Yes	No
5	**CHECK CURRENT DATA.** 1) Clear the memory using the Subaru Select Monitor or general scan tool. <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.> 2) Start the engine and warm up completely. 3) Using Subaru Select Monitor, read the value of «VVT Initial Position Learning Value #2» and «VVT Adv. Ang. Amount L» when idling condition is stable for 30 seconds or more. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> 4) Calculate the read value according to the following formula. At this time, ignore the unit. |«VVT Initial Position Learning Value #2» – (60 + «VVT Adv. Ang. Amount L»)|	Is the calculation result less than 10?	Go to step **6**.	Replace the ECM. <Ref. to FU(H4DO(w/o HEV))-100, Engine Control Module (ECM).>
6	**CHECK DTC.** 1) Clear the memory using the Subaru Select Monitor or general scan tool. <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.> 2) Perform drive cycle N. <Ref. to EN(H4DO w/o HEV)(diag)-63, DRIVE CYCLE N, PROCEDURE, Drive Cycle.>	Is the same DTC as current diagnosis displayed?	Replace the ECM. <Ref. to FU(H4DO(w/o HEV))-100, Engine Control Module (ECM).>	End.

L: DTC P0019 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 2)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-21, DTC P0019 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Engine stalls.
- Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Are DTCs other than P0016, P0017, P0018 or P0019 displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK EXHAUST OIL CONTROL SOLENOID LH.** Check the exhaust oil control solenoid LH. <Ref. to FU(H4DO(w/o HEV))-67, INSPECTION, Oil Control Solenoid.>	Is exhaust oil control solenoid LH normal?	Go to step **3**.	Replace the exhaust oil control solenoid LH. <Ref. to FU(H4DO(w/o HEV))-64, Oil Control Solenoid.>
3	**CHECK INSTALLATION CONDITION OF TIMING CHAIN.** Using ST and by turning the crankshaft, align the alignment marks of crank sprocket, intake cam sprocket and exhaust cam sprocket. <Ref. to ME(H4DO(w/o HEV))-169, Timing Chain Assembly.> ST 18252AA000 CRANKSHAFT SOCKET	Is timing chain installed to the appropriate position?	Go to step **4**.	Correct the installation condition of timing chain. <Ref. to ME(H4DO(w/o HEV))-169, Timing Chain Assembly.>
4	**CHECK CAM CARRIER FILTER.** Check the filter installed to cam carrier. <Ref. to ME(H4DO(w/o HEV))-257, INSPECTION, Cam Carrier.>	Is filter of cam carrier normal?	Replace the exhaust cam sprocket LH. <Ref. to ME(H4DO(w/o HEV))-191, Cam Sprocket.> After the operation is complete, go to the next step. Go to step **5**.	Replace the filter of cam carrier. <Ref. to ME(H4DO(w/o HEV))-220, Cam Carrier.>

	Step	Check	Yes	No
5	**CHECK CURRENT DATA.** 1) Clear the memory using the Subaru Select Monitor or general scan tool. <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.> 2) Start the engine and warm up completely. 3) Using Subaru Select Monitor, read the value of «VVT Ex Initial Position Learning Value #2» and «Exh. VVT Retard Ang. L» when idling condition is stable for 30 seconds or more. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> 4) Calculate the read value according to the following formula. At this time, ignore the unit. |«VVT Ex Initial Position Learning Value #2» – (90 – «Exh. VVT Retard Ang. L»)|	Is the calculation result less than 10?	Go to step **6**.	Replace the ECM. <Ref. to FU(H4DO(w/o HEV))-100, Engine Control Module (ECM).>
6	**CHECK DTC.** 1) Clear the memory using the Subaru Select Monitor or general scan tool. <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.> 2) Perform drive cycle N. <Ref. to EN(H4DO w/o HEV)(diag)-63, DRIVE CYCLE N, PROCEDURE, Drive Cycle.>	Is the same DTC as current diagnosis displayed?	Replace the ECM. <Ref. to FU(H4DO(w/o HEV))-100, Engine Control Module (ECM).>	End.

M: DTC P0020 "A" CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 2)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-21, DTC P0020 "A" CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

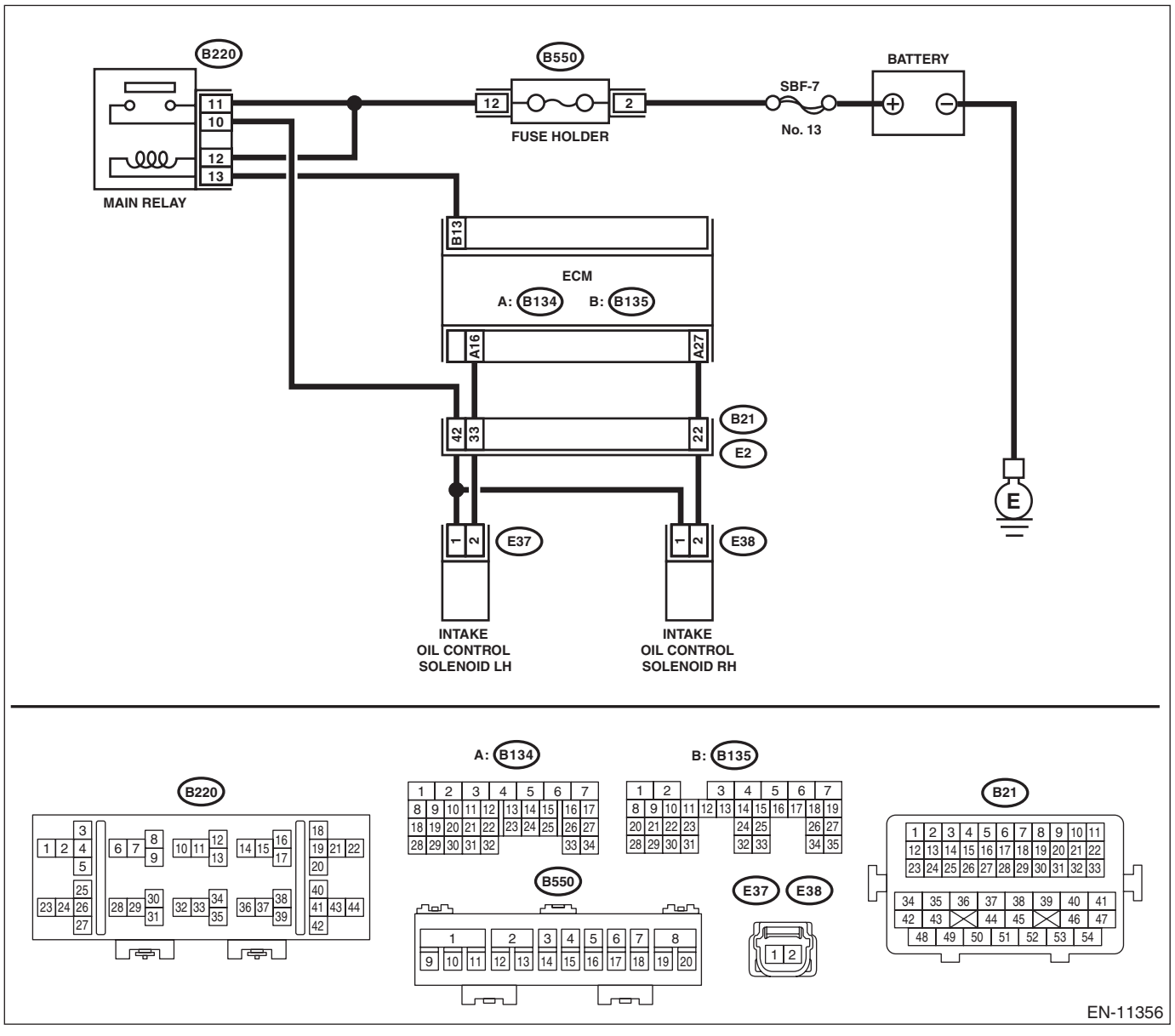
Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-16, Power Supply Circuit.>



	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL OF ECM.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 16 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **2**.	Go to step **3**.
2	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM connector.	Is there poor contact of ECM connector?	Repair the poor contact of ECM connector.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
3	**CHECK POWER SUPPLY TO THE INTAKE OIL CONTROL SOLENOID LH.** Measure the voltage between intake oil control solenoid LH connector and engine ground. ***Connector & terminal*** ***(E37) No. 1 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **4**.	Repair the power supply circuit.
4	**CHECK HARNESS BETWEEN ECM AND INTAKE OIL CONTROL SOLENOID LH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and intake oil control solenoid LH. 3) Measure the resistance between intake oil control solenoid LH connector and engine ground. ***Connector & terminal*** ***(E37) No. 2 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the short circuit to ground in harness between ECM connector and intake oil control solenoid LH connector.
5	**CHECK HARNESS BETWEEN ECM AND INTAKE OIL CONTROL SOLENOID LH CONNECTOR.** Measure the resistance of harness between ECM connector and intake oil control solenoid LH. ***Connector & terminal*** ***(B134) No. 16 — (E37) No. 2:***	Is the resistance less than 1 Ω?	Go to step **6**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and intake oil control solenoid LH connector • Poor contact of coupling connector
6	**CHECK INTAKE OIL CONTROL SOLENOID LH.** Measure the resistance between intake oil control solenoid LH terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 6 — 12 Ω?	Repair the poor contact of intake oil control solenoid LH connector.	Replace the intake oil control solenoid LH. <Ref. to FU(H4DO(w/o HEV))-64, Oil Control Solenoid.>

N: DTC P0021 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 2)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-21, DTC P0021 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Engine stalls.
- Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine and let it idle. 2) Read the value of «VVT Adv. Ang. Amount L» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.>	Is the value of «VVT Adv. Ang. Amount L» approx. 0 deg?	Go to step **2**.	Check the following item and repair or replace if necessary. • Intake cam sprocket (clog or dirt of oil routing, setting of spring) • Intake camshaft (dirt, damage of camshaft)
2	**CHECK CURRENT DATA.** 1) Drive with acceleration and deceleration at 80 km/h (50 MPH) or less. NOTE: Drive to an extent that the duty output of oil flow control solenoid valve increases. 2) Read the values of «OCV Duty L» and «VVT Adv. Ang. Amount L» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.>	When the value of «OCV Duty L» increases more than 10%, is the value of «VVT Adv. Ang. Amount L» approx. 0 deg?	Check the following item and repair or replace if necessary. • Intake cam sprocket (clog or dirt of oil routing, setting of spring) • Intake camshaft (dirt, damage of camshaft)	Perform the following procedures, and clean the oil routing. Replace the engine oil and idle the engine for 5 minutes, and then replace the oil filter and engine oil. <Ref. to LU(H4DO(w/o HEV))-13, REPLACEMENT, Engine Oil.> <Ref. to LU(H4DO(w/o HEV))-29, Engine Oil Filter.>

O: DTC P0023 B CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 2)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-21, DTC P0023 B CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

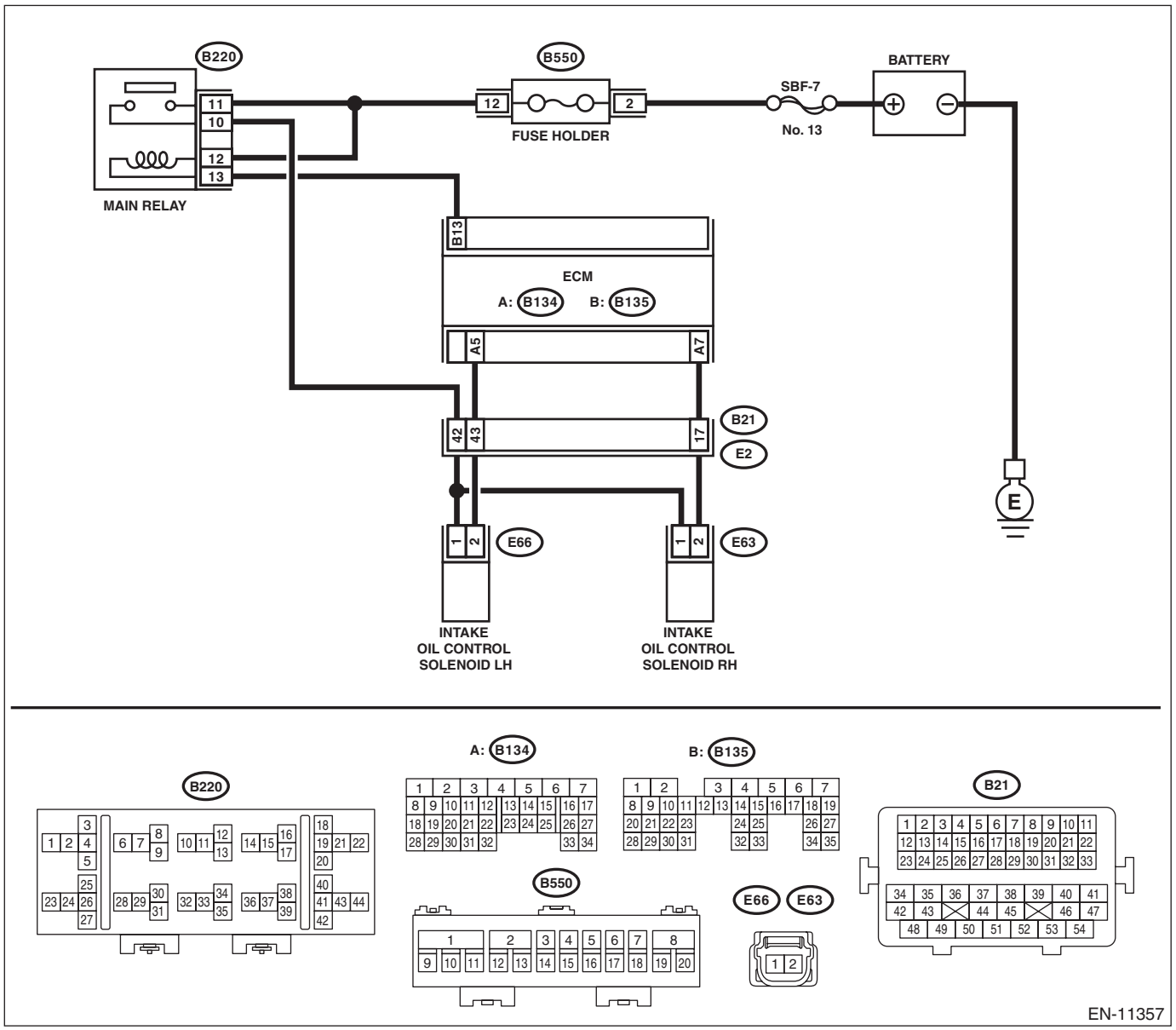
Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-16, Power Supply Circuit.>



	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL OF ECM.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 5 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **2**.	Go to step **3**.
2	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM connector.	Is there poor contact of ECM connector?	Repair the poor contact of ECM connector.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
3	**CHECK POWER SUPPLY TO THE EXHAUST OIL CONTROL SOLENOID LH.** Measure the voltage between exhaust oil control solenoid LH connector and engine ground. ***Connector & terminal*** ***(E66) No. 1 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **4**.	Repair the power supply circuit.
4	**CHECK HARNESS BETWEEN ECM AND EXHAUST OIL CONTROL SOLENOID LH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and exhaust oil control solenoid LH. 3) Measure the resistance between exhaust oil control solenoid LH connector and engine ground. ***Connector & terminal*** ***(E66) No. 2 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the short circuit to ground in harness between ECM connector and exhaust oil control solenoid LH connector.
5	**CHECK HARNESS BETWEEN ECM AND EXHAUST OIL CONTROL SOLENOID LH CONNECTOR.** Measure the resistance of harness between ECM connector and exhaust oil control solenoid LH. ***Connector & terminal*** ***(B134) No. 5 — (E66) No. 2:***	Is the resistance less than 1 Ω?	Go to step **6**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and exhaust oil control solenoid LH connector • Poor contact of coupling connector
6	**CHECK EXHAUST OIL CONTROL SOLENOID LH.** Measure the resistance between exhaust oil control solenoid LH terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 6 — 12 Ω?	Repair the poor contact of exhaust oil control solenoid LH connector.	Replace the exhaust oil control solenoid LH. <Ref. to FU(H4DO(w/o HEV))-64, Oil Control Solenoid.>

P: DTC P0024 EXHAUST AVCS SYSTEM 2 (RANGE/PERFORMANCE)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-21, DTC P0024 EXHAUST AVCS SYSTEM 2 (RANGE/PERFORMANCE), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Engine stalls.
- Improper idling

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine and let it idle. 2) Read the value of «Exh. VVT Retard Ang. L» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.>	Is the value of «Exh. VVT Retard Ang. L» approx. 0 deg?	Go to step **2**.	Check the following item and repair or replace if necessary. • Exhaust cam sprocket (clog or dirt of oil routing, setting of spring) • Exhaust camshaft (dirt, damage of camshaft)
2	**CHECK CURRENT DATA.** 1) Drive with acceleration and deceleration at 80 km/h (50 MPH) or less. NOTE: Drive to an extent that the duty output of oil flow control solenoid valve increases. 2) Read the values of «Exh. OCV Duty L» and «Exh. VVT Retard Ang. L» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.>	When the value of «Exh. OCV Duty L» increases more than 10%, is the value of «Exh. VVT Retard Ang. L» approx. 0 deg?	Check the following item and repair or replace if necessary. • Exhaust cam sprocket (clog or dirt of oil routing, setting of spring) • Exhaust camshaft (dirt, damage of camshaft)	Perform the following procedures, and clean the oil routing. Replace the engine oil and idle the engine for 5 minutes, and then replace the oil filter and engine oil. <Ref. to LU(H4DO(w/o HEV))-13, REPLACEMENT, Engine Oil.> <Ref. to LU(H4DO(w/o HEV))-29, Engine Oil Filter.>

Q: DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1)

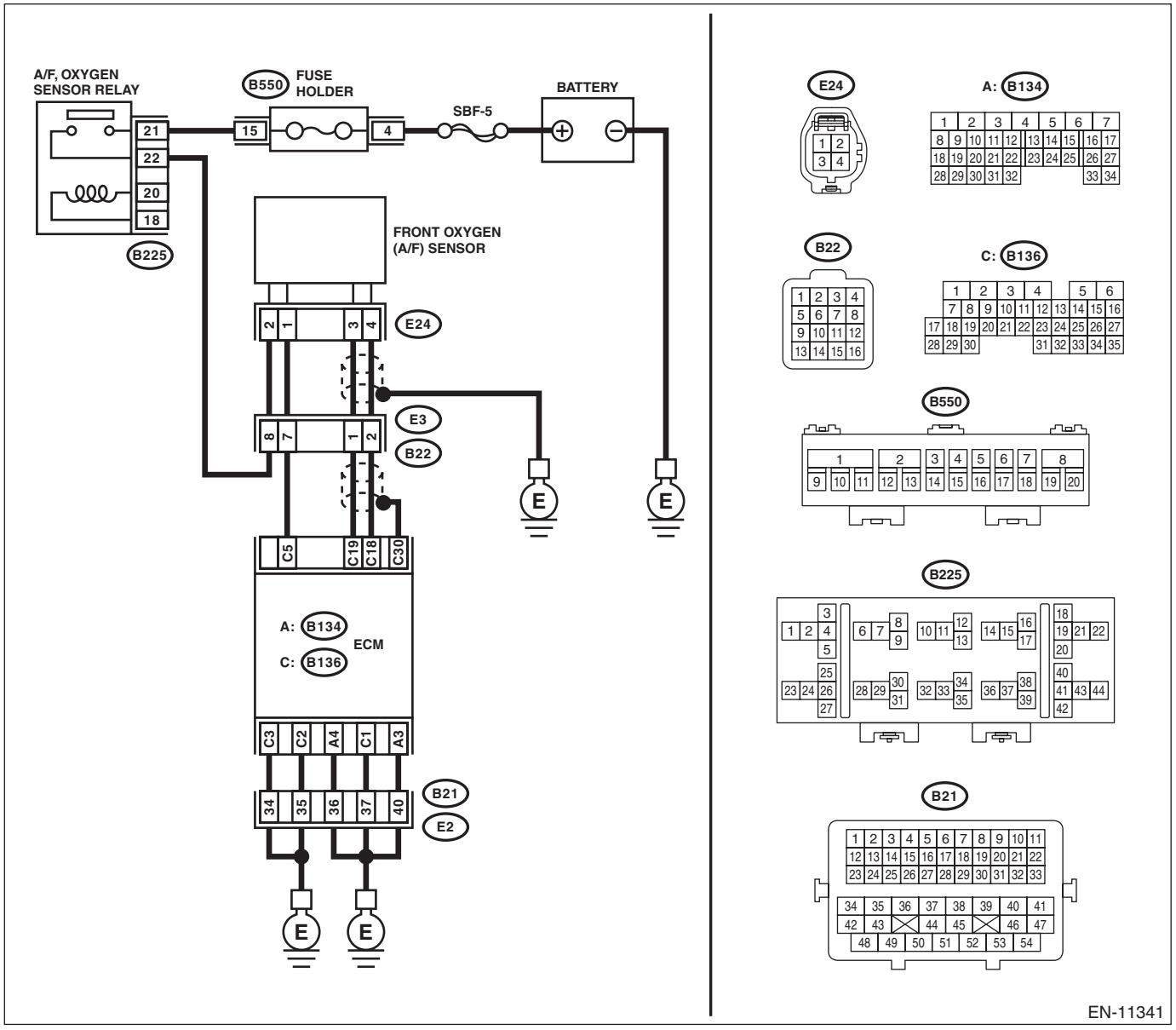
DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-22, DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Start and warm up the engine. 2) Turn the ignition switch to OFF. 3) Disconnect the connectors from ECM and front oxygen (A/F) sensor. 4) Measure the resistance of harness between ECM connector and front oxygen (A/F) sensor connector. ***Connector & terminal*** ***(B136) No. 5 — (E24) No. 1:*** ***(B136) No. 19 — (E24) No. 3:*** ***(B136) No. 18 — (E24) No. 4:***	Is the resistance less than 1 Ω?	Go to step **2**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and front oxygen (A/F) sensor connector • Poor contact of coupling connector
2	**CHECK FRONT OXYGEN (A/F) SENSOR.** Measure the resistance between front oxygen (A/F) sensor terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 2 — 3 Ω?	Go to step **3**.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DO(w/o HEV))-92, Front Oxygen (A/F) Sensor.>
3	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM and front oxygen (A/F) sensor connector.	Is there poor contact of ECM or front oxygen (A/F) sensor connector?	Repair the poor contact of ECM or front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DO(w/o HEV))-92, Front Oxygen (A/F) Sensor.>

R: DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1)

DTC DETECTING CONDITION:

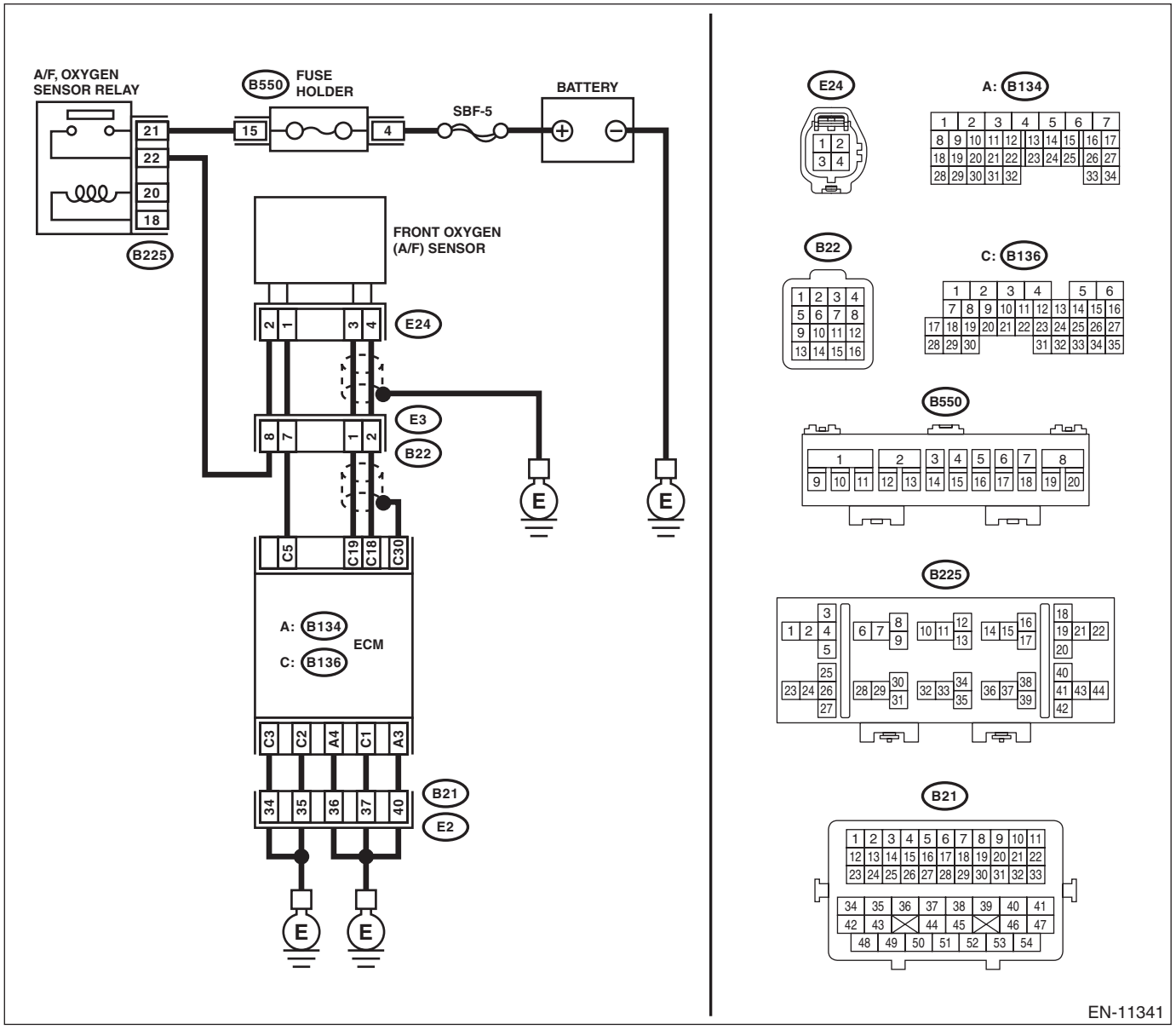
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-23, DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK POWER SUPPLY TO FRONT OXYGEN (A/F) SENSOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from front oxygen (A/F) sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between front oxygen (A/F) sensor connector and engine ground. ***Connector & terminal*** ***(E24) No. 2 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **2**.	Repair the power supply line. NOTE: In this case, repair the following item: • Open circuit in harness between A/F, oxygen sensor relay connector and front oxygen (A/F) sensor connector • Poor contact of A/F, oxygen sensor relay connector • Poor contact of coupling connector • Malfunction of A/F, oxygen sensor relay
2	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connector and front oxygen (A/F) sensor connector. ***Connector & terminal*** ***(B136) No. 5 — (E24) No. 1:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and front oxygen (A/F) sensor connector • Poor contact of coupling connector
3	**CHECK GROUND CIRCUIT FOR ECM.** Measure the resistance of harness between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 3 — Chassis ground:*** ***(B134) No. 4 — Chassis ground:*** ***(B136) No. 1 — Chassis ground:*** ***(B136) No. 2 — Chassis ground:*** ***(B136) No. 3 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM connector and engine ground • Poor contact of coupling connector
4	**CHECK FRONT OXYGEN (A/F) SENSOR.** Measure the resistance between front oxygen (A/F) sensor terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 2 — 3 Ω?	Repair the poor contact of ECM connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DO(w/o HEV))-92, Front Oxygen (A/F) Sensor.>

S: DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1)

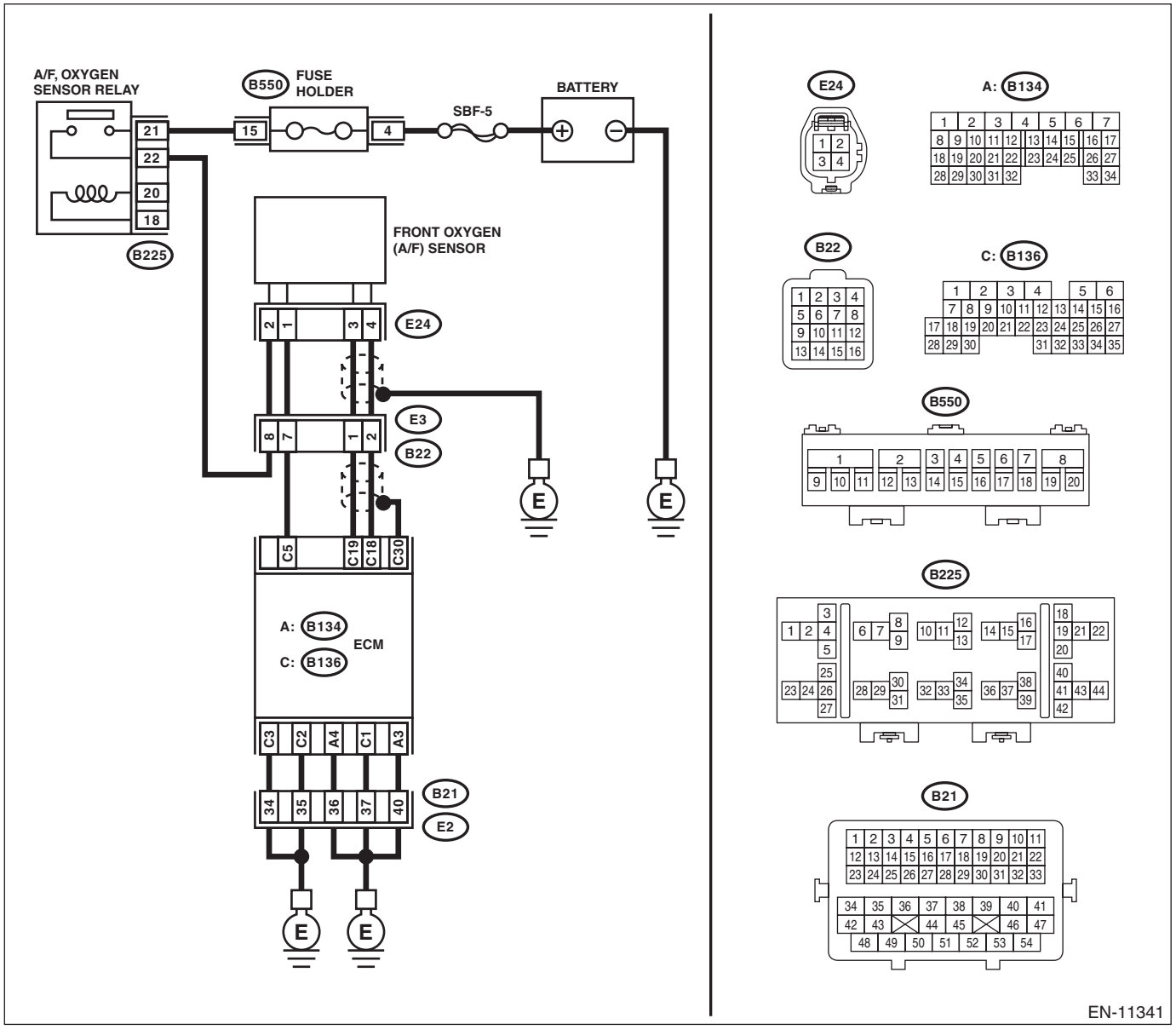
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-24, DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 5 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM connector and front oxygen (A/F) sensor connector.	Go to step **2**.
2	**CHECK GROUND CIRCUIT FOR ECM.** 1) Disconnect the connector from ECM. 2) Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 3 — Chassis ground:*** ***(B134) No. 4 — Chassis ground:*** ***(B136) No. 1 — Chassis ground:*** ***(B136) No. 2 — Chassis ground:*** ***(B136) No. 3 — Chassis ground:***	Is the resistance less than 5 Ω?	Repair the poor contact of ECM connector.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM connector and engine ground • Poor contact of coupling connector

T: DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2)

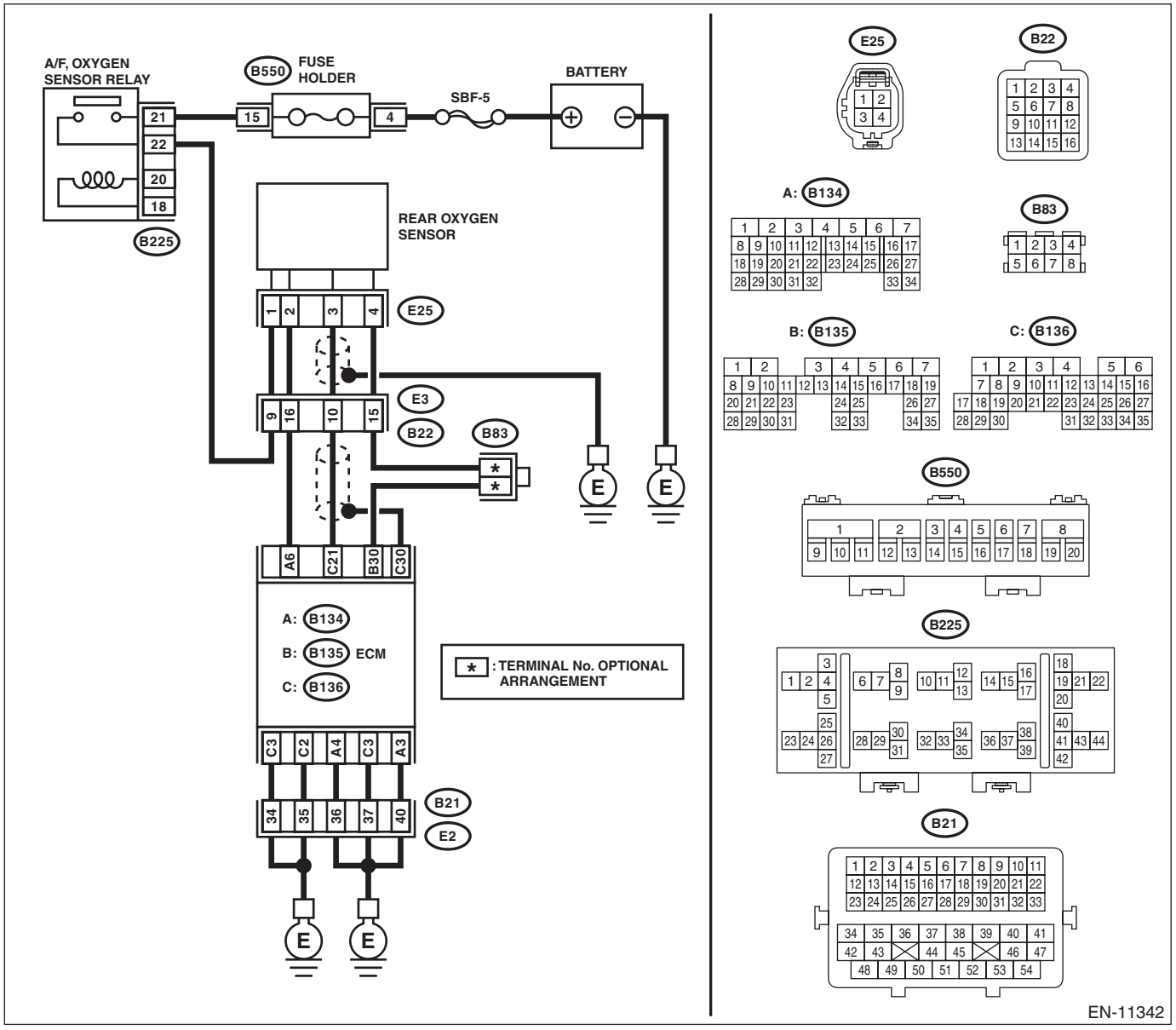
DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-25, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK POWER SUPPLY TO REAR OXYGEN SENSOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from rear oxygen sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between rear oxygen sensor connector and engine ground. ***Connector & terminal*** ***(E25) No. 1 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **2**.	Repair the power supply line. Or replace the main relay. NOTE: In this case, repair the following item: • Open circuit in harness between A/F, oxygen sensor relay connector and rear oxygen sensor connector • Poor contact of A/F, oxygen sensor relay connector • Poor contact of coupling connector • Malfunction of A/F, oxygen sensor relay
2	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connector and oxygen sensor connector. ***Connector & terminal*** ***(B134) No. 6 — (E25) No. 2:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and rear oxygen sensor connector • Poor contact of coupling connector
3	**CHECK GROUND CIRCUIT FOR ECM.** Measure the resistance of harness between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 3 — Chassis ground:*** ***(B134) No. 4 — Chassis ground:*** ***(B136) No. 1 — Chassis ground:*** ***(B136) No. 2 — Chassis ground:*** ***(B136) No. 3 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM connector and engine ground • Poor contact of coupling connector
4	**CHECK REAR OXYGEN SENSOR.** Measure the resistance between rear oxygen sensor terminals. ***Terminals*** ***No. 2 — No. 1:***	Is the resistance 5 — 6.4 Ω?	Repair the poor contact of ECM connector.	Replace the rear oxygen sensor. <Ref. to FU(H4DO(w/o HEV))-96, Rear Oxygen Sensor.>

U: DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2)

DTC DETECTING CONDITION:

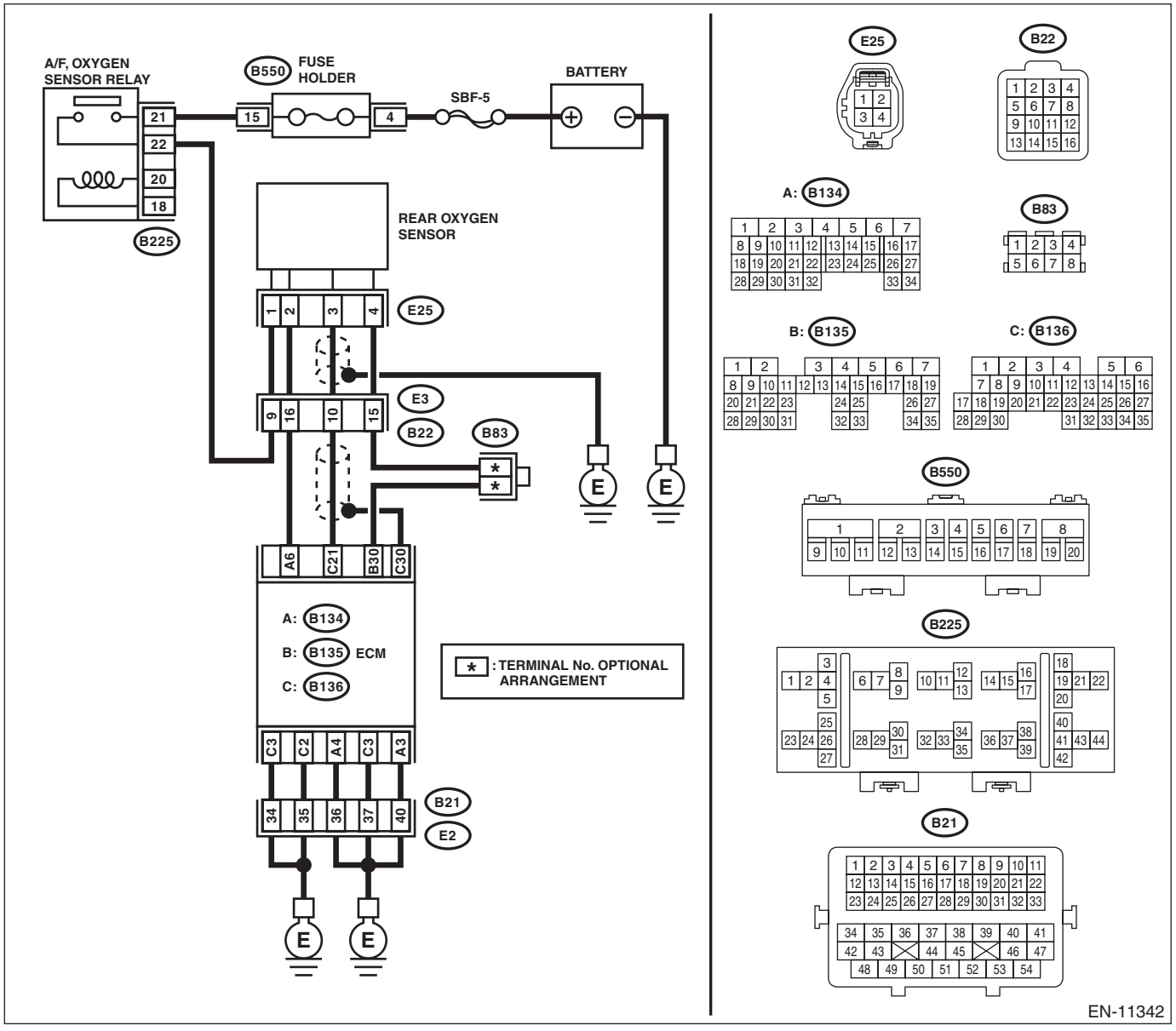
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-26, DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 6 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM connector and rear oxygen sensor connector.	Go to step **2**.
2	**CHECK GROUND CIRCUIT FOR ECM.** 1) Disconnect the connector from ECM. 2) Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 3 — Chassis ground:*** ***(B134) No. 4 — Chassis ground:*** ***(B136) No. 1 — Chassis ground:*** ***(B136) No. 2 — Chassis ground:*** ***(B136) No. 3 — Chassis ground:***	Is the resistance less than 5 Ω?	Repair the poor contact of ECM connector.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM connector and engine ground • Poor contact of coupling connector

V: DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-27, DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK AIR INTAKE SYSTEM.**	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair the air intake system.	Go to step **2**.
2	**CHECK MANIFOLD ABSOLUTE PRESSURE SENSOR.** 1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F). 2) For CVT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Read the value of «Mani. Absolute Pressure» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the "General Scan Tool Instruction Manual".	Is the value of «Mani. Absolute Pressure» 73.3 — 106.6 kPa (550 — 800 mmHg, 21.65 — 31.50 inHg) when the ignition is turned ON, and 20.0 — 46.7 kPa (150 — 350 mmHg, 5.91 — 13.78 inHg) while idling?	Go to step **3**.	Replace the manifold absolute pressure sensor. <Ref. to FU(H4DO(w/o HEV))-76, Manifold Absolute Pressure Sensor.>
3	**CHECK THROTTLE OPENING ANGLE.** Read the value of «Throttle Opening Angle» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the "General Scan Tool Instruction Manual".	Is the value of «Throttle Opening Angle» less than 5% when the throttle is fully closed?	Go to step **4**.	Replace the electronic throttle control. <Ref. to FU(H4DO(w/o HEV))-14, Throttle Body.>
4	**CHECK THROTTLE OPENING ANGLE.**	Is the value of «Throttle Opening Angle» 85% or more when the throttle is fully open?	Replace the manifold absolute pressure sensor. <Ref. to FU(H4DO(w/o HEV))-76, Manifold Absolute Pressure Sensor.>	Replace the electronic throttle control. <Ref. to FU(H4DO(w/o HEV))-14, Throttle Body.>

W: DTC P0071 AMBIENT TEMPERATURE SENSOR CIRCUIT "A" RANGE/PERFORMANCE

DTC DETECTING CONDITION:

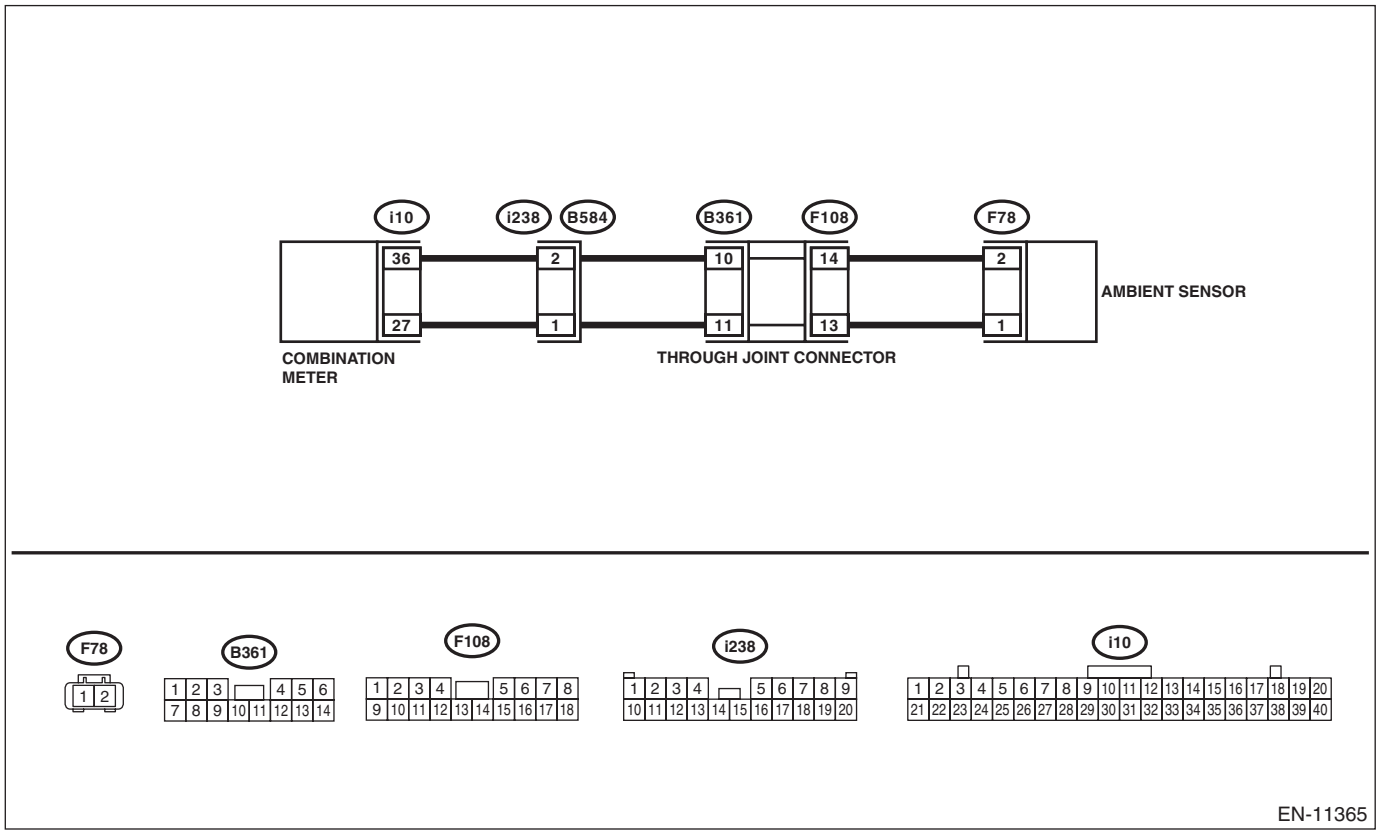
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-29, DTC P0071 AMBIENT TEMPERATURE SENSOR CIRCUIT "A" RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Air conditioning system <Ref. to WI(HEV)-56, WIRING DIAGRAM, Air Conditioning System.>



Step		Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.

	Step	Check	Yes	No
2	**CHECK AMBIENT SENSOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ambient sensor. 3) Measure the resistance between ambient sensor terminals while heating and cooling the ambient sensor using a hair drier. **CAUTION:** **Do not heat the part to the temperature where you cannot touch it with your bare hand in order to prevent burning yourself and protect the part.** ***Terminals*** ***No. 1 — No. 2:***	Is the resistance of ambient sensor different between during heating and during cooling?	Repair the poor contact of ECM connector.	Replace the ambient sensor. <Ref. to AC-77, Ambient Sensor.>

X: DTC P0072 AMBIENT TEMPERATURE SENSOR CIRCUIT "A" LOW

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-31, DTC P0072 AMBIENT TEMPERATURE SENSOR CIRCUIT "A" LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK DTC.** Check for DTC. <Ref. to EN(H4DO w/o HEV)(diag)-49, Read Diagnostic Trouble Code (DTC).>	Is DTC P0072 or P0073 displayed in «Present fault»?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK COMBINATION METER.** Check the combination meter system. <Ref. to IDI(diag)-2, Basic Diagnostic Procedure.>	Is combination meter system OK?	Replace the ambient sensor. <Ref. to AC-77, Ambient Sensor.>	Repair the combination meter system. <Ref. to IDI(diag)-2, Basic Diagnostic Procedure.>

Y: DTC P0073 AMBIENT TEMPERATURE SENSOR CIRCUIT "A" HIGH

NOTE:
For the diagnostic procedure, refer to DTC P0072. <Ref. to EN(H4DO w/o HEV)(diag)-139, DTC P0072 AMBIENT TEMPERATURE SENSOR CIRCUIT "A" LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Z: DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-33, DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Improper idling
- Engine stalls.
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

Step		Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check the appropriate DTC using the “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DO(w/o HEV))-73, Mass Air Flow and Intake Air Temperature Sensor.>

AA:DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-35, DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

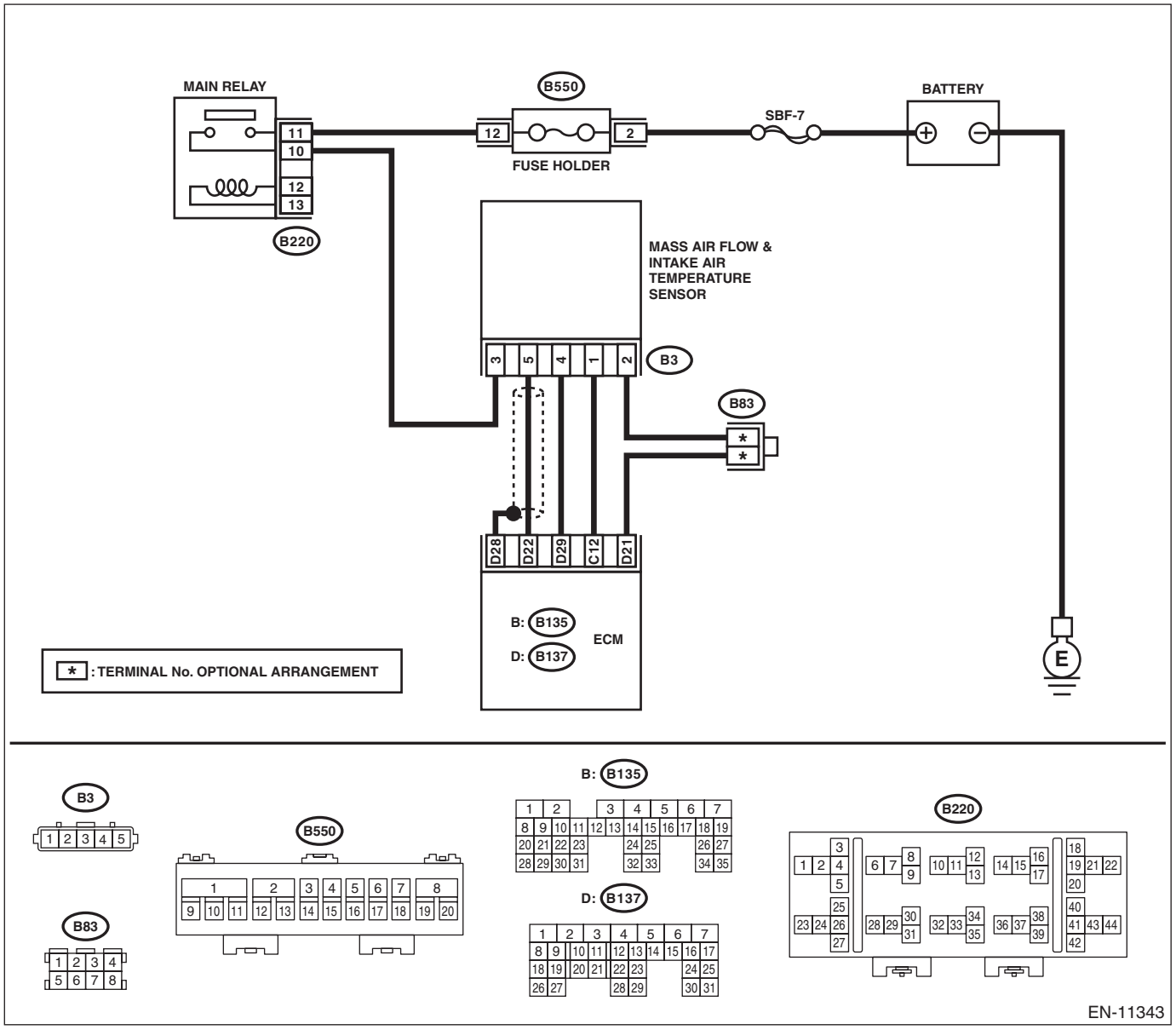
- Improper idling
- Engine stalls.
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «Air Flow Sensor Voltage» using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.>	Is the value of «Air Flow Sensor Voltage» less than 0.2 V?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK POWER SUPPLY OF MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the mass air flow and intake air temperature sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between mass air flow and intake air temperature sensor connector and engine ground. ***Connector & terminal*** ***(B3) No. 3 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between main relay and mass air flow and intake air temperature sensor connector • Poor contact of main relay connector
3	**CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM connector and the mass air flow and intake air temperature sensor connector. ***Connector & terminal*** ***(B137) No. 22 — (B3) No. 5:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the open circuit of harness between ECM connector and the mass air flow and intake air temperature sensor connector.
4	**CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.** Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B137) No. 22 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the ground short circuit of harness between ECM connector and the mass air flow and intake air temperature sensor connector.
5	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM and mass air flow and intake air temperature sensor connector.	Is there poor contact of ECM or mass air flow and intake air temperature sensor connector?	Repair the poor contact of ECM or mass air flow and intake air temperature sensor connector.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DO(w/o HEV))-73, Mass Air Flow and Intake Air Temperature Sensor.>

AB:DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-36, DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

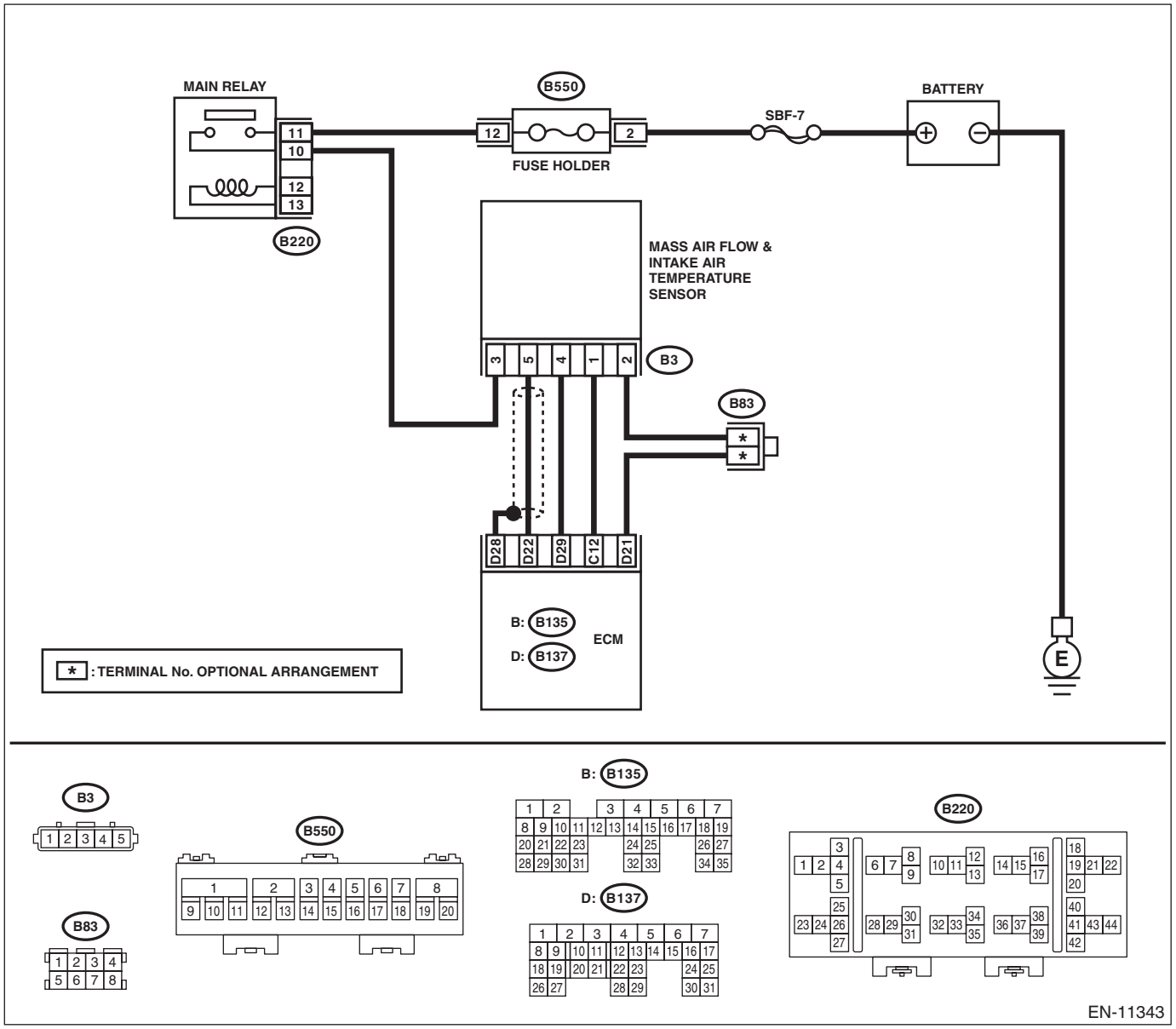
- Improper idling
- Engine stalls.
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «Air Flow Sensor Voltage» using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.>	Is the value of «Air Flow Sensor Voltage» 5 V or more?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the mass air flow and intake air temperature sensor. 3) Start the engine. 4) Read the value of «Air Flow Sensor Voltage» using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.>	Is the value of «Air Flow Sensor Voltage» 5 V or more?	Repair the short circuit of harness to power supply between ECM connector and the mass air flow and intake air temperature sensor connector.	Go to step **3**.
3	**CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between mass air flow and intake air temperature sensor connector and engine ground. ***Connector & terminal*** ***(B3) No. 4 — Engine ground:***	Is the resistance less than 5 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and the mass air flow and intake air temperature sensor connector • Poor contact of ECM connector
4	**CHECK FOR POOR CONTACT.** Check for poor contact of mass air flow and intake air temperature sensor connector.	Is there poor contact of mass air flow and intake air temperature sensor connector?	Repair the poor contact of mass air flow and intake air temperature sensor connector.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DO(w/o HEV))-73, Mass Air Flow and Intake Air Temperature Sensor.>

AC:DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT

DTC DETECTING CONDITION:

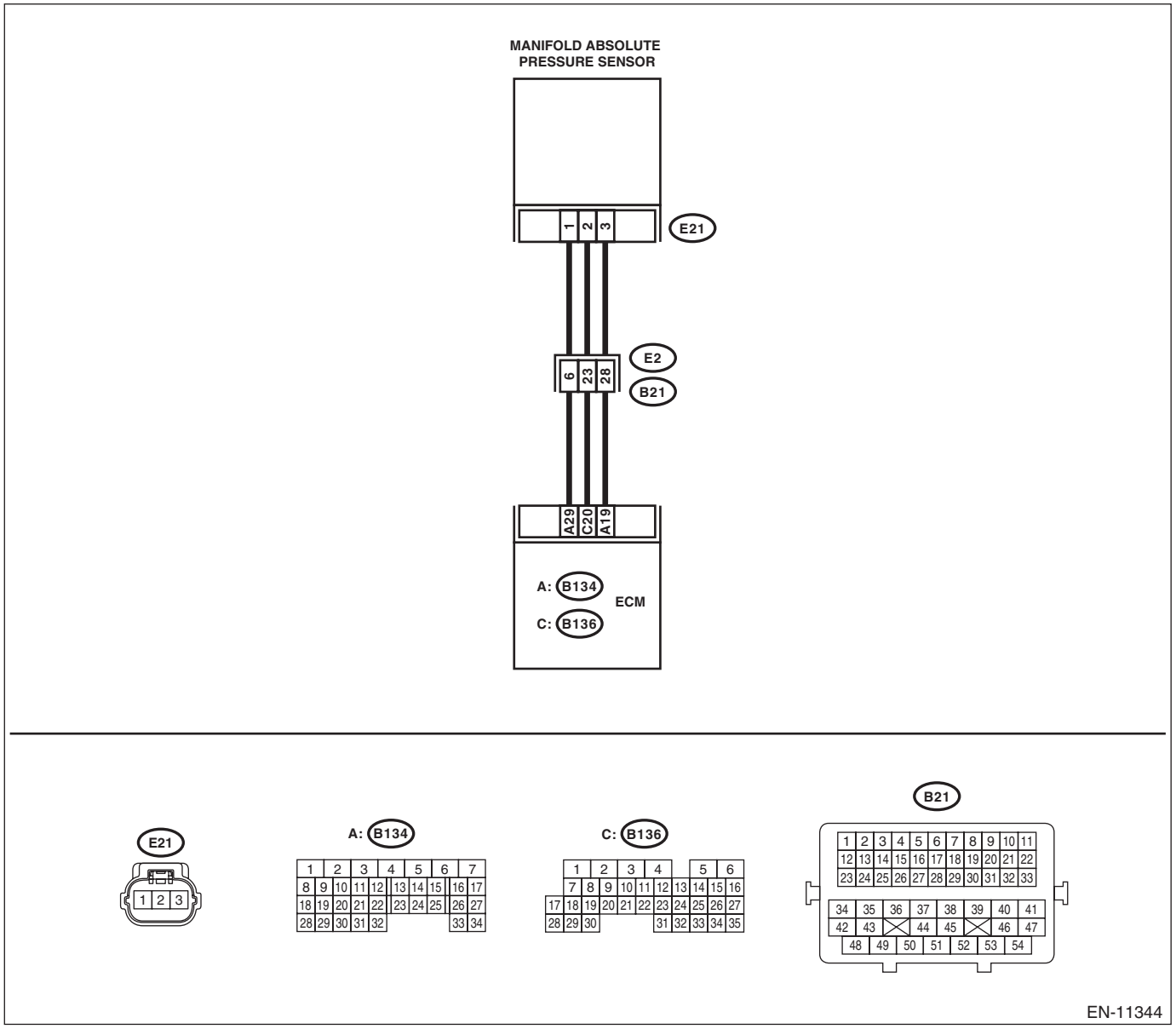
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-37, DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «Mani. Absolute Pressure» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Mani. Absolute Pressure» less than 13.3 kPa (100 mmHg, 3.94 inHg)?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK POWER SUPPLY OF MANIFOLD ABSOLUTE PRESSURE SENSOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from manifold absolute pressure sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between manifold absolute pressure sensor connector and engine ground. ***Connector & terminal*** ***(E21) No. 3 (+) — Engine ground (–):***	Is the voltage 4.5 V or more?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM connector and manifold absolute pressure sensor connector • Poor contact of ECM connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM connector and manifold absolute pressure sensor connector. ***Connector & terminal*** ***(B136) No. 20 — (E21) No. 2:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM connector and manifold absolute pressure sensor connector • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR.** Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 20 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair short circuit to ground in harness between ECM connector and manifold absolute pressure sensor connector.
5	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM and manifold absolute pressure sensor connector.	Is there poor contact of ECM or manifold absolute pressure sensor connector?	Repair the poor contact of ECM or manifold absolute pressure sensor connector.	Replace the manifold absolute pressure sensor. <Ref. to FU(H4DO(w/o HEV))-76, Manifold Absolute Pressure Sensor.>

AD:DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT

DTC DETECTING CONDITION:

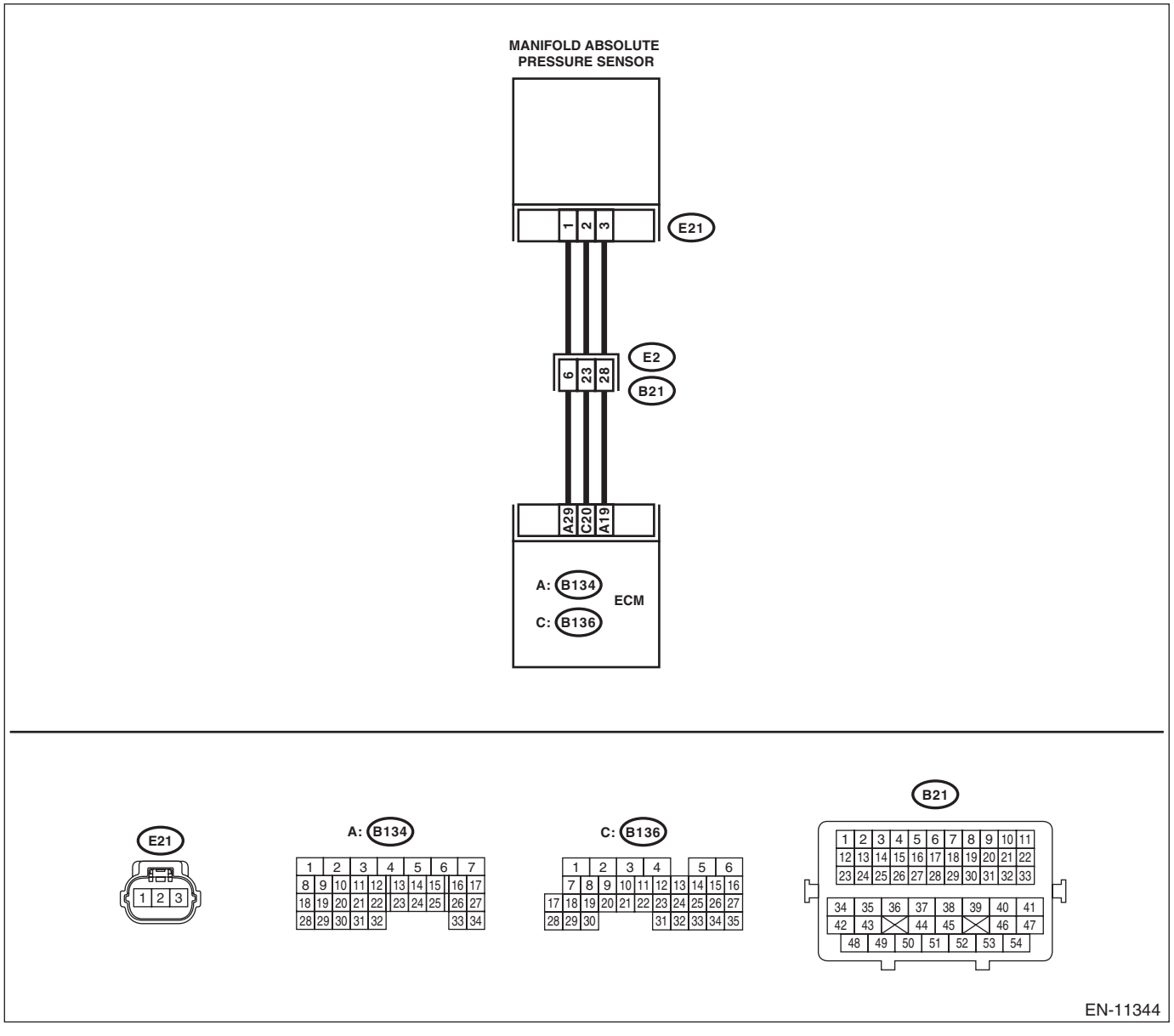
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-38, DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «Mani. Absolute Pressure» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Mani. Absolute Pressure» 119.5 kPa (896.5 mmHg, 35.29 inHg) or more?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from manifold absolute pressure sensor. 3) Start the engine. 4) Read the value data of «Mani. Absolute Pressure» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Mani. Absolute Pressure» 119.5 kPa (896.5 mmHg, 35.29 inHg) or more?	Repair the short circuit to power in harness between ECM connector and manifold absolute pressure sensor connector.	Go to step **3**.
3	**CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between manifold absolute pressure sensor connector and engine ground. ***Connector & terminal*** ***(E21) No. 1 — Engine ground:***	Is the resistance less than 5 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM connector and manifold absolute pressure sensor connector • Poor contact of ECM connector • Poor contact of coupling connector
4	**CHECK FOR POOR CONTACT.** Check for poor contact of manifold absolute pressure sensor connector.	Is there poor contact of manifold absolute pressure sensor connector?	Repair the poor contact of manifold absolute pressure sensor connector.	Replace the manifold absolute pressure sensor. <Ref. to FU(H4DO(w/o HEV))-76, Manifold Absolute Pressure Sensor.>

AE:DTC P0111 INTAKE AIR TEMPERATURE SENSOR RANGE/PERFORMANCE PROBLEM

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-39, DTC P0111 INTAKE AIR TEMPERATURE SENSOR RANGE/PERFORMANCE PROBLEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK ENGINE COOLANT TEMPERATURE.** 1) Start the engine and warm up completely. 2) Read the value of «Coolant Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Coolant Temp.» 75°C (167°F) or more?	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DO(w/o HEV))-73, Mass Air Flow and Intake Air Temperature Sensor.>	Check for DTC P0125. <Ref. to EN(H4DO w/o HEV)(diag)-163, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AF:DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-42, DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

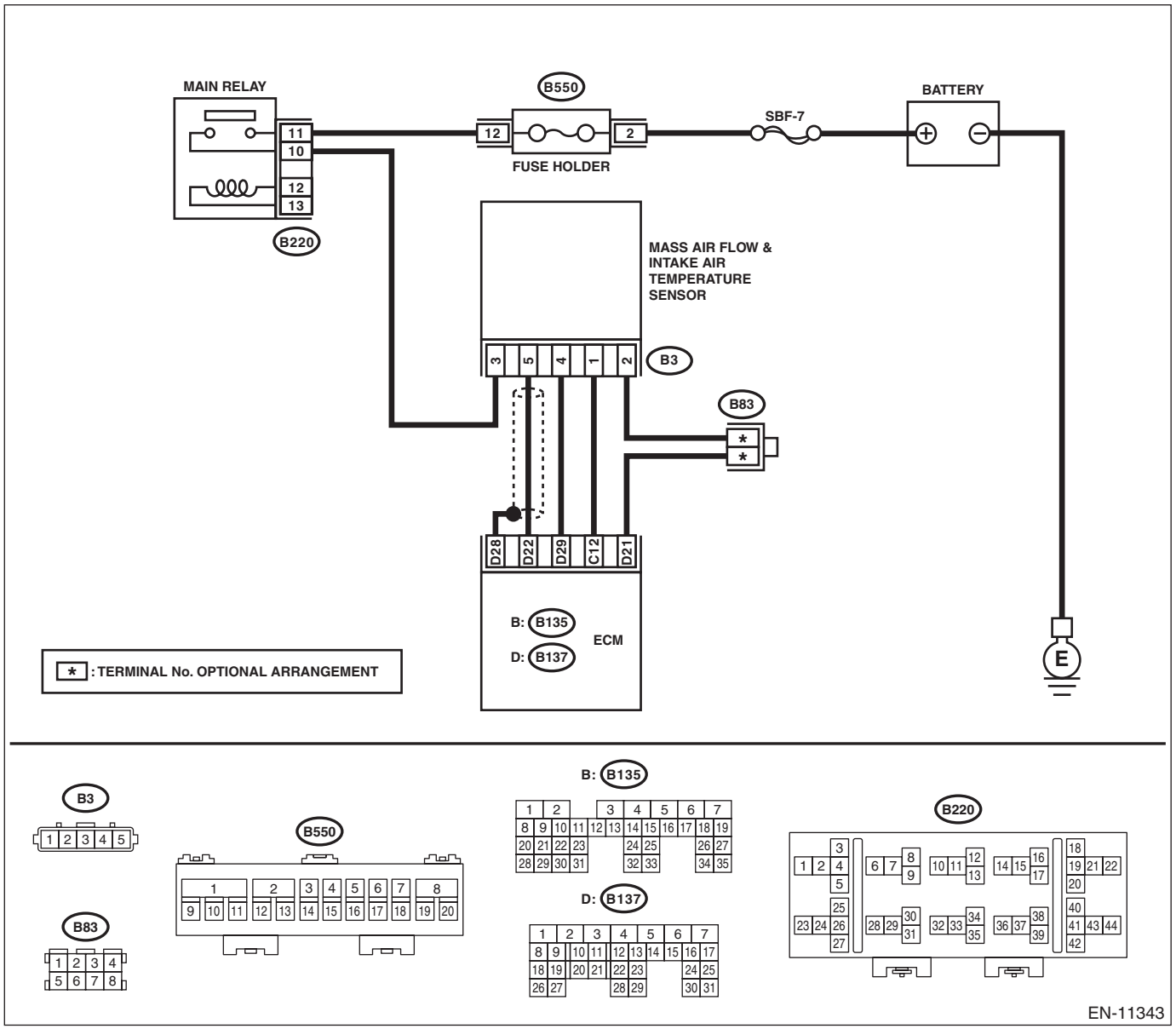
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «Intake Air Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Intake Air Temp.» 120°C (248°F) or more?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and the mass air flow and intake air temperature sensor. 3) Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B137) No. 12 — Chassis ground:***	Is the resistance 1 MΩ or more?	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DO(w/o HEV))-73, Mass Air Flow and Intake Air Temperature Sensor.>	Repair the ground short circuit of harness between ECM connector and the mass air flow and intake air temperature sensor connector.

AG:DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-43, DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

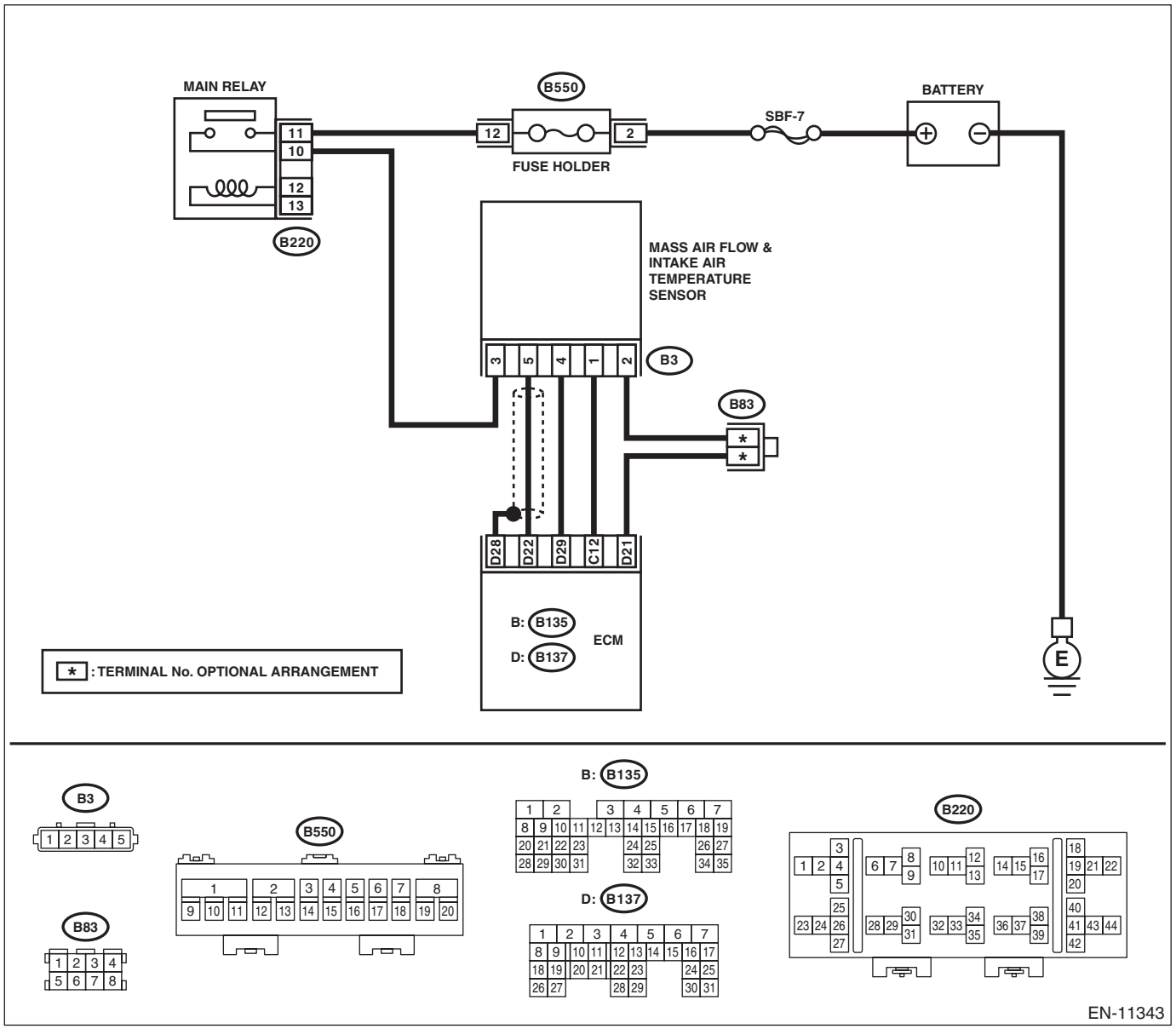
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «Intake Air Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Intake Air Temp.» –40°C (–40°F) or less?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM and mass air flow and intake air temperature sensor connector.	Is there poor contact of ECM or mass air flow and intake air temperature sensor connector?	Repair the poor contact of ECM or mass air flow and intake air temperature sensor connector.	Go to step **3**.
3	**CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and the mass air flow and intake air temperature sensor. 3) Measure the resistance of harness between ECM connector and the mass air flow and intake air temperature sensor connector. ***Connector & terminal*** ***(B137) No. 12 — (B3) No. 1:*** ***(B137) No. 11 — (B3) No. 2:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and the mass air flow and intake air temperature sensor connector • Poor contact of joint connector
4	**CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.** 1) Connect all connectors. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B137) No. 12 (+) — Chassis ground (–):***	Is the voltage 5 V or more?	Repair the short circuit of harness to power supply between ECM connector and the mass air flow and intake air temperature sensor connector.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DO(w/o HEV))-73, Mass Air Flow and Intake Air Temperature Sensor.>

AH:DTC P0116 ENGINE COOLANT TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-44, DTC P0116 ENGINE COOLANT TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Hard to start
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check the appropriate DTC using the “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK ENGINE COOLANT TEMPERATURE SENSOR.** 1) Disconnect the connectors from the engine coolant temperature sensor. 2) Measure the resistance between engine coolant temperature sensor terminals when the engine coolant is cold and after warmed up. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance of engine coolant temperature sensor different between when engine coolant is cold and after warmed up?	Repair the poor contact of ECM connector.	Replace the engine coolant temperature sensor. <Ref. to FU(H4DO(w/o HEV))-51, Engine Coolant Temperature Sensor.>

AI: DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW

DTC DETECTING CONDITION:

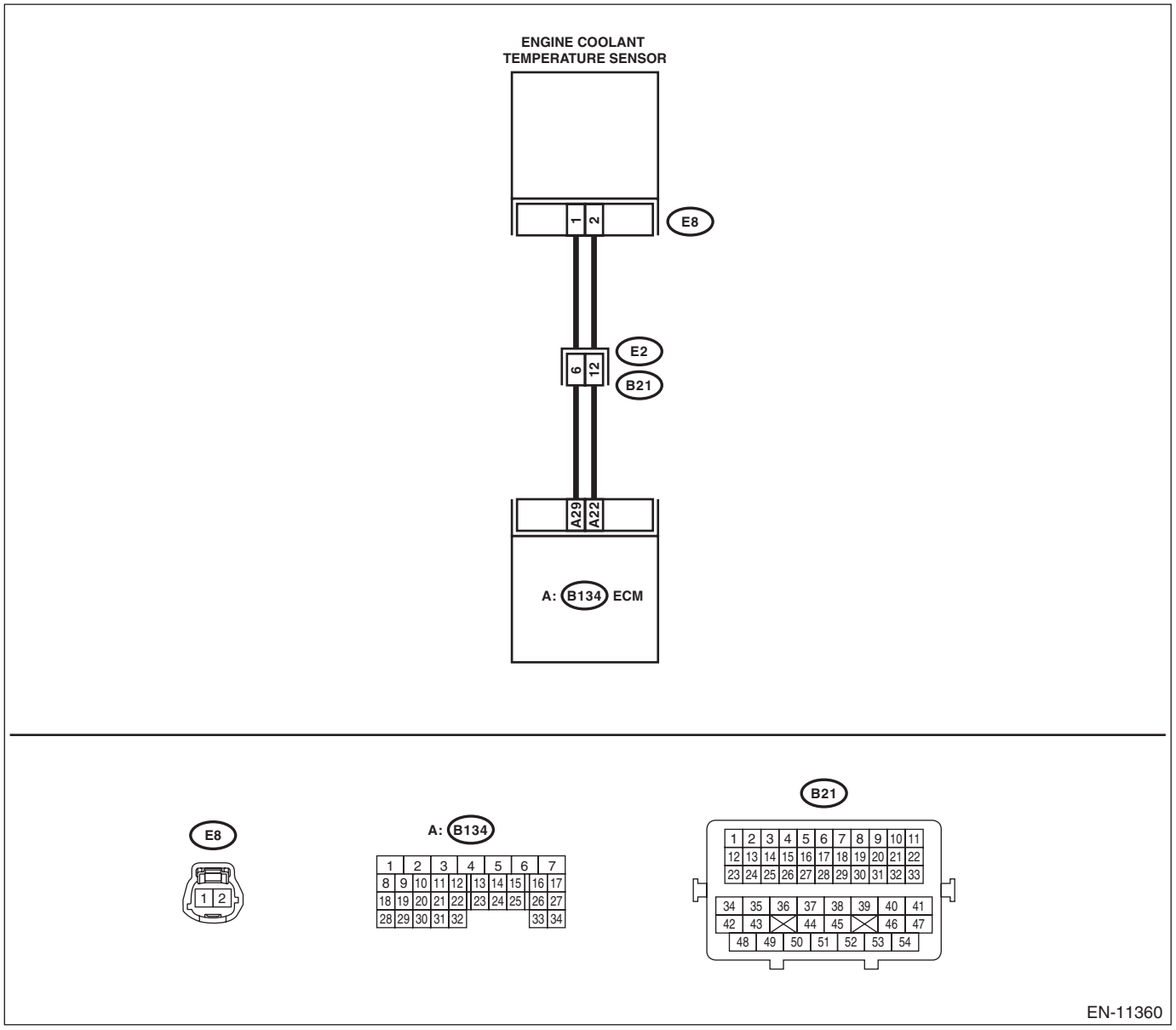
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-46, DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Hard to start
- Improper idling
- Poor driving performance

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:
Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «Coolant Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Coolant Temp.» 120°C (248°F) or more?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK HARNESS BETWEEN ECM AND ENGINE COOLANT TEMPERATURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and engine coolant temperature sensor. 3) Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 30 — Chassis ground:***	Is the resistance 1 MΩ or more?	Replace the engine coolant temperature sensor. <Ref. to FU(H4DO(w/o HEV))-51, Engine Coolant Temperature Sensor.>	Repair the short circuit to ground in harness between ECM connector and engine coolant temperature sensor connector.

AJ:DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH

DTC DETECTING CONDITION:

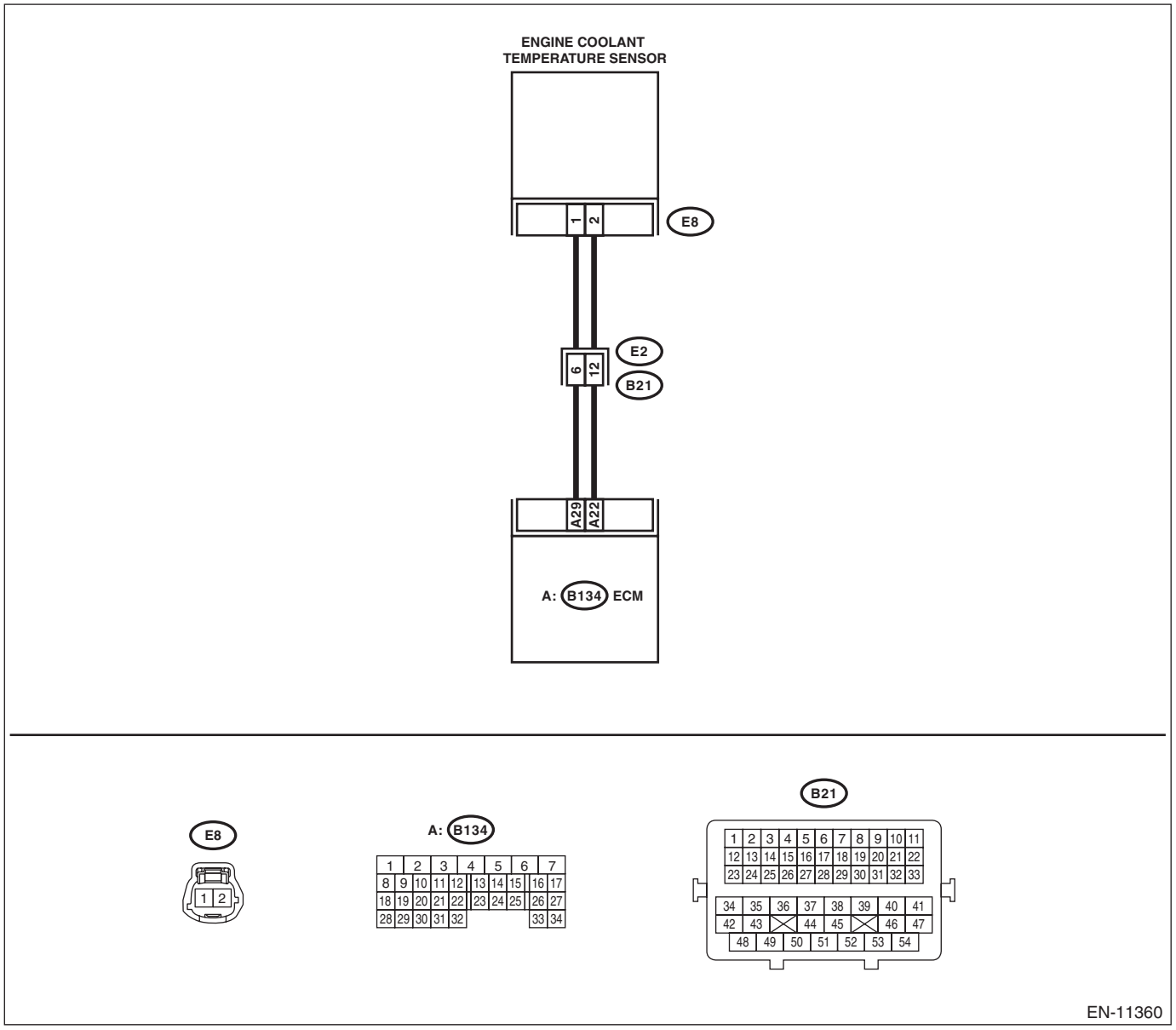
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-47, DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Hard to start
- Improper idling
- Poor driving performance

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:
Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «Coolant Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Coolant Temp.» –40°C (–40°F) or less?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM and engine coolant temperature sensor connector.	Is there poor contact of ECM or engine coolant temperature sensor connector?	Repair the poor contact of ECM or engine coolant temperature sensor connector.	Go to step **3**.
3	**CHECK HARNESS BETWEEN ECM AND ENGINE COOLANT TEMPERATURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and engine coolant temperature sensor. 3) Measure the resistance of harness between ECM connector and engine coolant temperature sensor connector. ***Connector & terminal*** ***(B134) No. 30 — (E8) No. 2:*** ***(B134) No. 29 — (E8) No. 1:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and engine coolant temperature sensor connector • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN ECM AND ENGINE COOLANT TEMPERATURE SENSOR CONNECTOR.** 1) Connect all connectors. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B137) No. 22 (+) — Chassis ground (–):***	Is the voltage 5 V or more?	Repair the short circuit of harness to power supply between ECM connector and engine coolant temperature sensor connector.	Replace the engine coolant temperature sensor. <Ref. to FU(H4DO(w/o HEV))-51, Engine Coolant Temperature Sensor.>

AK:DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT LOW

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-48, DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

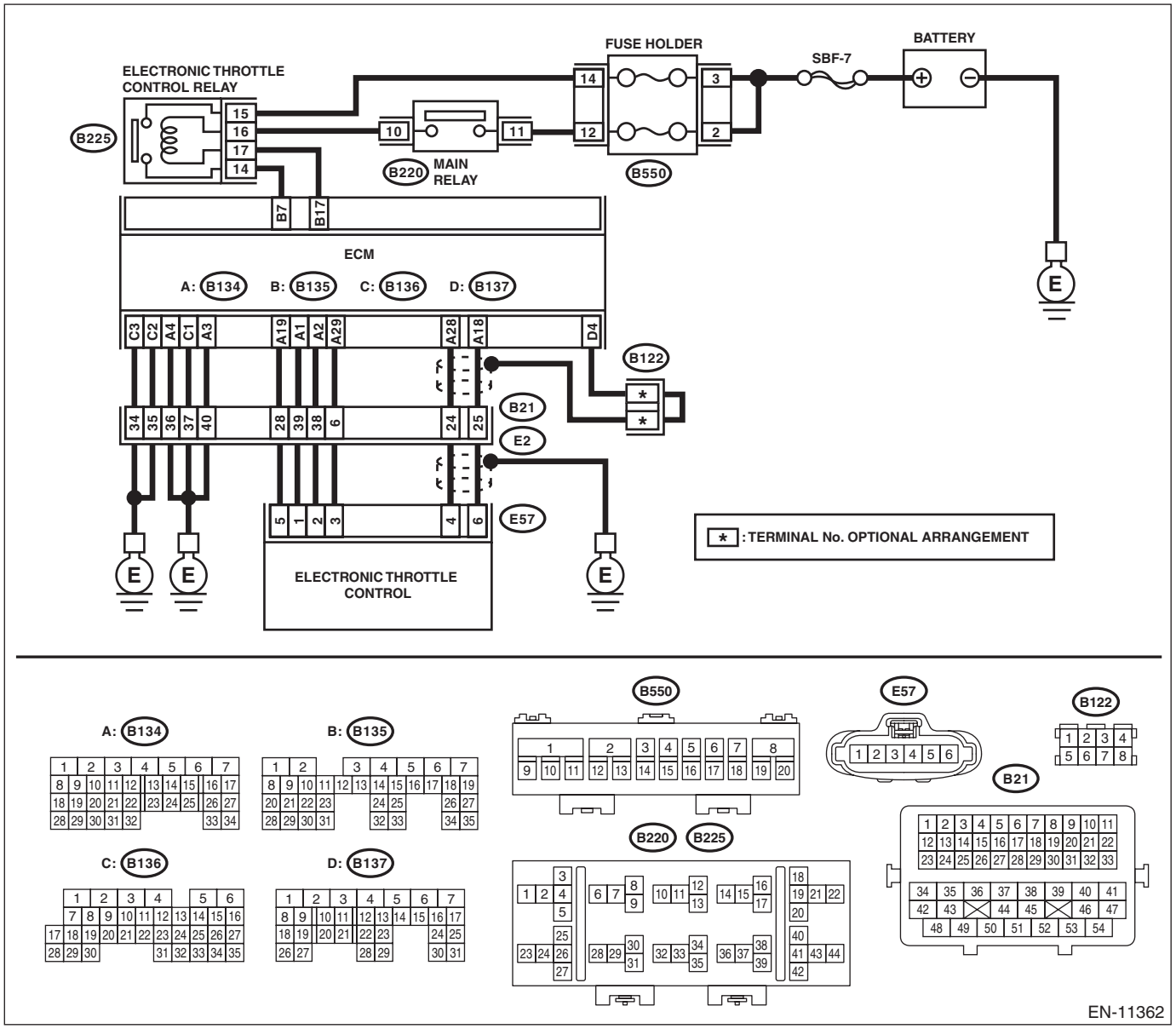
- Improper idling
- Engine stalls.
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 19 — Chassis ground:*** ***(B134) No. 18 — Chassis ground:*** ***(B134) No. 18 — (B136) No. 4:***	Is the resistance 1 MΩ or more?	Go to step **2**.	Repair the ground short circuit of harness between ECM connector and electronic throttle control connector.
2	**CHECK SHORT CIRCUIT INSIDE THE ECM.** 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 6 — Engine ground:***	Is the resistance 1 MΩ or more?	Replace the electronic throttle control. <Ref. to FU(H4DO(w/o HEV))-14, Throttle Body.>	Repair the ground short circuit of harness between ECM connector and electronic throttle control connector. Replace the ECM if defective. <Ref. to FU(H4DO(w/o HEV))-100, Engine Control Module (ECM).>

AL:DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT HIGH

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-49, DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

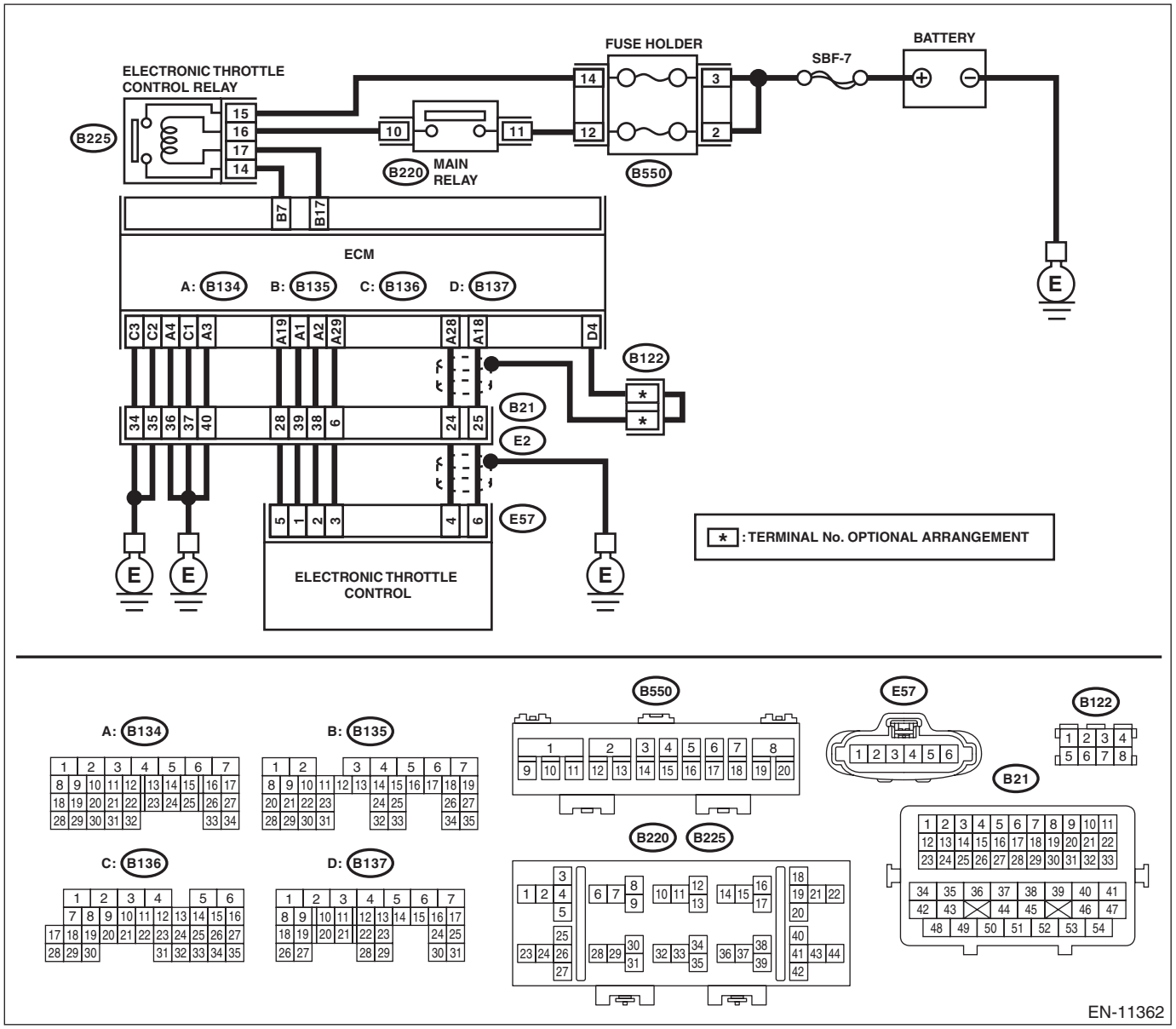
- Improper idling
- Engine stalls.
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance of harness between ECM connector and electronic throttle control connector. ***Connector & terminal*** ***(B134) No. 18 — (E57) No. 6:*** ***(B134) No. 29 — (E57) No. 3:***	Is the resistance less than 1 Ω?	Go to step **2**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and electronic throttle control connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 3 — Engine ground:***	Is the resistance less than 5 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM connector and engine ground • Poor contact of ECM connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 6 (+) — Engine ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between ECM connector and electronic throttle control connector.	Go to step **4**.
4	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connectors. ***Connector & terminal*** ***(B134) No. 19 — (B134) No. 18:***	Is the resistance 1 MΩ or more?	Repair the poor contact of electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4DO(w/o HEV))-14, Throttle Body.>	Repair the short circuit to power in the harness between ECM connector and electronic throttle control connector.

AM:DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-50, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

Engine does not return to idle.

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK TIRE SIZE.**	Is the tire size as specified and the same size as three other wheels?	Go to step **2**.	Replace the tire.
2	**CHECK ENGINE COOLANT.** Check the following items: • Amount of engine coolant • Engine coolant freeze • Contamination of engine coolant	Is the engine coolant normal?	Go to step **3**.	Fill or replace the engine coolant. <Ref. to CO(H4DO(w/o HEV))-16, REPLACEMENT, Engine Coolant.>
3	**CHECK THERMOSTAT.**	Does the thermostat remain opened?	Replace the thermostat. <Ref. to CO(H4DO(w/o HEV))-64, Thermostat.>	Replace the engine coolant temperature sensor. <Ref. to FU(H4DO(w/o HEV))-51, Engine Coolant Temperature Sensor.>

AN:DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-51, DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

Thermostat remains open.

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check the appropriate DTC using the “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK ENGINE COOLANT.**	Is the engine coolant amount normal?	Go to step **3**.	Refill the engine coolant. <Ref. to CO(H4DO(w/o HEV))-16, Engine Coolant.>
3	**CHECK RADIATOR FAN.** 1) Start the engine. 2) Check the radiator fan operation.	Does the radiator fan continuously rotate for 3 minutes or more during idling?	Repair radiator fan circuit. <Ref. to CO(H4DO(w/o HEV))-89, Radiator Main Fan and Fan Motor.> and <Ref. to CO(H4DO(w/o HEV))-93, Radiator Sub Fan and Fan Motor.>	Replace the thermostat. <Ref. to CO(H4DO(w/o HEV))-64, Thermostat.>

AO:DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1)

DTC DETECTING CONDITION:

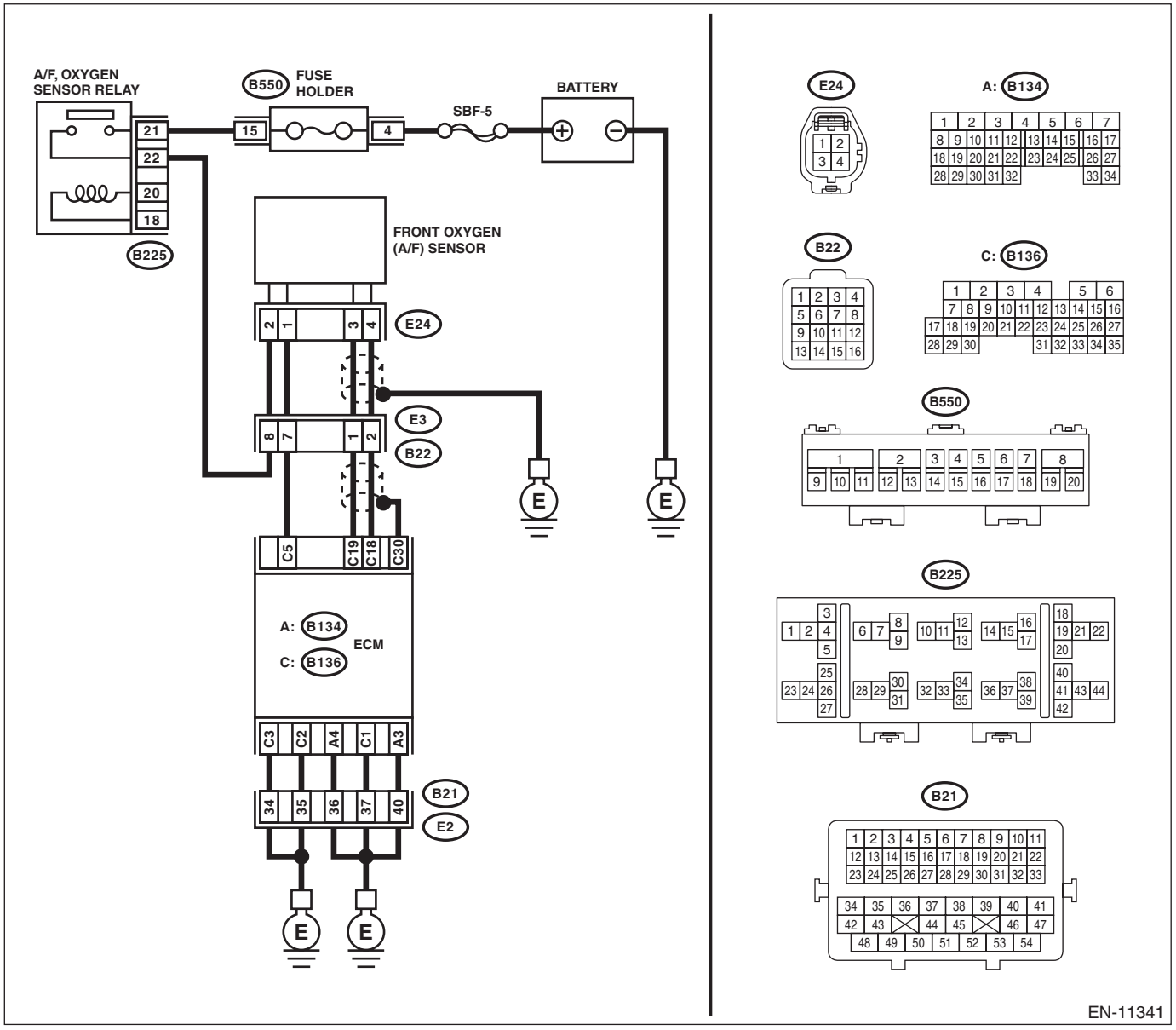
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-54, DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



Step		Check	Yes	No
1	**CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **2**.

Step		Check	Yes	No
2	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and front oxygen (A/F) sensor. 3) Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 18 — Chassis ground:*** ***(B136) No. 19 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **3**.	Repair the short circuit to ground in harness between ECM connector and front oxygen (A/F) sensor connector.
3	**CHECK FOR POOR CONTACT.** Check for poor contact of the front oxygen (A/F) sensor connector.	Is there poor contact of front oxygen (A/F) sensor connector?	Repair the poor contact of front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DO(w/o HEV))-92, Front Oxygen (A/F) Sensor.>

AP:DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1)

DTC DETECTING CONDITION:

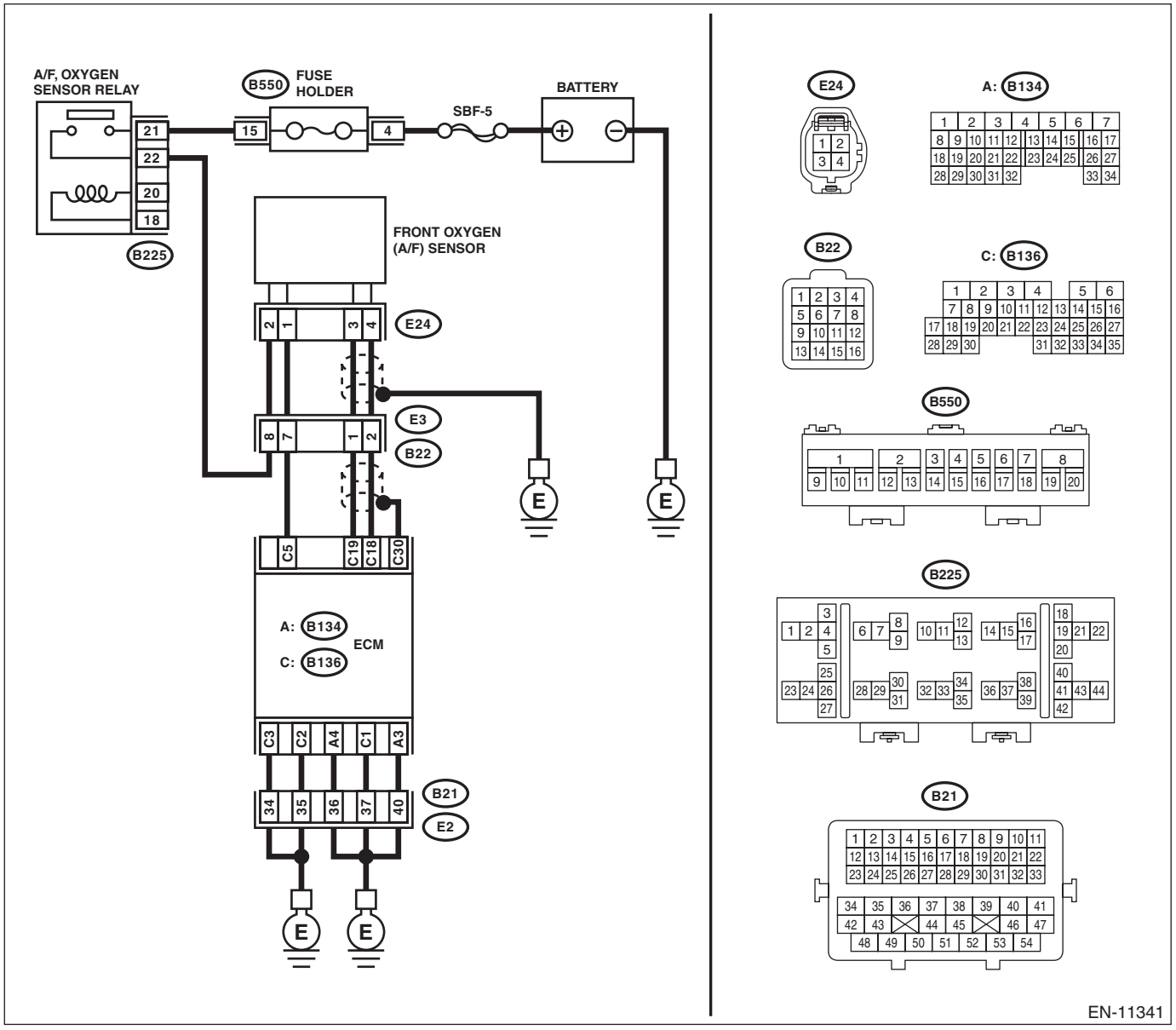
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-55, DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



Step		Check	Yes	No
1	**CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **2**.

	Step	Check	Yes	No
2	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from front oxygen (A/F) sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 18 (+) — Chassis ground (–):*** ***(B136) No. 19 (+) — Chassis ground (–):***	Is the voltage 8 V or more?	Repair the short circuit to power in the harness between ECM connector and front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DO(w/o HEV))-92, Front Oxygen (A/F) Sensor.>

AQ:DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1)

DTC DETECTING CONDITION:

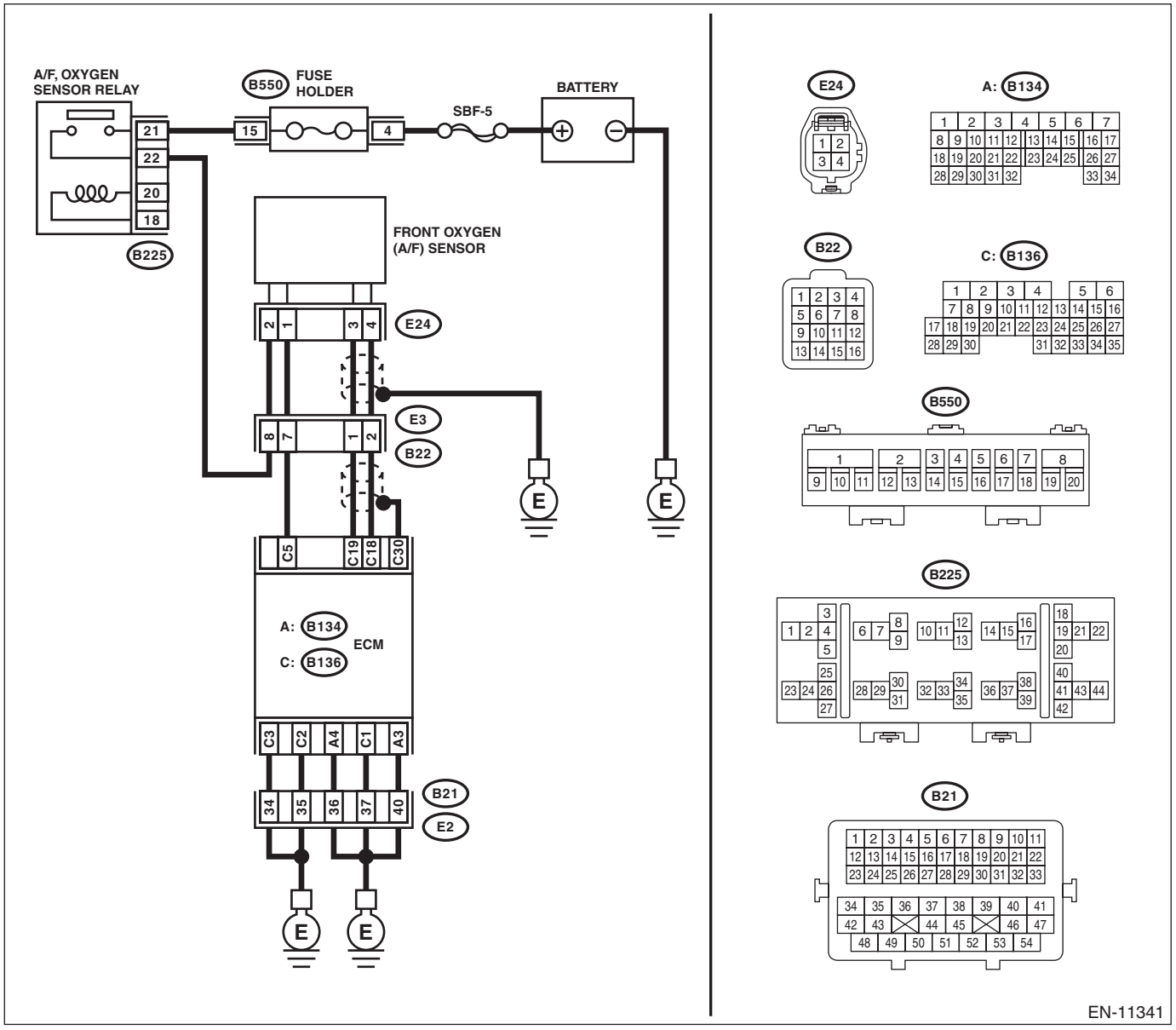
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-56, DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and front oxygen (A/F) sensor. 3) Measure the resistance of harness between ECM connector and front oxygen (A/F) sensor connector. ***Connector & terminal*** ***(B136) No. 19 — (E24) No. 3:*** ***(B136) No. 18 — (E24) No. 4:***	Is the resistance less than 1 Ω?	Go to step **2**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and front oxygen (A/F) sensor connector • Poor contact of coupling connector
2	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM and front oxygen (A/F) sensor connector.	Is there poor contact of ECM or front oxygen (A/F) sensor connector?	Repair the poor contact of ECM or front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DO(w/o HEV))-92, Front Oxygen (A/F) Sensor.>

AR:DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2)

DTC DETECTING CONDITION:

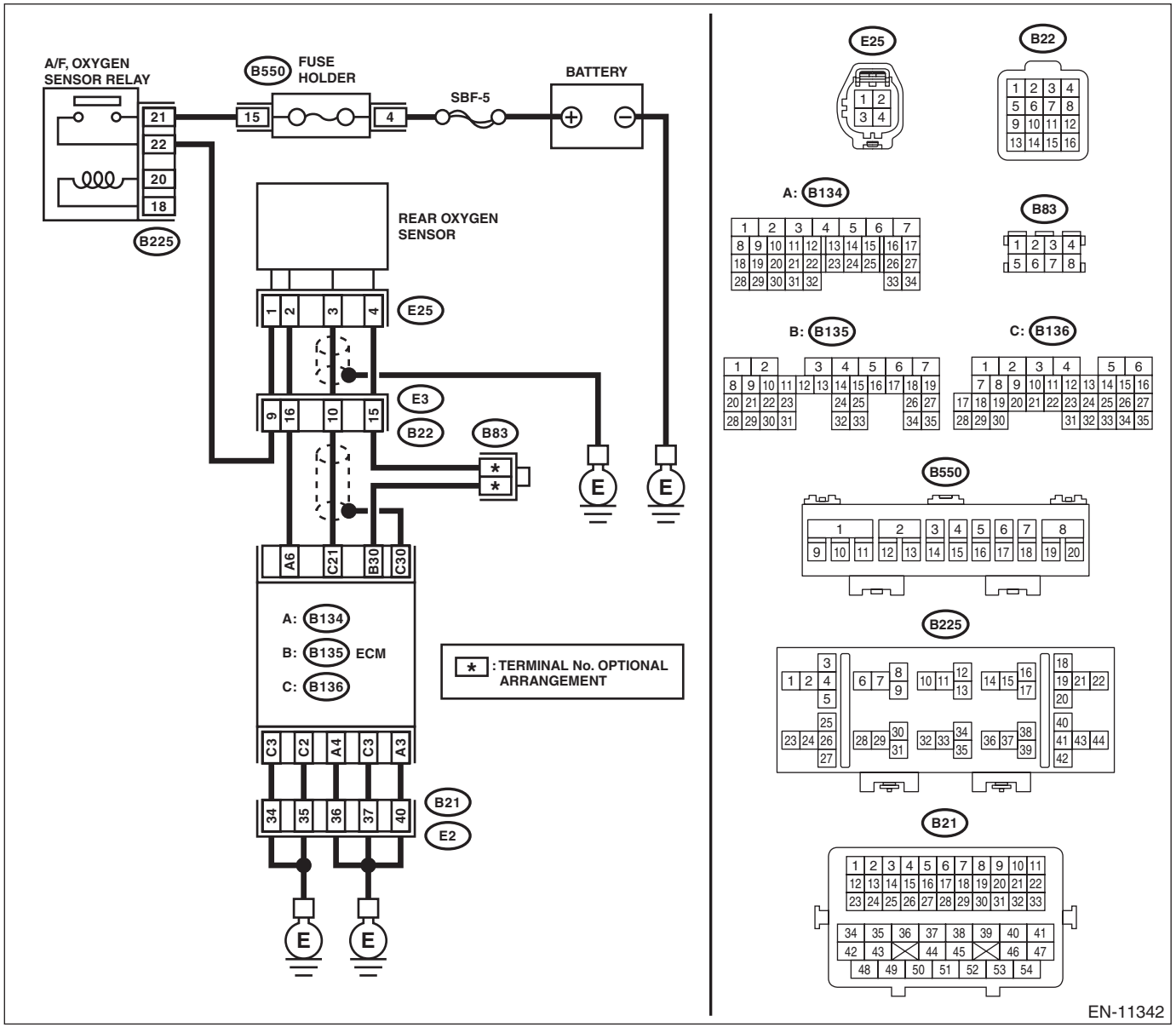
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-57, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK REAR OXYGEN SENSOR DATA.** 1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), and keep the engine speed at 3,000 rpm. (2 minutes maximum) 2) Read the value of «Rear O2 Sensor» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Rear O2 Sensor» 0.490 V or more?	Go to step **5**.	Go to step **2**.
2	**CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **3**.
3	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM connector and rear oxygen sensor connector. ***Connector & terminal*** ***(B136) No. 21 — (E25) No. 3:*** ***(B135) No. 30 — (E25) No. 4:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and rear oxygen sensor connector • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between rear oxygen sensor connector and chassis ground. ***Connector & terminal*** ***(E25) No. 3 (+) — Chassis ground (–):***	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H4DO(w/o HEV))-96, Rear Oxygen Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and rear oxygen sensor connector • Poor contact of coupling connector • Poor contact of ECM connector
5	**CHECK EXHAUST SYSTEM.** Check exhaust system parts. NOTE: Check the following items. • Looseness and improper fitting of exhaust system parts • Damage (crack, hole etc.) of parts • Loose part and improper installation between front oxygen (A/F) sensor and rear oxygen sensor	Is there any fault in exhaust system?	Repair or replace faulty parts.	Replace the rear oxygen sensor. <Ref. to FU(H4DO(w/o HEV))-96, Rear Oxygen Sensor.>

AS:DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2)

DTC DETECTING CONDITION:

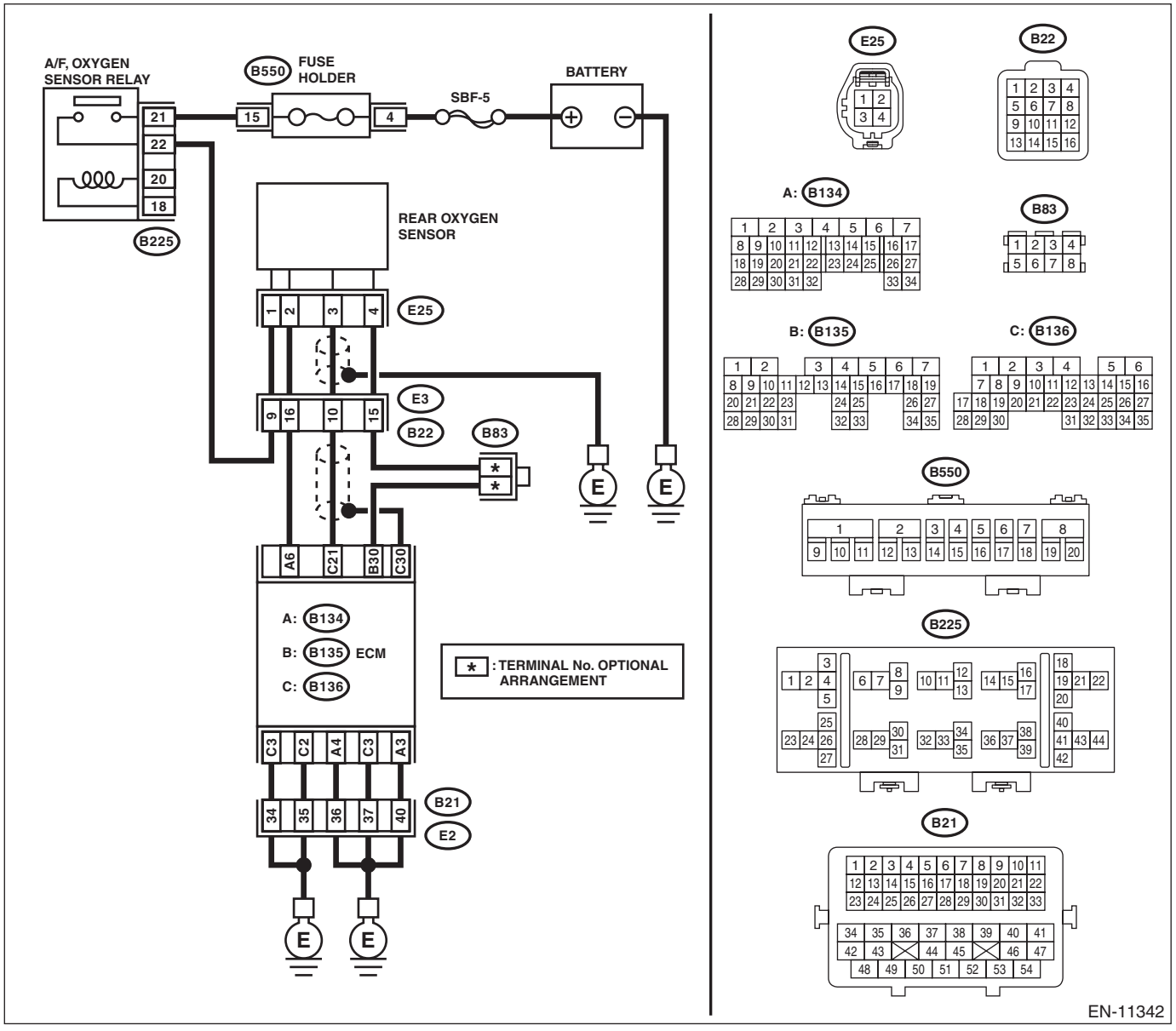
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-58, DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK REAR OXYGEN SENSOR DATA.** 1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), and rapidly reduce the engine speed from 3,000 rpm. 2) Read the value of «Rear O2 Sensor» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Rear O2 Sensor» 0.250 V or less?	Go to step **5**.	Go to step **2**.
2	**CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **3**.
3	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM connector and rear oxygen sensor connector. ***Connector & terminal*** ***(B136) No. 21 — (E25) No. 3:*** ***(B135) No. 30 — (E25) No. 4:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and rear oxygen sensor connector • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between rear oxygen sensor connector and chassis ground. ***Connector & terminal*** ***(E25) No. 3 (+) — Chassis ground (–):***	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H4DO(w/o HEV))-96, Rear Oxygen Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and rear oxygen sensor connector • Poor contact of coupling connector • Poor contact of ECM connector
5	**CHECK EXHAUST SYSTEM.** Check exhaust system parts. NOTE: Check the following items. • Looseness and improper fitting of exhaust system parts • Damage (crack, hole etc.) of parts • Loose part and improper installation between front oxygen (A/F) sensor and rear oxygen sensor	Is there any fault in exhaust system?	Repair or replace faulty parts.	Replace the rear oxygen sensor. <Ref. to FU(H4DO(w/o HEV))-96, Rear Oxygen Sensor.>

AT:DTC P013A O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 2)

DTC DETECTING CONDITION:

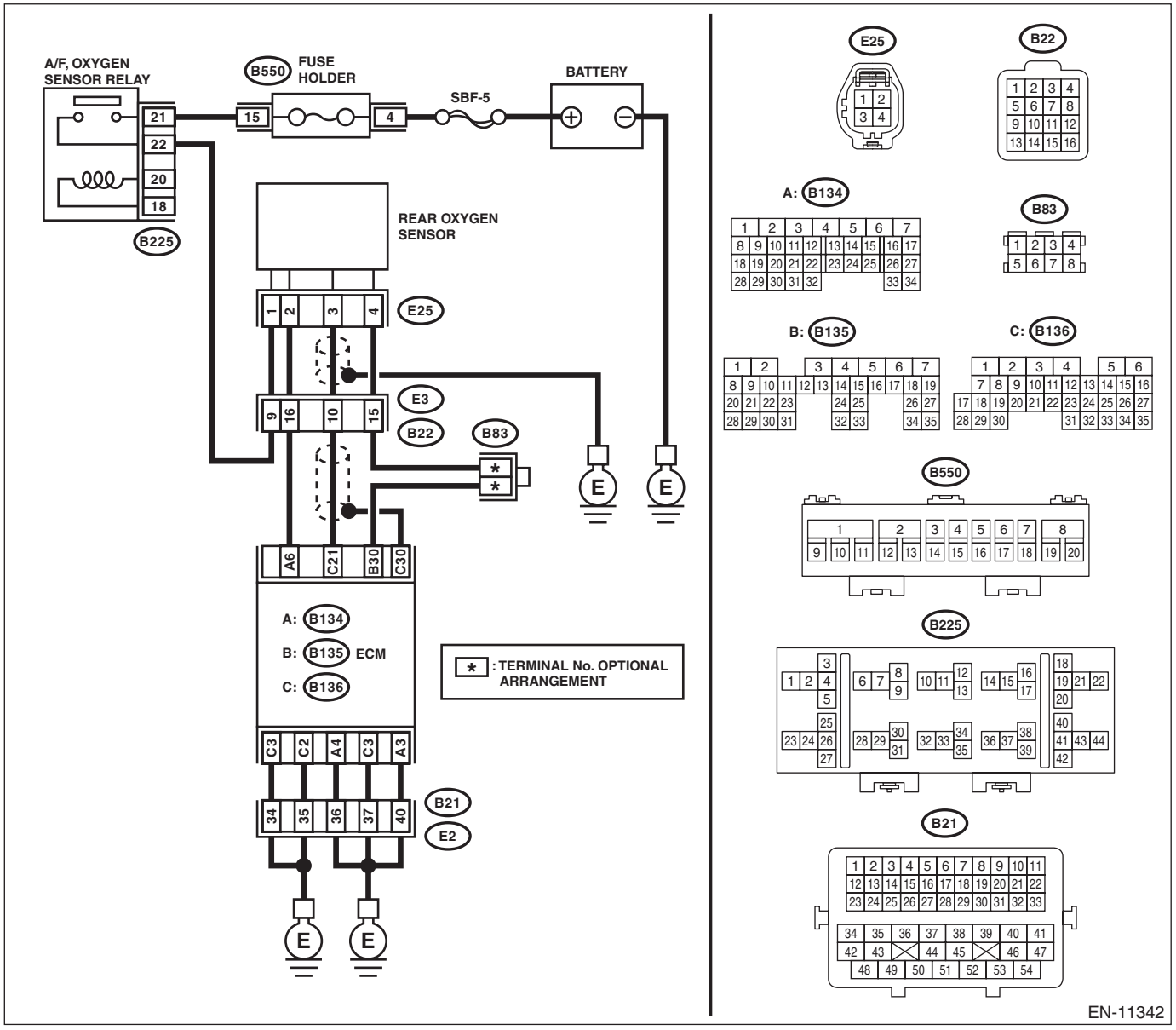
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-59, DTC P013A O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM connector and rear oxygen sensor connector. ***Connector & terminal*** ***(B136) No. 21 — (E25) No. 3:***	Is the resistance less than 1 Ω?	Go to step **2**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and rear oxygen sensor connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** Measure the resistance between rear oxygen sensor connector and chassis ground. ***Connector & terminal*** ***(E25) No. 3 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **3**.	Repair the short circuit to ground in harness between ECM connector and rear oxygen sensor connector.
3	**CHECK REAR OXYGEN SENSOR.** Measure the resistance between rear oxygen sensor terminals. ***Terminals*** ***No. 3 — No. 4***	Is the resistance less than 1 Ω?	Replace the rear oxygen sensor. <Ref. to FU(H4DO(w/o HEV))-96, Rear Oxygen Sensor.>	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.

AU:DTC P013B O2 SENSOR SLOW RESPONSE - LEAN TO RICH (BANK 1 SENSOR 2)

NOTE:
For the diagnostic procedure, refer to DTC P013A. <Ref. to EN(H4DO w/o HEV)(diag)-175, DTC P013A O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AV:DTC P013E O2 SENSOR DELAYED RESPONSE - RICH TO LEAN (BANK 1 SENSOR 2)

NOTE:
For the diagnostic procedure, refer to DTC P013A. <Ref. to EN(H4DO w/o HEV)(diag)-175, DTC P013A O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AW:DTC P013F O2 SENSOR DELAYED RESPONSE - LEAN TO RICH (BANK 1 SENSOR 2)

NOTE:
For the diagnostic procedure, refer to DTC P013A. <Ref. to EN(H4DO w/o HEV)(diag)-175, DTC P013A O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AX:DTC P0141 O2 SENSOR HEATER CIRCUIT (BANK1 SENSOR2)

Refer to DTC P0037 for diagnostic procedure. <Ref. to EN(H4DO w/o HEV)(diag)-132, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AY:DTC P014C O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-68, DTC P014C O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK EXHAUST SYSTEM.** NOTE: Check the following items. • Loose installation of front portion of exhaust pipe onto cylinder heads • Loose connection between front exhaust pipe and front catalytic converter • Damage of exhaust pipe resulting in a hole	Is there any fault in exhaust system?	Repair the exhaust system.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DO(w/o HEV))-92, Front Oxygen (A/F) Sensor.>

AZ:DTC P014D O2 SENSOR SLOW RESPONSE - LEAN TO RICH (BANK 1 SENSOR 1)

NOTE:
For the diagnostic procedure, refer to DTC P014C. <Ref. to EN(H4DO w/o HEV)(diag)-178, DTC P014C O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BA:DTC P015A O2 SENSOR DELAYED RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1)

NOTE:
For the diagnostic procedure, refer to DTC P014C. <Ref. to EN(H4DO w/o HEV)(diag)-178, DTC P014C O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BB:DTC P015B O2 SENSOR DELAYED RESPONSE - LEAN TO RICH (BANK 1 SENSOR 1)

NOTE:
For the diagnostic procedure, refer to DTC P014C. <Ref. to EN(H4DO w/o HEV)(diag)-178, DTC P014C O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BC:DTC P0171 SYSTEM TOO LEAN (BANK 1)

Refer to DTC P0172 for diagnostic procedure. <Ref. to EN(H4DO w/o HEV)(diag)-179, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BD:DTC P0172 SYSTEM TOO RICH (BANK 1)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-77, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Improper idling
- Engine stalls.
- Poor driving performance

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK EXHAUST SYSTEM.**	Are there holes or loose bolts on exhaust system?	Repair the exhaust system.	Go to step **2**.
2	**CHECK AIR INTAKE SYSTEM.**	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair the air intake system.	Go to step **3**.
3	**CHECK FUEL PRESSURE.** **WARNING:** **Place "NO OPEN FLAMES" signs near the working area.** **CAUTION:** **Be careful not to spill fuel.** Measure the fuel pressure. <Ref. to ME(H4DO(w/o HEV))-35, INSPECTION, Fuel Pressure.> **CAUTION:** **Release fuel pressure before removing the fuel pressure gauge.**	Is the measured value 340 — 400 kPa (3.5 — 4.1 kg/cm^2, 49 — 58 psi)?	Go to step **4**.	Check the fuel pump and fuel delivery line. <Ref. to FU(H4DO(w/o HEV))-142, INSPECTION, Fuel Pump.> <Ref. to FU(H4DO(w/o HEV))-170, INSPECTION, Fuel Delivery and Evaporation Lines.>
4	**CHECK ENGINE COOLANT TEMPERATURE SENSOR.** 1) Start the engine and warm up completely. 2) Read the value of «Coolant Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Coolant Temp.» 75°C (167°F) or more?	Go to step **5**.	Replace the engine coolant temperature sensor. <Ref. to FU(H4DO(w/o HEV))-51, Engine Coolant Temperature Sensor.>

	Step	Check	Yes	No
5	**CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.** 1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F). 2) For CVT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Read the value of «Mass Air Flow» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Mass Air Flow» 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)?	Go to step **6**.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DO(w/o HEV))-73, Mass Air Flow and Intake Air Temperature Sensor.>
6	**CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.** 1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F). 2) For CVT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Open the front hood. 6) Measure the ambient temperature. 7) Read the value of «Intake Air Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Subtract ambient temperature from «Intake Air Temp.». Is the obtained value –10 — 50°C (–18 — 90°F)?	Repair the poor contact of ECM connector.	Check the mass air flow and intake air temperature sensor. <Ref. to FU(H4DO(w/o HEV))-73, Mass Air Flow and Intake Air Temperature Sensor.>

BE:DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-78, DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Hard to start
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

Step		Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check the appropriate DTC using the “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Replace the engine oil temperature sensor. <Ref. to FU(H4DO(w/o HEV))-53, Engine Oil Temperature Sensor.>

BF:DTC P0197 ENGINE OIL TEMPERATURE SENSOR LOW

DTC DETECTING CONDITION:

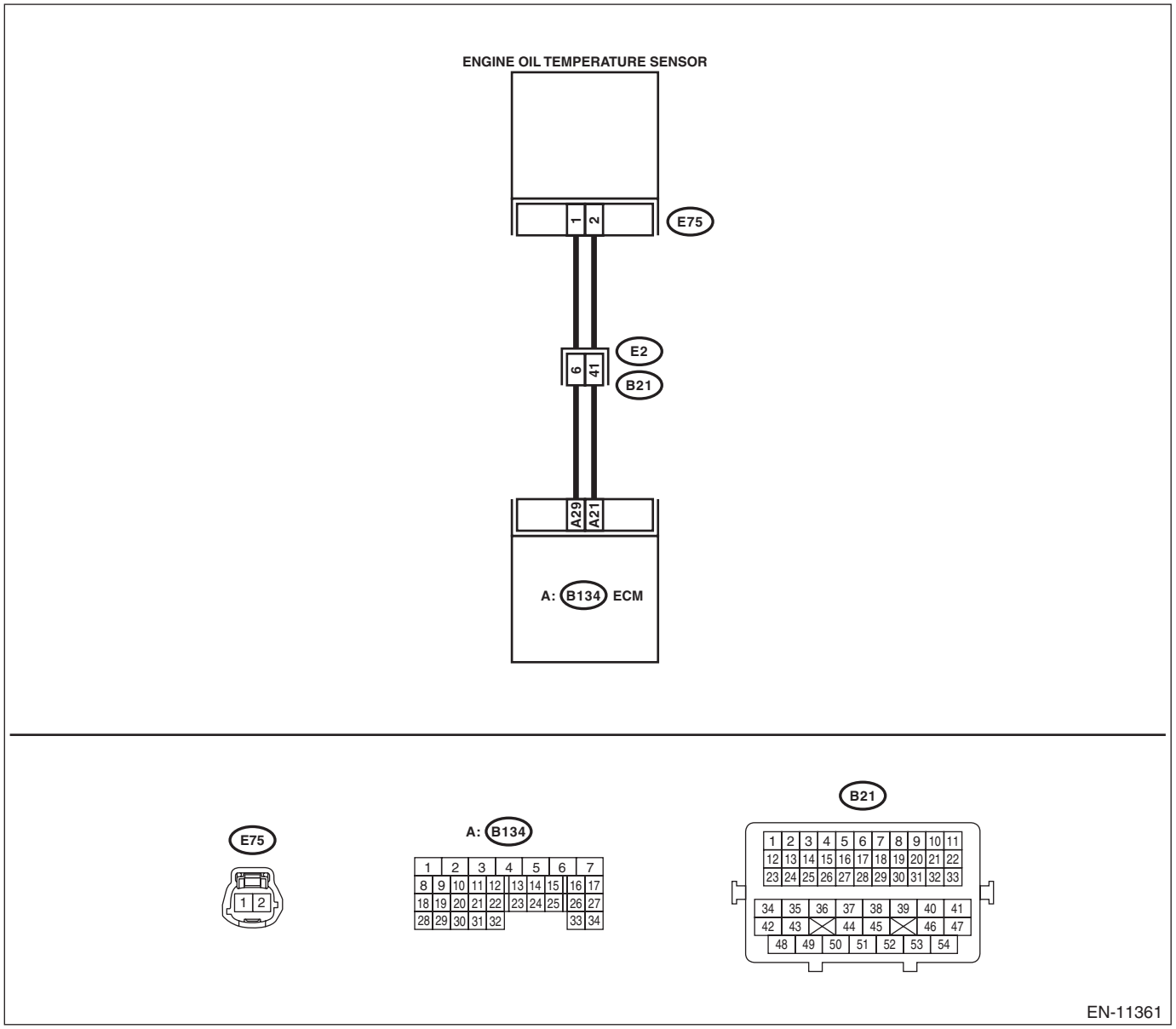
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-80, DTC P0197 ENGINE OIL TEMPERATURE SENSOR LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Hard to start
- Improper idling
- Poor driving performance

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:
Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «Oil Temperature» using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.>	Is the value of «Oil Temperature» 150°C (302°F) or more?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK HARNESS BETWEEN ECM AND ENGINE OIL TEMPERATURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and engine oil temperature sensor. 3) Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 20 — Chassis ground:***	Is the resistance 1 MΩ or more?	Replace the engine oil temperature sensor. <Ref. to FU(H4DO(w/o HEV))-53, Engine Oil Temperature Sensor.>	Repair the short circuit to ground in the harness between the ECM connector and engine oil temperature sensor connector.

BG:DTC P0198 ENGINE OIL TEMPERATURE SENSOR HIGH

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-81, DTC P0198 ENGINE OIL TEMPERATURE SENSOR HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

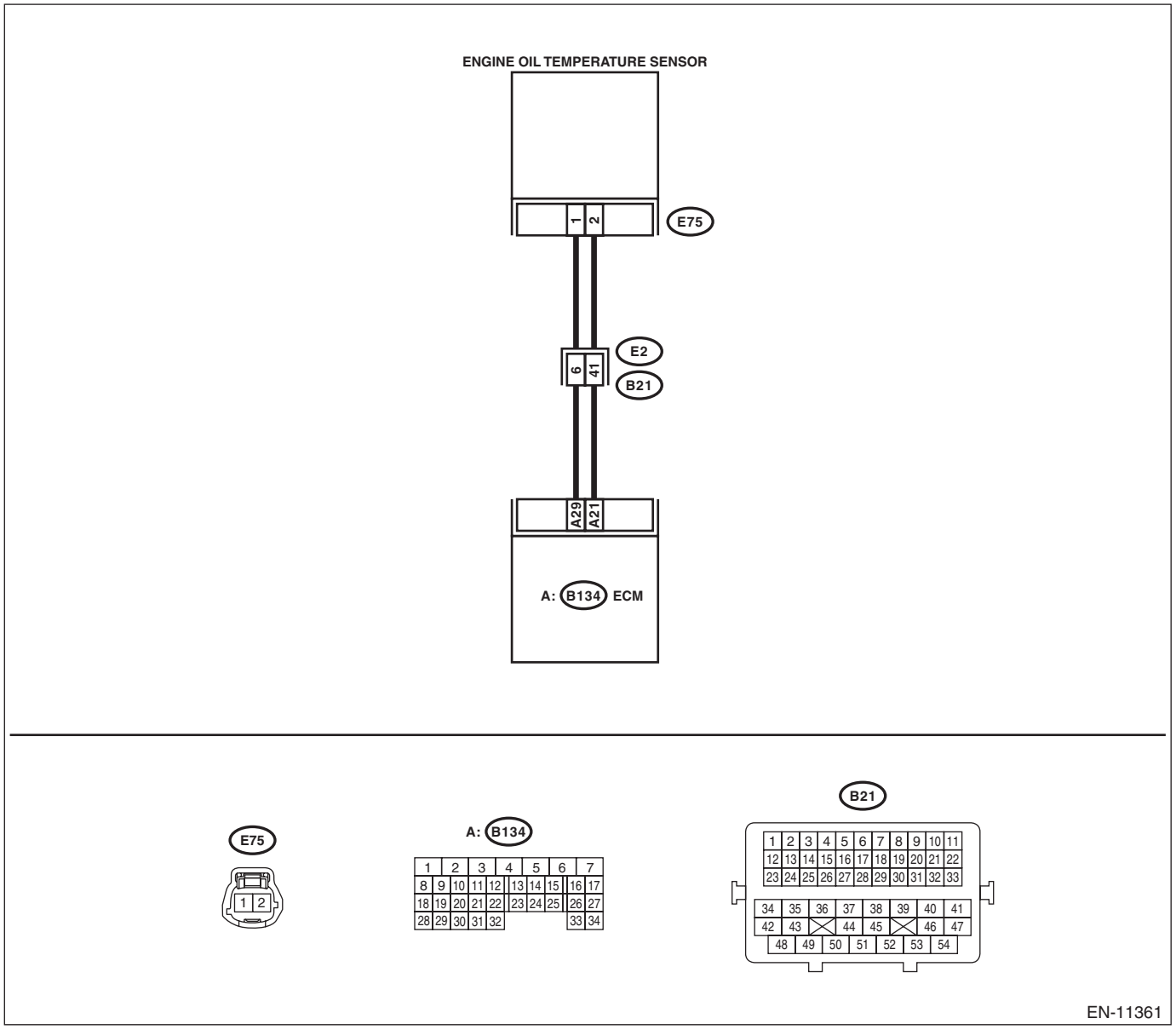
- Hard to start
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «Oil Temperature» using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.>	Is the value of «Oil Temperature» –40°C (–40°F) or less?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK FOR POOR CONTACT.** Check for poor contact between the ECM and engine oil temperature sensor connectors.	Is there poor contact of the ECM or engine oil temperature sensor connectors?	Repair the poor contact of ECM or engine oil temperature sensor connector.	Go to step **3**.
3	**CHECK HARNESS BETWEEN ECM AND ENGINE OIL TEMPERATURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and engine oil temperature sensor. 3) Measure the resistance of the harness between the ECM connector and engine oil temperature sensor connector. ***Connector & terminal*** ***(B134) No. 29 — (E75) No. 1:*** ***(B134) No. 20 — (E75) No. 2:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and engine oil temperature sensor connector • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN ECM AND ENGINE OIL TEMPERATURE SENSOR CONNECTOR.** 1) Connect all connectors. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 20 (+) — Chassis ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in harness between ECM connector and engine oil temperature sensor connector.	Replace the engine oil temperature sensor. <Ref. to FU(H4DO(w/o HEV))-53, Engine Oil Temperature Sensor.>

BH:DTC P0201 INJECTOR #1

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-82, DTC P0201 INJECTOR #1, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

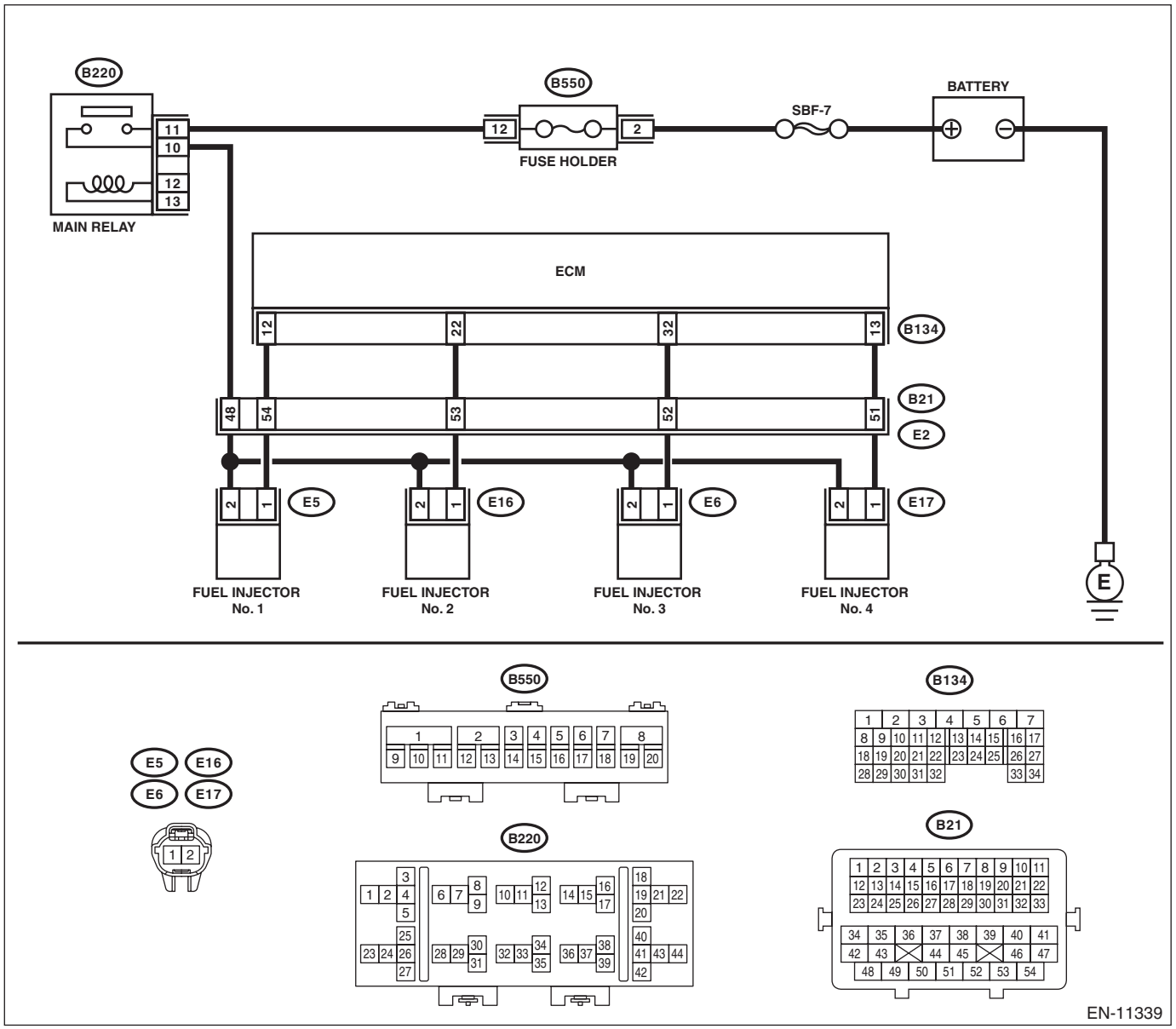
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK POWER SUPPLY TO FUEL INJECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector. 3) Turn the ignition switch to ON. 4) Measure the voltage between fuel injector connector and the engine ground. ***Connector & terminal*** ***DTC P0201; (E5) No. 2 (+) — Engine ground (–):*** ***DTC P0202; (E16) No. 2 (+) — Engine ground (–):*** ***DTC P0203; (E6) No. 2 (+) — Engine ground (–):*** ***DTC P0204; (E17) No. 2 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **2**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between main relay and fuel injector connector • Poor contact of main relay connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between fuel injector connector and engine ground. ***Connector & terminal*** ***DTC P0201; (E5) No. 1 — Engine ground:*** ***DTC P0202; (E16) No. 1 — Engine ground:*** ***DTC P0203; (E6) No. 1 — Engine ground:*** ***DTC P0204; (E17) No. 1 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **3**.	Repair the short circuit to ground in harness between ECM connector and fuel injector connector.
3	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** Measure the resistance of harness between ECM connector and fuel injector connector. ***Connector & terminal*** ***DTC P0201; (B134) No. 12 — (E5) No. 1:*** ***DTC P0202; (B134) No. 22 — (E16) No. 1:*** ***DTC P0203; (B134) No. 32 — (E6) No. 1:*** ***DTC P0204; (B134) No. 13 — (E17) No. 1:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and fuel injector connector • Poor contact of coupling connector
4	**CHECK FUEL INJECTOR.** Measure the resistance between fuel injector terminals on the corresponding cylinder. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 5 — 20 Ω?	Go to step **5**.	Replace the fuel injector. <Ref. to FU(H4DO(w/o HEV))-79, Fuel Injector.>
5	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM connector.	Is there poor contact of ECM connector?	Repair the poor contact of ECM connector.	Go to step **6**.

	Step	Check	Yes	No
6	**CHECK FUEL INJECTOR OPERATION.** 1) Connect all connectors. 2) Start the engine. 3) Check if the corresponding fuel injector emits operating sound. NOTE: Use a sound scope to check the operating sound.	Does the fuel injector emit operating sound?	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.	Repair the poor contact of fuel injector connector.

BI: DTC P0202 INJECTOR #2

NOTE:
For the diagnostic procedure, refer to DTC P0201. <Ref. to EN(H4DO w/o HEV)(diag)-186, DTC P0201 INJECTOR #1, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BJ:DTC P0203 INJECTOR #3

NOTE:
For the diagnostic procedure, refer to DTC P0201. <Ref. to EN(H4DO w/o HEV)(diag)-186, DTC P0201 INJECTOR #1, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BK:DTC P0204 INJECTOR #4

NOTE:
For the diagnostic procedure, refer to DTC P0201. <Ref. to EN(H4DO w/o HEV)(diag)-186, DTC P0201 INJECTOR #1, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BL:DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT LOW

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-83, DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

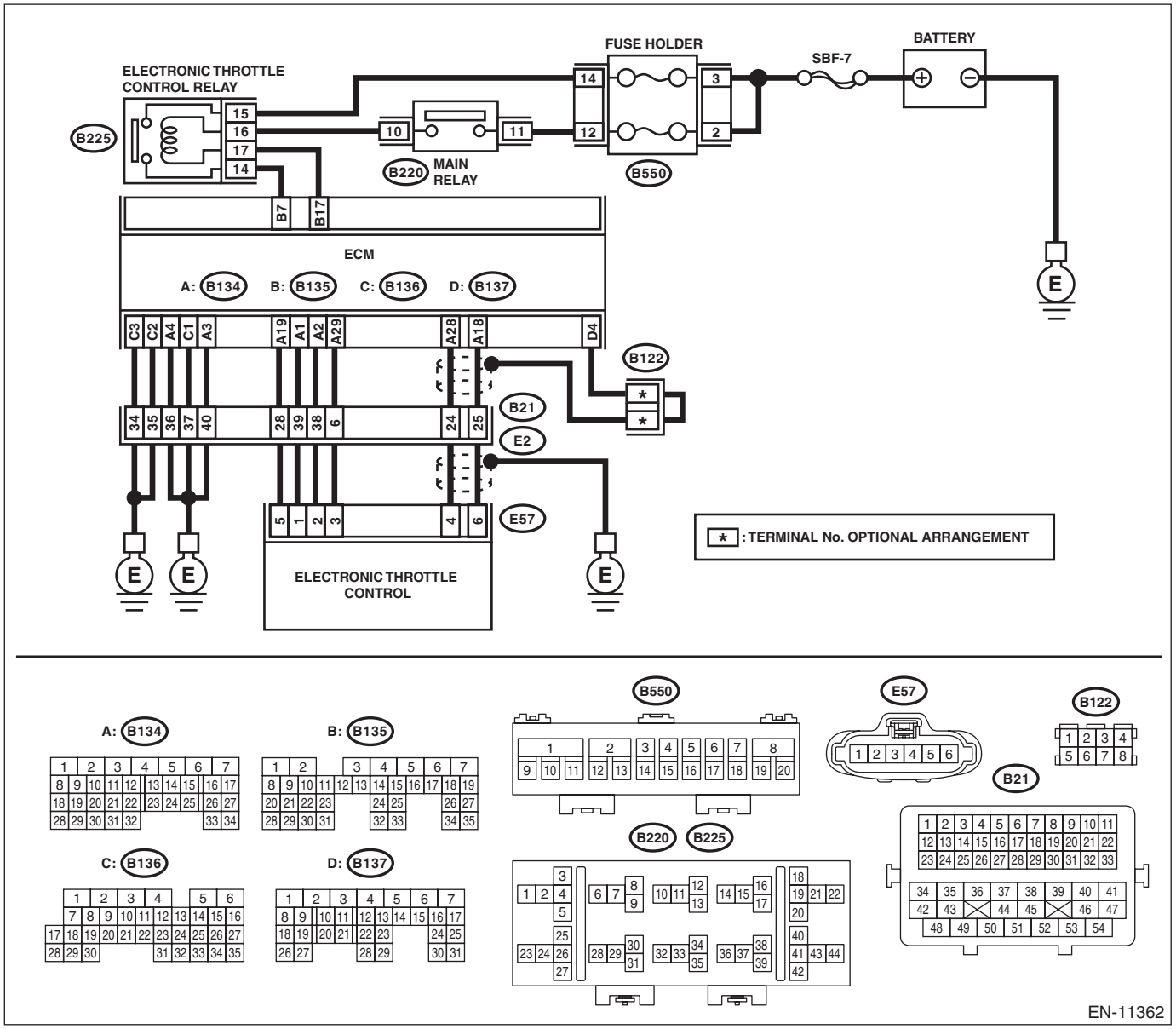
- Improper idling
- Poor driving performance
- Engine stalls.

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 19 — Chassis ground:*** ***(B134) No. 28 — Chassis ground:*** ***(B134) No. 28 — (B137) No. 4:***	Is the resistance 1 MΩ or more?	Go to step **2**.	Repair the ground short circuit of harness between ECM connector and electronic throttle control connector.
2	**CHECK SHORT CIRCUIT INSIDE THE ECM.** 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 4 — Engine ground:***	Is the resistance 1 MΩ or more?	Replace the electronic throttle control. <Ref. to FU(H4DO(w/o HEV))-14, Throttle Body.>	Repair the ground short circuit of harness between ECM connector and electronic throttle control connector. Replace the ECM if defective. <Ref. to FU(H4DO(w/o HEV))-100, Engine Control Module (ECM).>

BM:DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT HIGH

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-84, DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

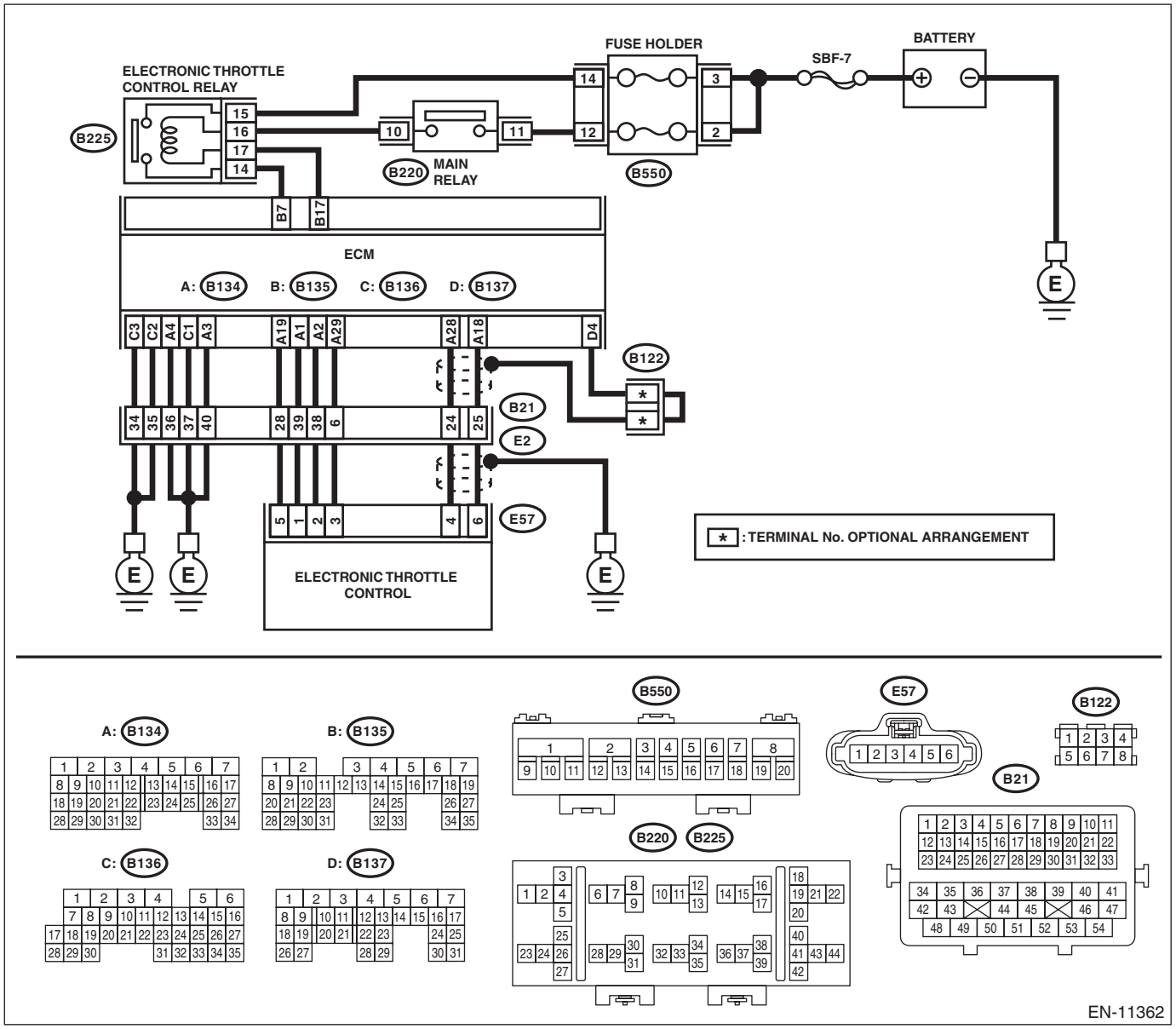
- Improper idling
- Poor driving performance
- Engine stalls.

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance of harness between ECM connector and electronic throttle control connector. ***Connector & terminal*** ***(B134) No. 28 — (E57) No. 4:*** ***(B134) No. 29 — (E57) No. 3:***	Is the resistance less than 1 Ω?	Go to step **2**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and electronic throttle control connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 3 — Engine ground:***	Is the resistance less than 5 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM connector and engine ground • Poor contact of ECM connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 4 (+) — Engine ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between ECM connector and electronic throttle control connector.	Go to step **4**.
4	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connectors. ***Connector & terminal*** ***(B134) No. 19 — (B134) No. 28:***	Is the resistance 1 MΩ or more?	Repair the poor contact of electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4DO(w/o HEV))-14, Throttle Body.>	Repair the short circuit to power in the harness between ECM connector and electronic throttle control connector.

BN:DTC P0300 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- Immediately at fault recognition (A misfire which could damage catalyst occurs.)
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-84, DTC P0300 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

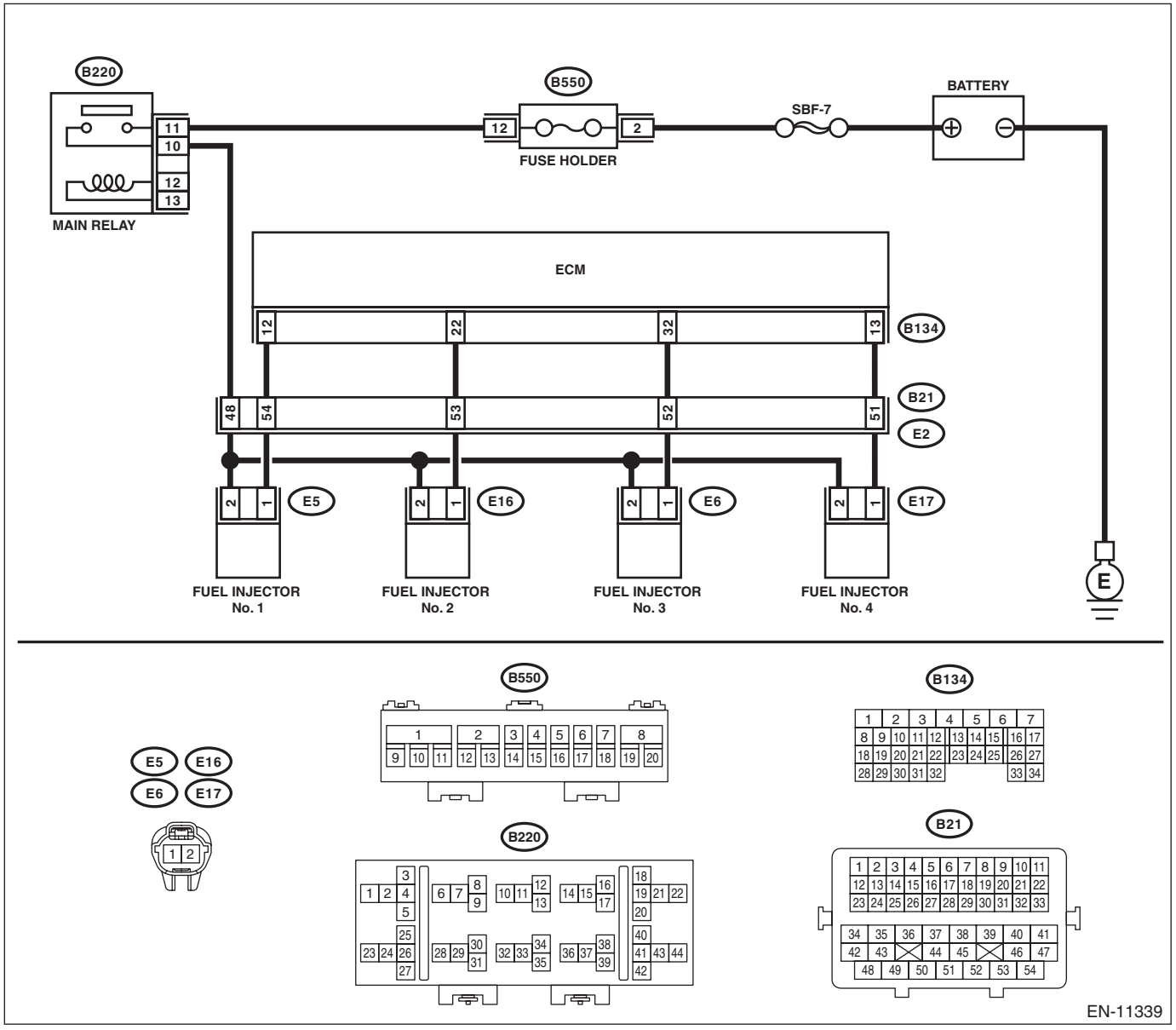
- Engine stalls.
- Improper idling
- Rough driving

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



EN-11339

	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL OF ECM.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground on all cylinders. ***Connector & terminal*** ***#1 (B134) No. 12 (+) — Chassis ground (–):*** ***#2 (B134) No. 22 (+) — Chassis ground (–):*** ***#3 (B134) No. 32 (+) — Chassis ground (–):*** ***#4 (B134) No. 13 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **6**.	Go to step **2**.
2	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from all fuel injectors. 3) Measure the resistance between all fuel injector connectors and engine ground. ***Connector & terminal*** ***#1 (E5) No. 1 — Engine ground:*** ***#2 (E16) No. 1 — Engine ground:*** ***#3 (E6) No. 1 — Engine ground:*** ***#4 (E17) No. 1 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **3**.	Repair the short circuit to ground in harness between ECM connector and fuel injector connector.
3	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** Measure the resistance of harness between ECM and fuel injector on all cylinders. ***Connector & terminal*** ***#1 (B134) No. 12 — (E5) No. 1:*** ***#2 (B134) No. 22 — (E16) No. 1:*** ***#3 (B134) No. 32 — (E6) No. 1:*** ***#4 (B134) No. 13 — (E17) No. 1:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and fuel injector connector • Poor contact of coupling connector
4	**CHECK FUEL INJECTOR.** Measure the resistance between all fuel injector terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 5 — 20 Ω?	Go to step **5**.	Replace the faulty fuel injector. <Ref. to FU(H4DO(w/o HEV))-79, Fuel Injector.>
5	**CHECK POWER SUPPLY LINE.** 1) Turn the ignition switch to ON. 2) Measure the voltage between all fuel injectors and the engine ground. ***Connector & terminal*** ***#1 (E5) No. 2 (+) — Engine ground (–):*** ***#2 (E16) No. 2 (+) — Engine ground (–):*** ***#3 (E6) No. 2 (+) — Engine ground (–):*** ***#4 (E17) No. 2 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Repair the poor contact of all connectors in fuel injector circuit.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between the main relay connector and fuel injector connector on faulty cylinders • Poor contact of coupling connector • Poor contact of main relay connector

	Step	Check	Yes	No
6	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from all fuel injectors. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground on all cylinders. ***Connector & terminal*** ***#1 (B134) No. 12 (+) — Chassis ground (–):*** ***#2 (B134) No. 22 (+) — Chassis ground (–):*** ***#3 (B134) No. 32 (+) — Chassis ground (–):*** ***#4 (B134) No. 13 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in harness between ECM connector and fuel injector connectors.	Go to step **7**.
7	**CHECK FUEL INJECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between all fuel injector terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 5 — 20 Ω?	Go to step **8**.	Replace the faulty fuel injector. <Ref. to FU(H4DO(w/o HEV))-79, Fuel Injector.>
8	**CHECK INSTALLATION CONDITION OF CAMSHAFT POSITION SENSOR/CRANKSHAFT POSITION SENSOR.**	Is the camshaft position sensor or crankshaft position sensor loosely installed?	Tighten the camshaft position sensor or crankshaft position sensor. <Ref. to FU(H4DO(w/o HEV))-61, INSTALLATION, Camshaft Position Sensor.> <Ref. to FU(H4DO(w/o HEV))-56, INSTALLATION, Crankshaft Position Sensor.>	Go to step **9**.
9	**CHECK CRANKSHAFT POSITION SENSOR PLATE.**	Is the crankshaft position sensor plate rusted or does it have broken teeth?	Replace the crankshaft position sensor plate. <Ref. to ME(H4DO(w/o HEV))-304, Cylinder Block.>	Go to step **10**.
10	**CHECK INSTALLATION CONDITION OF TIMING CHAIN.** Turn the crankshaft using ST, and align the alignment mark on crank sprocket with alignment mark on cylinder block. ST 18252AA000 CRANKSHAFT SOCKET	Is the timing chain dislocated from its proper position?	Correct the installation condition of timing chain. <Ref. to ME(H4DO(w/o HEV))-169, Timing Chain Assembly.>	Go to step **11**.
11	**CHECK FUEL LEVEL.**	Is the fuel meter indication higher than the “Lower” level?	Go to step **12**.	Refill the fuel so that the fuel meter indication is higher than the “Lower” level, and proceed to the next step. Go to step **12**.

	Step	Check	Yes	No
12	**CHECK STATUS OF MALFUNCTION INDICATOR LIGHT.** 1) Clear the memory using the Subaru Select Monitor or general scan tool. <Ref. to EN(H4DO w/o HEV)(diag)-65, Clear Memory Mode.> 2) Start the engine, and drive the vehicle 10 minutes or more.	Does the malfunction indicator light illuminate or blink?	Go to step **14**.	Go to step **13**.
13	**CHECK CAUSE OF MISFIRE.**	Was the cause of misfire identified when the engine is running?	Finish diagnostics operation, if the engine has no abnormality.	Repair the poor contact of connector. NOTE: In this case, repair the following item: • Poor contact of ignition coil connector • Poor contact of fuel injector connector on faulty cylinders • Poor contact of ECM connector • Poor contact of coupling connector
14	**CHECK AIR INTAKE SYSTEM.**	Is there any fault in air intake system?	Repair the air intake system. NOTE: Check the following items. • Are there air leaks or air suction caused by loose or dislocated nuts and bolts? • Are there cracks or any disconnection of hoses?	Go to step **15**.
15	**CHECK ALL CYLINDERS.**	Is there a fault in any cylinder?	Repair or replace the faulty part of the faulty cylinder. NOTE: Check the following items. • Spark plug • Ignition coil • Fuel injector • Compression ratio • Skipping timing chain teeth	Go to DTC P0171. <Ref. to EN(H4DO w/o HEV)(diag)-178, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BO:DTC P0301 CYLINDER 1 MISFIRE DETECTED

NOTE:
For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4DO w/o HEV)(diag)-198, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BP:DTC P0302 CYLINDER 2 MISFIRE DETECTED

NOTE:
For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4DO w/o HEV)(diag)-198, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BQ:DTC P0303 CYLINDER 3 MISFIRE DETECTED

NOTE:
For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4DO w/o HEV)(diag)-198, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BR:DTC P0304 CYLINDER 4 MISFIRE DETECTED

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- Immediately at fault recognition (A misfire which could damage catalyst occurs.)
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-93, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

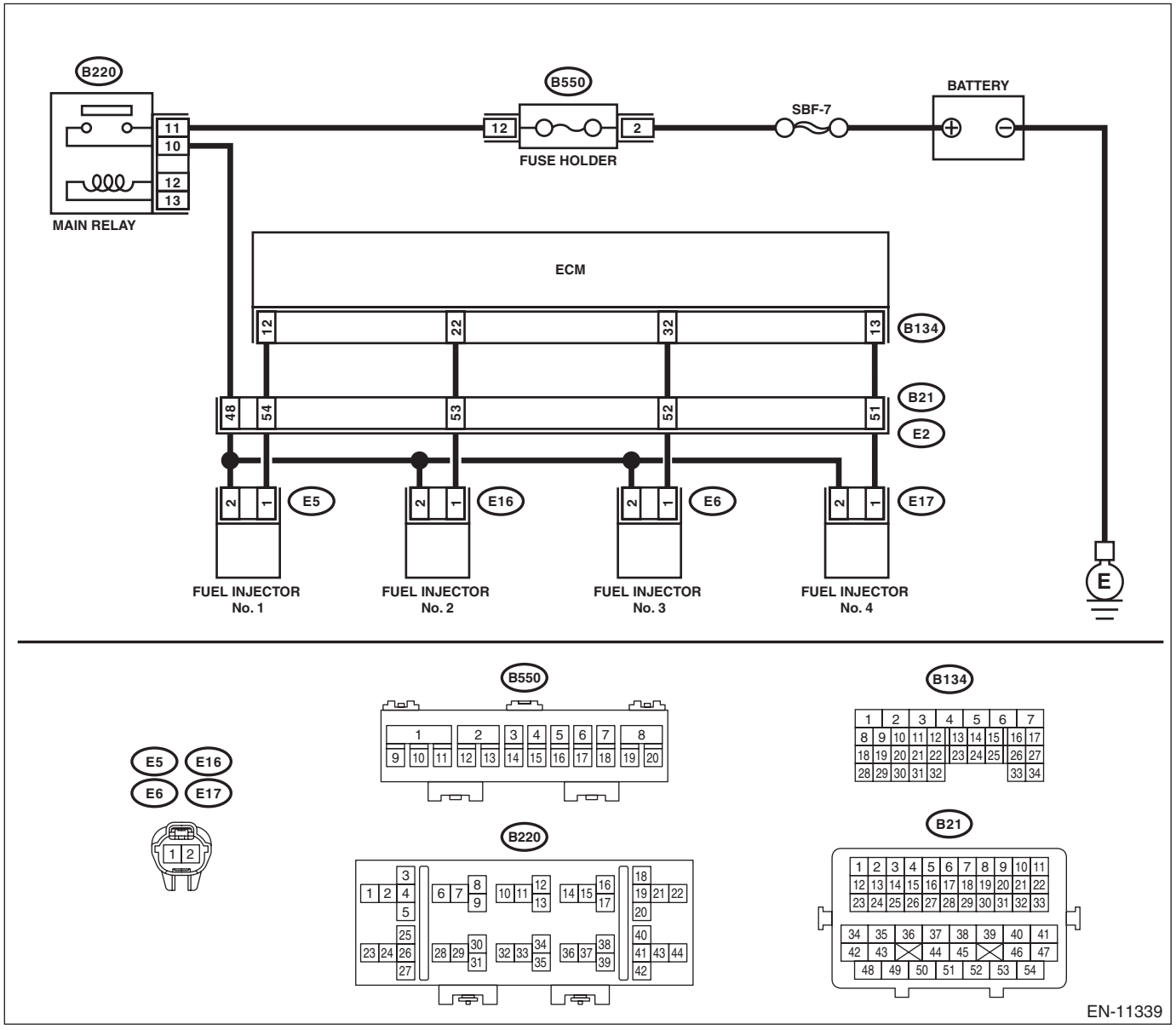
- Engine stalls.
- Improper idling
- Rough driving

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL OF ECM.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground on faulty cylinders. ***Connector & terminal*** ***#1 (B134) No. 12 (+) — Chassis ground (–):*** ***#2 (B134) No. 22 (+) — Chassis ground (–):*** ***#3 (B134) No. 32 (+) — Chassis ground (–):*** ***#4 (B134) No. 13 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **6**.	Go to step **2**.
2	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector on faulty cylinders. 3) Measure the resistance between fuel injector connector and engine ground on faulty cylinders. ***Connector & terminal*** ***#1 (E5) No. 1 — Engine ground:*** ***#2 (E16) No. 1 — Engine ground:*** ***#3 (E6) No. 1 — Engine ground:*** ***#4 (E17) No. 1 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **3**.	Repair the short circuit to ground in harness between ECM connector and fuel injector connector.
3	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** Measure the resistance of harness between ECM and fuel injector on faulty cylinders. ***Connector & terminal*** ***#1 (B134) No. 12 — (E5) No. 1:*** ***#2 (B134) No. 22 — (E16) No. 1:*** ***#3 (B134) No. 32 — (E6) No. 1:*** ***#4 (B134) No. 13 — (E17) No. 1:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and fuel injector connector • Poor contact of coupling connector
4	**CHECK FUEL INJECTOR.** Measure the resistance between fuel injector terminals on faulty cylinder. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 5 — 20 Ω?	Go to step **5**.	Replace the faulty fuel injector. <Ref. to FU(H4DO(w/o HEV))-79, Fuel Injector.>
5	**CHECK POWER SUPPLY LINE.** 1) Turn the ignition switch to ON. 2) Measure the voltage between fuel injector and engine ground on faulty cylinders. ***Connector & terminal*** ***#1 (E5) No. 2 (+) — Engine ground (–):*** ***#2 (E16) No. 2 (+) — Engine ground (–):*** ***#3 (E6) No. 2 (+) — Engine ground (–):*** ***#4 (E17) No. 2 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Repair the poor contact of all connectors in fuel injector circuit.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between the main relay connector and fuel injector connector on faulty cylinders • Poor contact of coupling connector • Poor contact of main relay connector

Step		Check	Yes	No
6	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector on faulty cylinders. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground on faulty cylinders. ***Connector & terminal*** ***#1 (B134) No. 12 (+) — Chassis ground (–):*** ***#2 (B134) No. 22 (+) — Chassis ground (–):*** ***#3 (B134) No. 32 (+) — Chassis ground (–):*** ***#4 (B134) No. 13 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in harness between ECM connector and fuel injector connectors.	Go to step **7**.
7	**CHECK FUEL INJECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between fuel injector terminals on faulty cylinder. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 5 — 20 Ω?	Go to step **8**.	Replace the faulty fuel injector. <Ref. to FU(H4DO(w/o HEV))-79, Fuel Injector.>
8	**CHECK INSTALLATION CONDITION OF CAMSHAFT POSITION SENSOR/CRANKSHAFT POSITION SENSOR.**	Is the camshaft position sensor or crankshaft position sensor loosely installed?	Tighten the camshaft position sensor or crankshaft position sensor. <Ref. to FU(H4DO(w/o HEV))-61, INSTALLATION, Camshaft Position Sensor.> <Ref. to FU(H4DO(w/o HEV))-56, INSTALLATION, Crankshaft Position Sensor.>	Go to step **9**.
9	**CHECK CRANKSHAFT POSITION SENSOR PLATE.**	Is the crankshaft position sensor plate rusted or does it have broken teeth?	Replace the crankshaft position sensor plate. <Ref. to ME(H4DO(w/o HEV))-304, Cylinder Block.>	Go to step **10**.
10	**CHECK INSTALLATION CONDITION OF TIMING CHAIN.** Turn the crankshaft using ST, and align the alignment mark on crank sprocket with alignment mark on cylinder block. ST 18252AA000 CRANKSHAFT SOCKET	Is the timing chain dislocated from its proper position?	Correct the installation condition of timing chain. <Ref. to ME(H4DO(w/o HEV))-169, Timing Chain Assembly.>	Go to step **11**.
11	**CHECK FUEL LEVEL.**	Is the fuel meter indication higher than the “Lower” level?	Go to step **12**.	Refill the fuel so that the fuel meter indication is higher than the “Lower” level, and proceed to the next step. Go to step **12**.

	Step	Check	Yes	No
12	**CHECK STATUS OF MALFUNCTION INDICATOR LIGHT.** 1) Clear the memory using the Subaru Select Monitor or general scan tool. <Ref. to EN(H4DO w/o HEV)(diag)-65, Clear Memory Mode.> 2) Start the engine, and drive the vehicle 10 minutes or more.	Does the malfunction indicator light illuminate or blink?	Go to step **14**.	Go to step **13**.
13	**CHECK CAUSE OF MISFIRE.**	Was the cause of misfire identified when the engine is running?	Finish diagnostics operation, if the engine has no abnormality.	Repair the poor contact of connector. NOTE: In this case, repair the following item: • Poor contact of ignition coil connector • Poor contact of fuel injector connector on faulty cylinders • Poor contact of ECM connector • Poor contact of coupling connector
14	**CHECK AIR INTAKE SYSTEM.**	Is there any fault in air intake system?	Repair the air intake system. NOTE: Check the following items. • Are there air leaks or air suction caused by loose or dislocated nuts and bolts? • Are there cracks or any disconnection of hoses?	Go to step **15**.
15	**CHECK CYLINDER.**	Is there any fault in the cylinder?	Repair or replace faulty parts. NOTE: Check the following items. • Spark plug • Ignition coil • Fuel injector • Compression ratio • Skipping timing chain teeth	Go to DTC P0171. <Ref. to EN(H4DO w/o HEV)(diag)-178, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BS:DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-94, DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

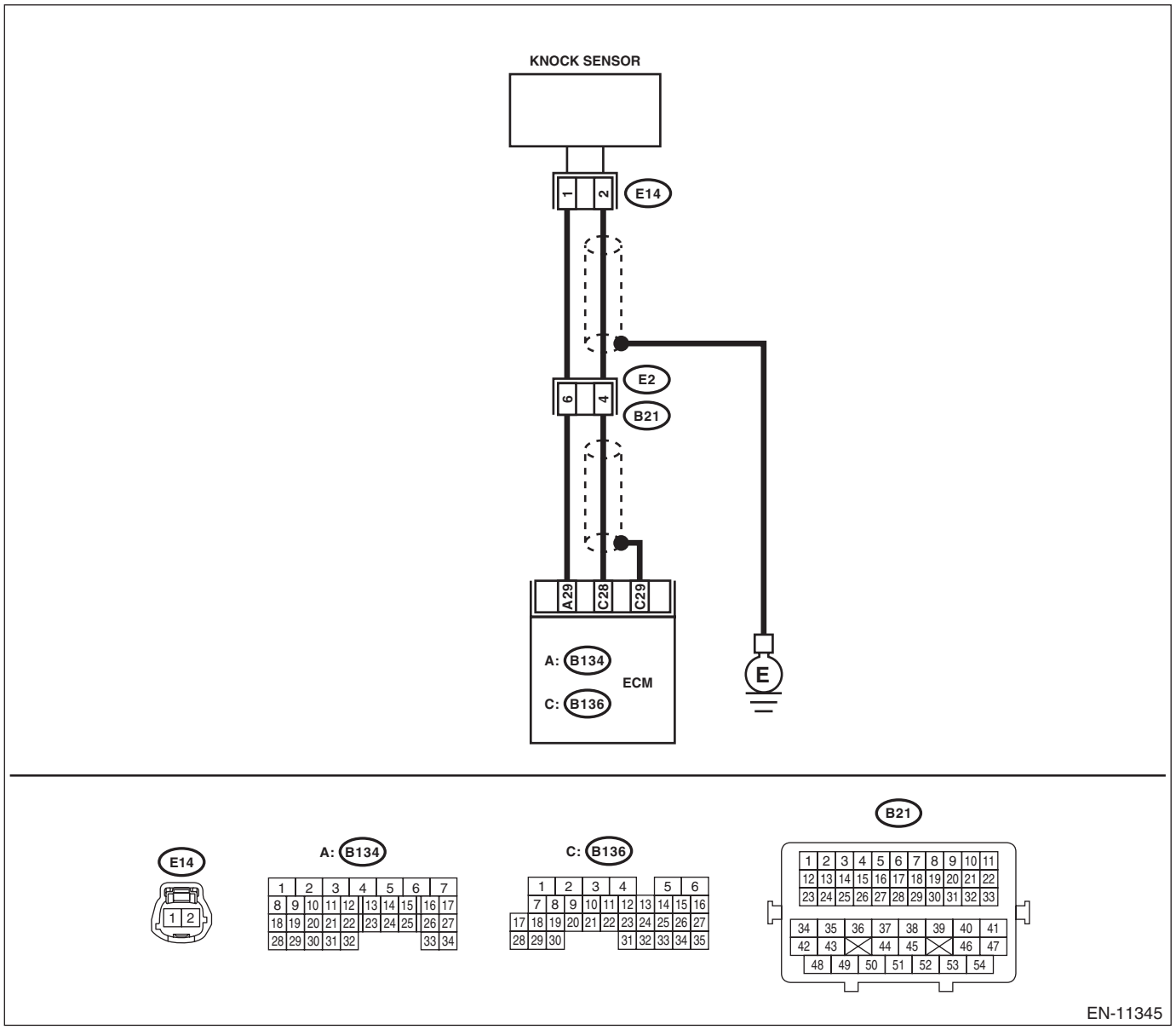
- Poor driving performance
- Knocking occurs

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND KNOCK SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connectors. ***Connector & terminal*** ***(B136) No. 28 — (B134) No. 29:***	Is the resistance less than 500 kΩ?	Go to step **2**.	Go to step **3**.
2	**CHECK KNOCK SENSOR.** 1) Disconnect the connector from the knock sensor. 2) Measure the resistance between knock sensor terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance less than 500 kΩ?	Replace the knock sensor. <Ref. to FU(H4DO(w/o HEV))-68, Knock Sensor.>	Repair the short circuit to ground in harness between ECM connector and knock sensor connector. NOTE: The harness between both connectors are shielded. Remove the shield and repair the short circuit of harness.
3	**CHECK INPUT SIGNAL OF ECM.** 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 28 (+) — Chassis ground (–):***	Is the voltage 2 V or more?	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.	Repair the short circuit to ground in harness between ECM connector and knock sensor connector. NOTE: The harness between both connectors are shielded. Remove the shield and repair the short circuit of harness.

BT:DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-95, DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

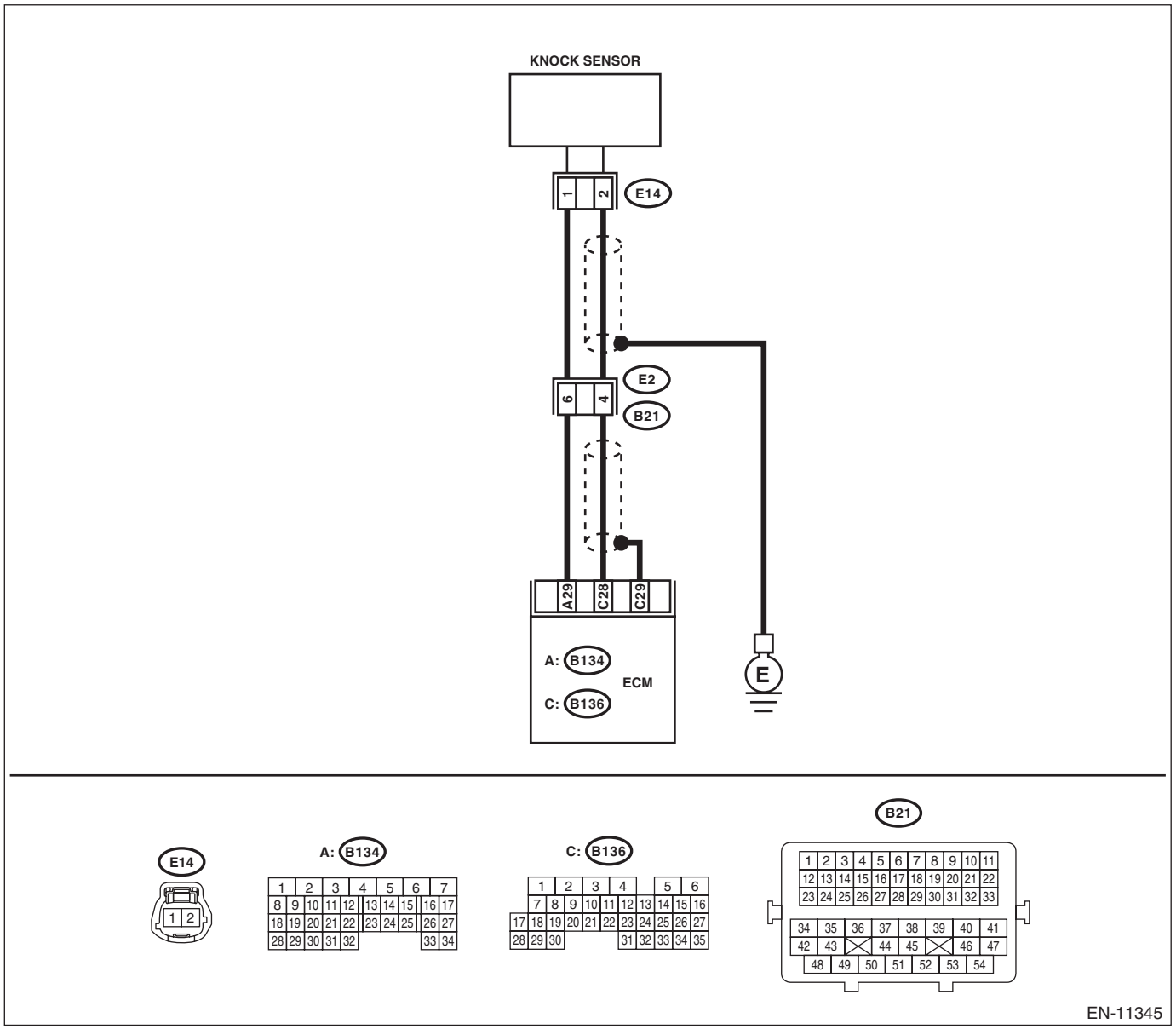
- Poor driving performance
- Knocking occurs

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND KNOCK SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connectors. ***Connector & terminal*** ***(B136) No. 28 — (B134) No. 29:***	Is the resistance 600 kΩ or more?	Go to step **2**.	Repair the poor contact of ECM connector.
2	**CHECK KNOCK SENSOR.** 1) Disconnect the connector from the knock sensor. 2) Measure the resistance between knock sensor terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 600 kΩ or more?	Replace the knock sensor. <Ref. to FU(H4DO(w/o HEV))-68, Knock Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and knock sensor connector • Poor contact of knock sensor connector • Poor contact of coupling connector

BU:DTC P0335 CRANKSHAFT POSITION SENSOR “A” CIRCUIT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-96, DTC P0335 CRANKSHAFT POSITION SENSOR “A” CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

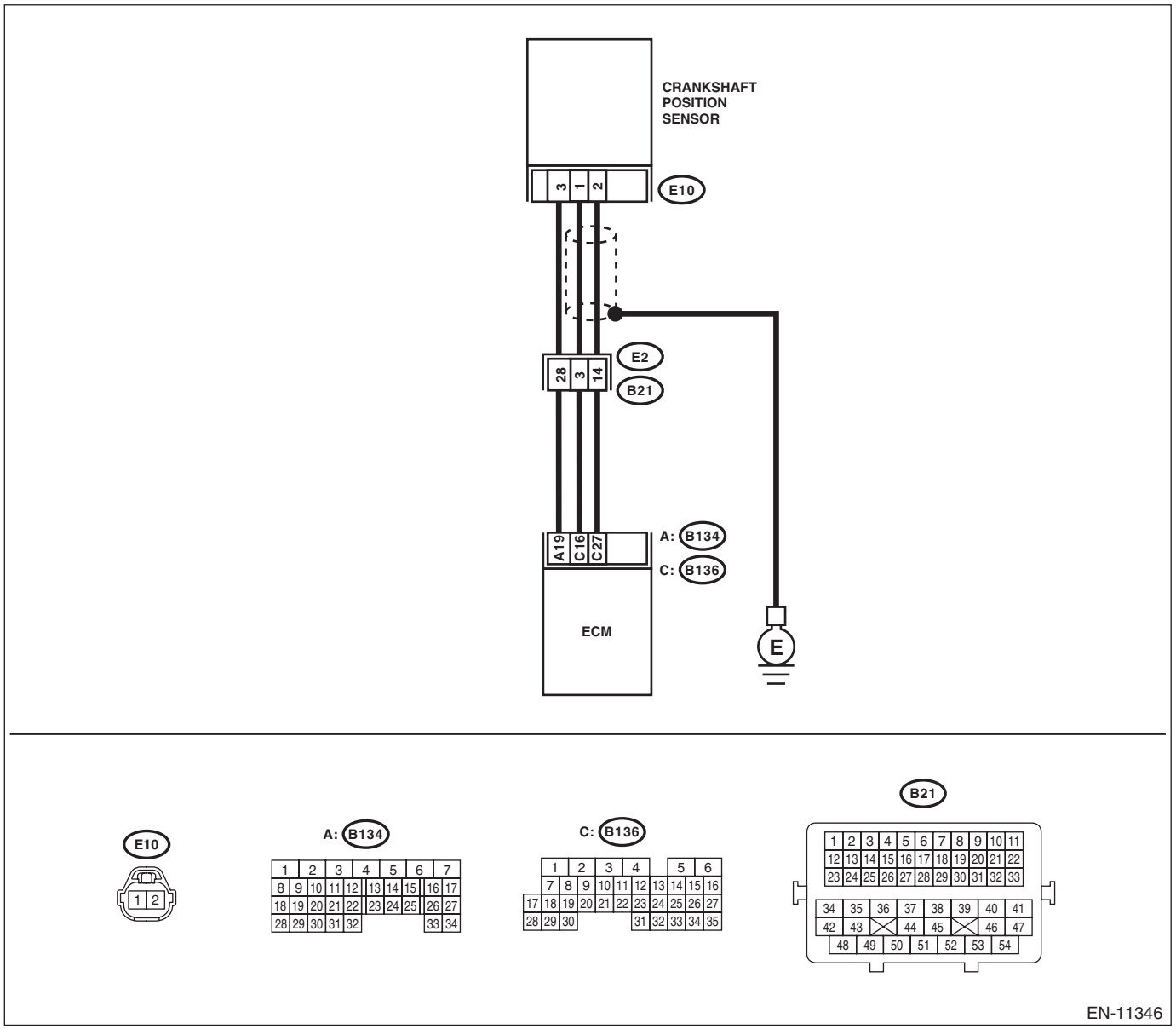
- Engine stalls.
- Failure of engine to start

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK INSTALLATION CONDITION OF CRANKSHAFT POSITION SENSOR.**	Is the crankshaft position sensor installation bolt tightened securely?	Go to step **2**.	Tighten the crankshaft position sensor installation bolt securely. <Ref. to FU(H4DO(w/o HEV))-56, INSTALLATION, Crankshaft Position Sensor.>
2	**CHECK CRANKSHAFT POSITION SENSOR.** 1) Turn the ignition switch to OFF. 2) Remove the crankshaft position sensor. 3) Measure the resistance between terminals of crankshaft position sensor. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance between 1 and 4 kΩ?	Go to step **3**.	Replace the crankshaft position sensor. <Ref. to FU(H4DO(w/o HEV))-55, Crankshaft Position Sensor.>
3	**CHECK HARNESS BETWEEN ECM AND CRANKSHAFT POSITION SENSOR CONNECTOR.** 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM connector and crankshaft position sensor connector. ***Connector & terminal*** ***(B136) No. 16 — (E10) No. 1:*** ***(B136) No. 27 — (E10) No. 2:***	Is the resistance less than 1 Ω?	Repair the poor contact of ECM and crankshaft position sensor connector.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and crankshaft position sensor connector • Poor contact of coupling connector

BV:DTC P0336 CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-98, DTC P0336 CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Engine stalls.
- Failure of engine to start

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK CONDITION OF CRANKSHAFT POSITION SENSOR.** Turn the ignition switch to OFF.	Is the crankshaft position sensor installation bolt tightened securely?	Go to step **2**.	Tighten the crankshaft position sensor installation bolt securely. <Ref. to FU(H4DO(w/o HEV))-56, INSTALLATION, Crankshaft Position Sensor.>
2	**CHECK CRANKSHAFT POSITION SENSOR PLATE.**	Is there crack or damage in the crankshaft position sensor plate teeth?	Replace the crankshaft position sensor plate. <Ref. to ME(H4DO(w/o HEV))-304, Cylinder Block.>	Go to step **3**.
3	**CHECK INSTALLATION CONDITION OF TIMING CHAIN.** Turn the crankshaft, and align alignment mark on crank sprocket with alignment mark on cylinder block. ST 18252AA000 CRANKSHAFT SOCKET	Is the timing chain dislocated from its proper position?	Correct the installation condition of timing chain. <Ref. to ME(H4DO(w/o HEV))-169, Timing Chain Assembly.>	Replace the crankshaft position sensor. <Ref. to FU(H4DO(w/o HEV))-55, Crankshaft Position Sensor.>

BW:DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-100, DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

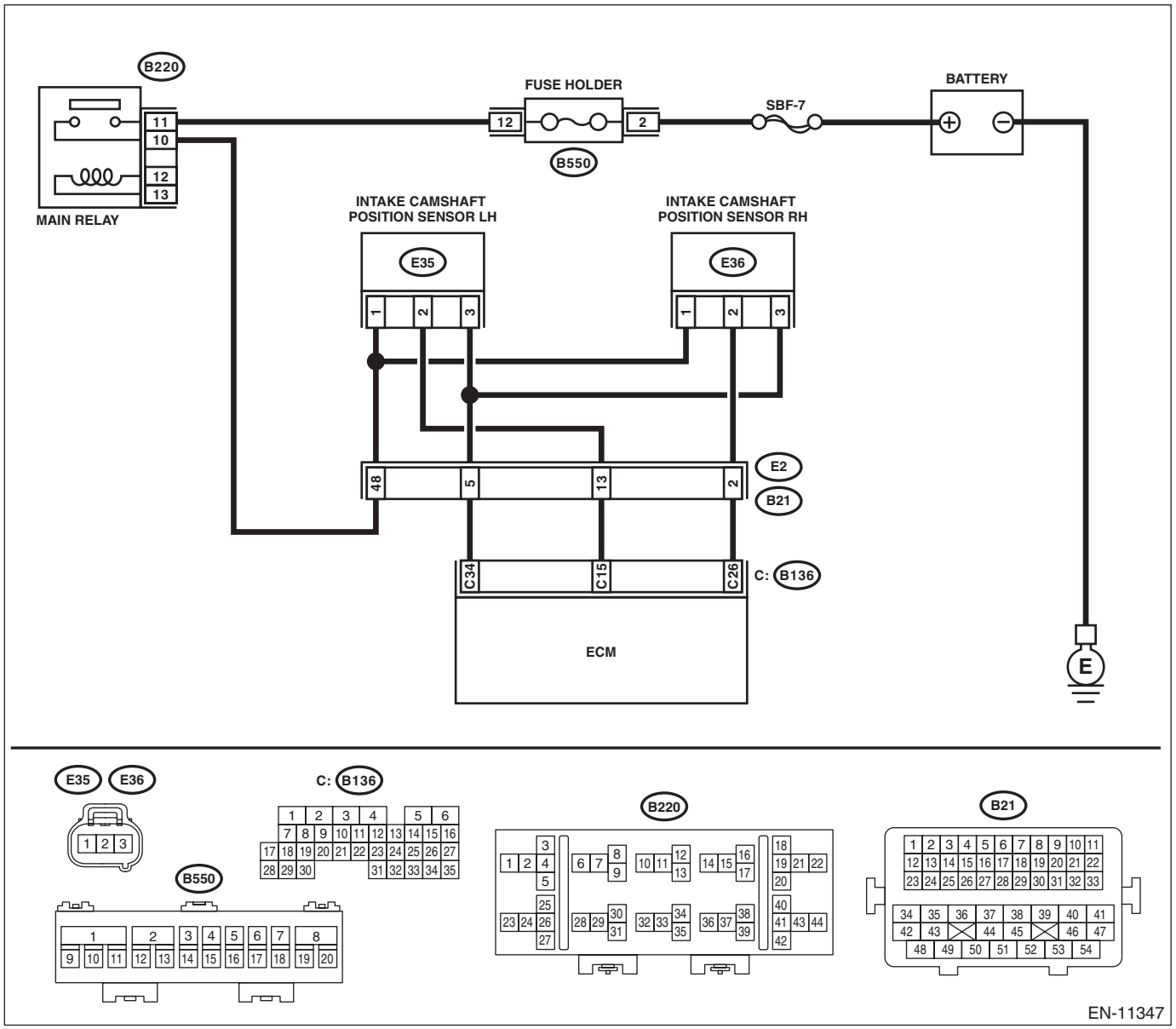
- Engine stalls.
- Failure of engine to start

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK POWER SUPPLY OF CAMSHAFT POSITION SENSOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from camshaft position sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E36) No. 1 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **2**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit or short circuit to ground in harness between main relay connector and camshaft position sensor connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connector and camshaft position sensor connector. ***Connector & terminal*** ***(B136) No. 26 — (E36) No. 2:*** ***(B136) No. 34 — (E36) No. 3:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and camshaft position sensor connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** Measure the resistance between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E36) No. 2 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **4**.	Repair short circuit to ground in harness between ECM connector and camshaft position sensor connector.
4	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** Measure the voltage between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E36) No. 2 (+) — Engine ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between ECM connector and camshaft position sensor connector.	Go to step **5**.
5	**CHECK CONDITION OF CAMSHAFT POSITION SENSOR.**	Is the camshaft position sensor installation bolt tightened securely?	Go to step **6**.	Tighten the camshaft position sensor installation bolt securely.
6	**CHECK CAMSHAFT POSITION SENSOR.** Check the waveform of the camshaft position sensor. <Ref. to EN(H4DO w/o HEV)(diag)-19, Engine Control Module (ECM) I/O Signal.>	Is there any abnormality in waveform?	Replace the camshaft position sensor. <Ref. to FU(H4DO(w/o HEV))-59, Camshaft Position Sensor.>	Repair the following item. • Poor contact of ECM connector • Poor contact of camshaft position sensor connector • Poor contact of coupling connector

BX:DTC P0341 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR)

NOTE:
For the diagnostic procedure, refer to DTC P0340. <Ref. to EN(H4DO w/o HEV)(diag)-209, DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BY:DTC P0345 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 2)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-103, DTC P0345 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

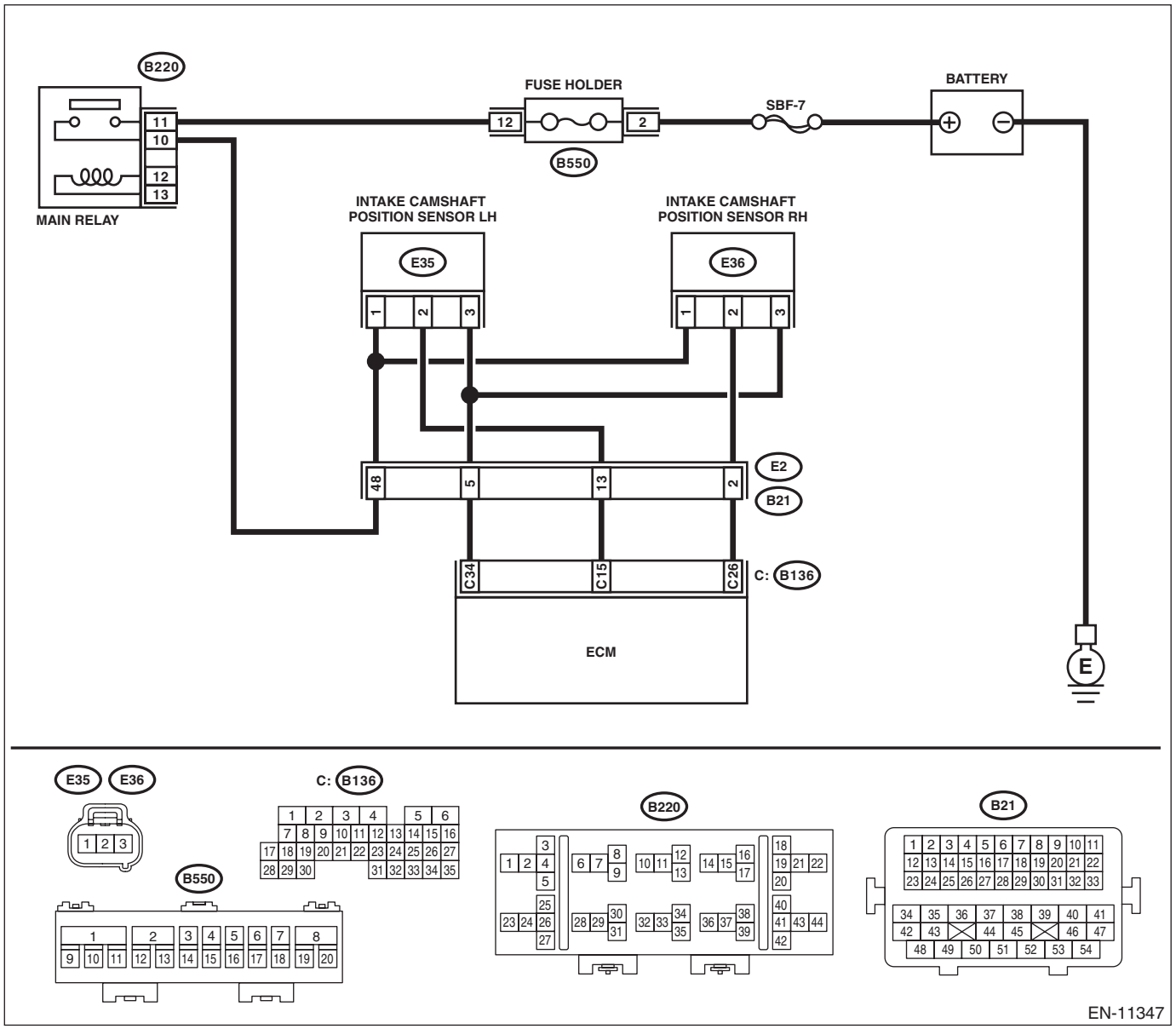
- Engine stalls.
- Failure of engine to start

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK POWER SUPPLY OF CAMSHAFT POSITION SENSOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from camshaft position sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E35) No. 1 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **2**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit or short circuit to ground in harness between main relay connector and camshaft position sensor connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connector and camshaft position sensor connector. ***Connector & terminal*** ***(B136) No. 15 — (E35) No. 2:*** ***(B136) No. 34 — (E35) No. 3:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and camshaft position sensor connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** Measure the resistance between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E35) No. 2 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **4**.	Repair short circuit to ground in harness between ECM connector and camshaft position sensor connector.
4	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** Measure the voltage between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E35) No. 2 (+) — Engine ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between ECM connector and camshaft position sensor connector.	Go to step **5**.
5	**CHECK CONDITION OF CAMSHAFT POSITION SENSOR.**	Is the camshaft position sensor installation bolt tightened securely?	Go to step **6**.	Tighten the camshaft position sensor installation bolt securely.
6	**CHECK CAMSHAFT POSITION SENSOR.** Check the waveform of the camshaft position sensor. <Ref. to EN(H4DO w/o HEV)(diag)-19, Engine Control Module (ECM) I/O Signal.>	Is there any abnormality in waveform?	Replace the camshaft position sensor. <Ref. to FU(H4DO(w/o HEV))-59, Camshaft Position Sensor.>	Repair the following item. • Poor contact of ECM connector • Poor contact of camshaft position sensor connector • Poor contact of coupling connector

BZ:DTC P0346 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 2)

NOTE:
For the diagnostic procedure, refer to DTC P0345. <Ref. to EN(H4DO w/o HEV)(diag)-212, DTC P0345 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CA:DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-104, DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

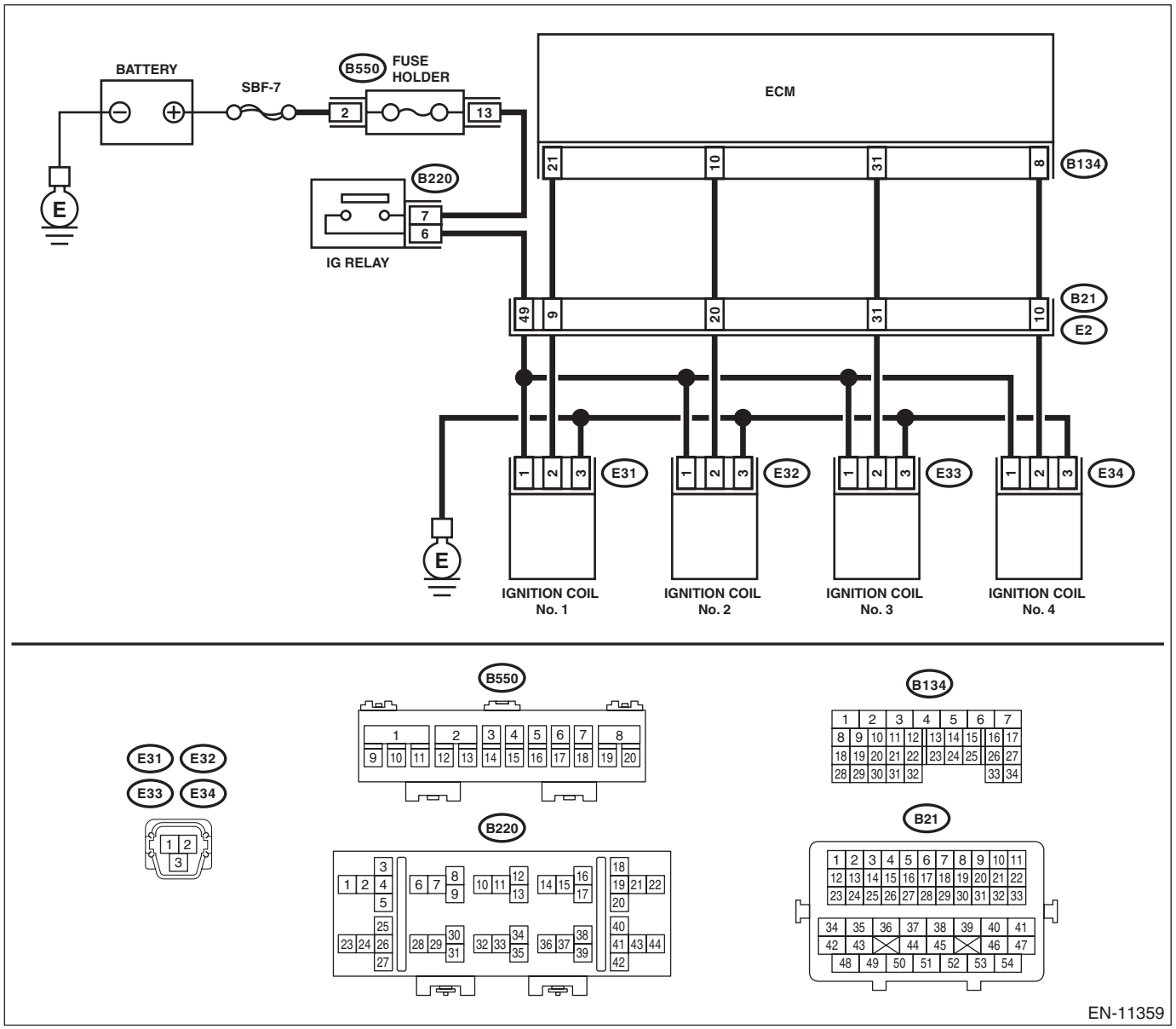
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK IGNITION COIL POWER SUPPLY CIRCUIT.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ignition coil. 3) Turn the ignition switch to ON. 4) Measure the voltage between ignition coil connector and engine ground. ***Connector & terminal*** ***DTC P0351; (E31) No. 1 (+) — Engine ground (–):*** ***DTC P0352; (E32) No. 1 (+) — Engine ground (–):*** ***DTC P0353; (E33) No. 1 (+) — Engine ground (–):*** ***DTC P0354; (E34) No. 1 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **2**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit or short circuit to ground in harness of power supply circuit • Blown out of fuse • Poor contact of IG relay connector • Poor contact of coupling connector • Faulty IG relay
2	**CHECK HARNESS OF IGNITION COIL GROUND CIRCUIT.** 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between ignition coil connector and engine ground. ***Connector & terminal*** ***DTC P0351; (E31) No. 3 — Engine ground:*** ***DTC P0352; (E32) No. 3 — Engine ground:*** ***DTC P0353; (E33) No. 3 — Engine ground:*** ***DTC P0354; (E34) No. 3 — Engine ground:***	Is the resistance less than 5 Ω?	Go to step **3**.	Repair the open circuit in harness between ignition coil connector and engine grounding terminal.
3	**CHECK HARNESS BETWEEN ECM AND IGNITION COIL CONNECTOR.** 1) Disconnect the connector from ECM. 2) Measure the resistance between ignition coil connector and engine ground. ***Connector & terminal*** ***DTC P0351; (E31) No. 2 — Engine ground:*** ***DTC P0352; (E32) No. 2 — Engine ground:*** ***DTC P0353; (E33) No. 2 — Engine ground:*** ***DTC P0354; (E34) No. 2 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **4**.	Repair the ground short circuit of harness between ECM connector and ignition coil connector.
4	**CHECK HARNESS BETWEEN ECM AND IGNITION COIL CONNECTOR.** Measure the resistance of harness between ECM connector and ignition coil connector. ***Connector & terminal*** ***DTC P0351; (B134) No. 21 — (E31) No. 2:*** ***DTC P0352; (B134) No. 10 — (E32) No. 2:*** ***DTC P0353; (B134) No. 31 — (E33) No. 2:*** ***DTC P0354; (B134) No. 8 — (E34) No. 2:***	Is the resistance less than 1 Ω?	Go to step **5**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM connector and the ignition coil connector • Poor contact of coupling connector
5	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM connector.	Is there poor contact of ECM connector?	Repair the poor contact of ECM connector.	Go to step **6**.
6	**CHECK SPARK PLUG CONDITION.** 1) Remove the spark plug of the corresponding cylinder. <Ref. to IG(H4DO(w/o HEV))-4, REMOVAL, Spark Plug.> 2) Check the spark plug condition. <Ref. to IG(H4DO(w/o HEV))-7, INSPECTION, Spark Plug.>	Is the spark plug condition normal?	Replace the ignition coil. <Ref. to IG(H4DO(w/o HEV))-12, Ignition Coil.>	Replace the spark plug. <Ref. to IG(H4DO(w/o HEV))-4, Spark Plug.>

CB:DTC P0352 IGNITION COIL B PRIMARY/SECONDARY CIRCUIT

NOTE:
For the diagnostic procedure, refer to DTC P0351. <Ref. to EN(H4DO w/o HEV)(diag)-215, DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CC:DTC P0353 IGNITION COIL C PRIMARY/SECONDARY CIRCUIT

NOTE:
For the diagnostic procedure, refer to DTC P0351. <Ref. to EN(H4DO w/o HEV)(diag)-215, DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CD:DTC P0354 IGNITION COIL D PRIMARY/SECONDARY CIRCUIT

NOTE:
For the diagnostic procedure, refer to DTC P0351. <Ref. to EN(H4DO w/o HEV)(diag)-215, DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CE:DTC P0365 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 1)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-105, DTC P0365 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

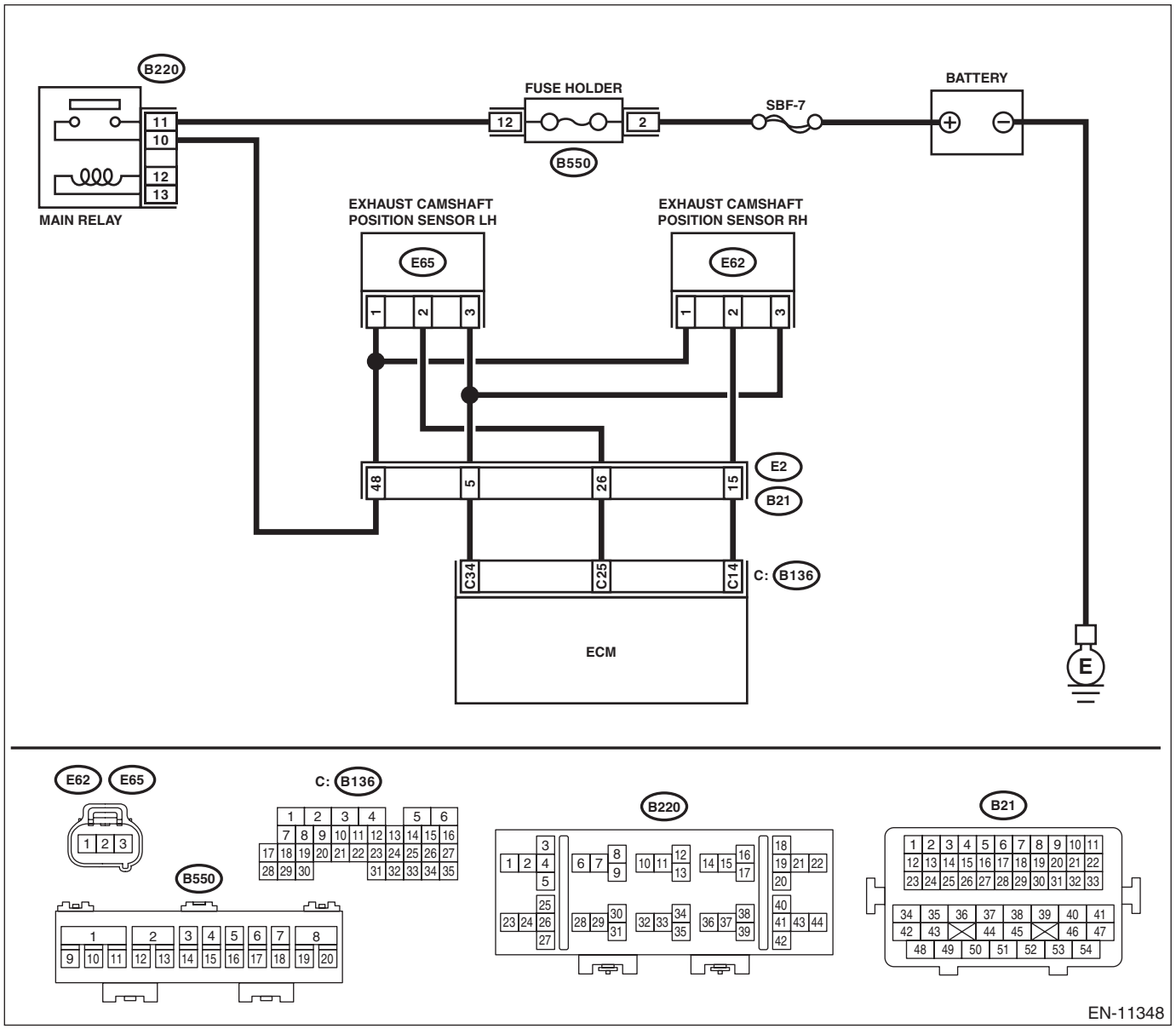
- Engine stalls.
- Failure of engine to start

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK POWER SUPPLY OF CAMSHAFT POSITION SENSOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from camshaft position sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E62) No. 1 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **2**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit or short circuit to ground in harness between main relay connector and camshaft position sensor connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connector and camshaft position sensor connector. ***Connector & terminal*** ***(B136) No. 14 — (E62) No. 2:*** ***(B136) No. 34 — (E62) No. 3:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and camshaft position sensor connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** Measure the resistance between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E62) No. 2 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **4**.	Repair short circuit to ground in harness between ECM connector and camshaft position sensor connector.
4	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** Measure the voltage between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E62) No. 2 (+) — Engine ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between ECM connector and camshaft position sensor connector.	Go to step **5**.
5	**CHECK CONDITION OF CAMSHAFT POSITION SENSOR.**	Is the camshaft position sensor installation bolt tightened securely?	Go to step **6**.	Tighten the camshaft position sensor installation bolt securely.
6	**CHECK CAMSHAFT POSITION SENSOR.** Check the waveform of the camshaft position sensor. <Ref. to EN(H4DO w/o HEV)(diag)-19, Engine Control Module (ECM) I/O Signal.>	Is there any abnormality in waveform?	Replace the camshaft position sensor. <Ref. to FU(H4DO(w/o HEV))-59, Camshaft Position Sensor.>	Repair the following item. • Poor contact of ECM connector • Poor contact of camshaft position sensor connector • Poor contact of coupling connector

CF:DTC P0366 CAMSHAFT POSITION SENSOR B CIRCUIT RANGE/PERFORMANCE (BANK 1)

NOTE:
For the diagnostic procedure, refer to DTC P0365. <Ref. to EN(H4DO w/o HEV)(diag)-218, DTC P0365 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CG:DTC P0390 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 2)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-107, DTC P0390 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

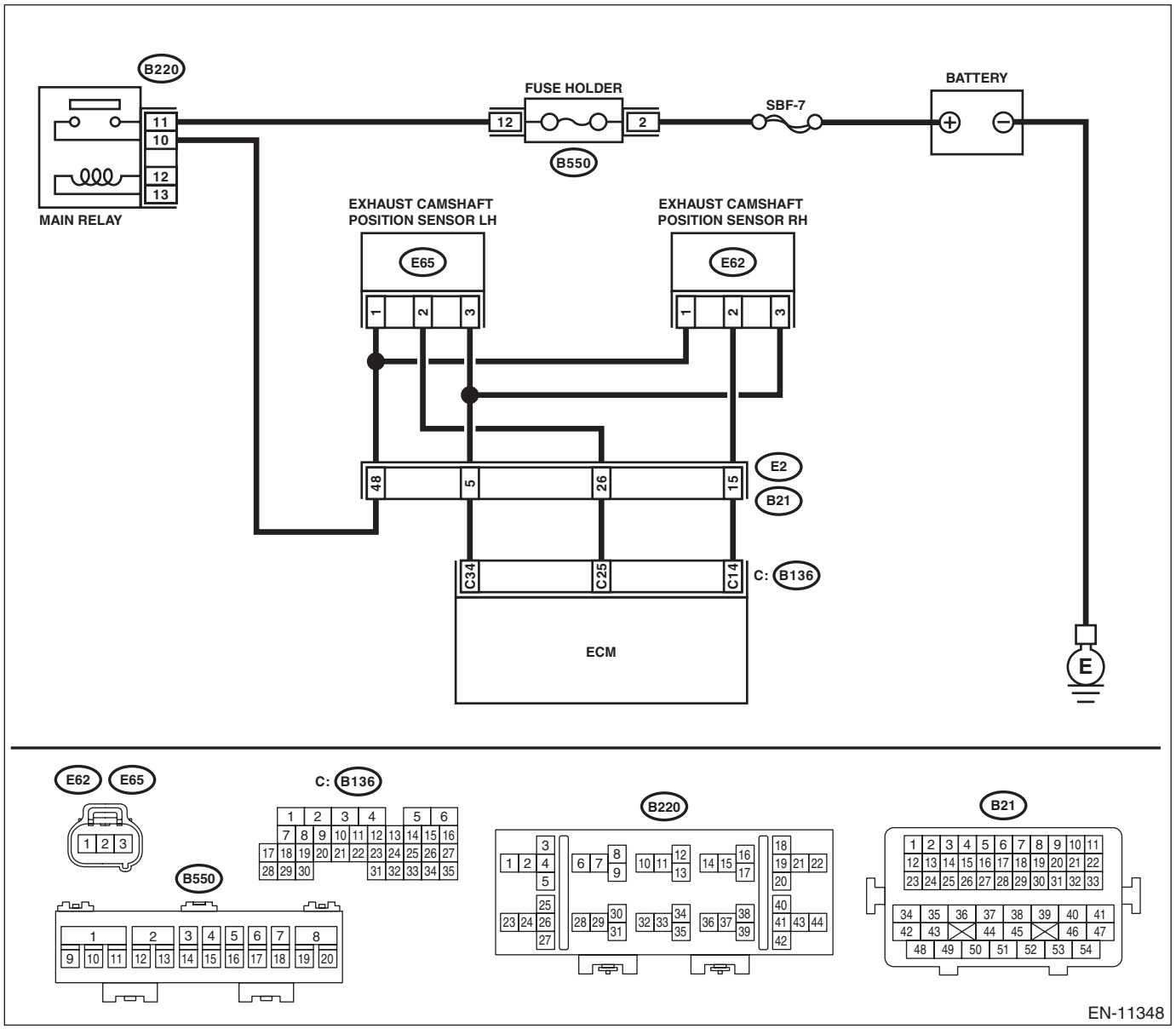
- Engine stalls.
- Failure of engine to start

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK POWER SUPPLY OF CAMSHAFT POSITION SENSOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from camshaft position sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E65) No. 1 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **2**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit or short circuit to ground in harness between main relay connector and camshaft position sensor connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connector and camshaft position sensor connector. ***Connector & terminal*** ***(B136) No. 25 — (E65) No. 2:*** ***(B136) No. 34 — (E65) No. 3:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and camshaft position sensor connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** Measure the resistance between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E65) No. 2 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **4**.	Repair short circuit to ground in harness between ECM connector and camshaft position sensor connector.
4	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** Measure the voltage between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E65) No. 2 (+) — Engine ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between ECM connector and camshaft position sensor connector.	Go to step **5**.
5	**CHECK CONDITION OF CAMSHAFT POSITION SENSOR.**	Is the camshaft position sensor installation bolt tightened securely?	Go to step **6**.	Tighten the camshaft position sensor installation bolt securely.
6	**CHECK CAMSHAFT POSITION SENSOR.** Check the waveform of the camshaft position sensor. <Ref. to EN(H4DO w/o HEV)(diag)-19, Engine Control Module (ECM) I/O Signal.>	Is there any abnormality in waveform?	Replace the camshaft position sensor. <Ref. to FU(H4DO(w/o HEV))-59, Camshaft Position Sensor.>	Repair the following item. • Poor contact of ECM connector • Poor contact of camshaft position sensor connector • Poor contact of coupling connector

CH:DTC P0391 CAMSHAFT POSITION SENSOR B CIRCUIT RANGE/PERFORMANCE (BANK 2)

NOTE:
For the diagnostic procedure, refer to DTC P0390. <Ref. to EN(H4DO w/o HEV)(diag)-221, DTC P0390 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CI: DTC P0400 EXHAUST GAS RECIRCULATION FLOW

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-108, DTC P0400 EXHAUST GAS RECIRCULATION FLOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Movement performance problem when engine is low speed.
- Improper idling
- Movement performance problem

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «Mani. Absolute Pressure» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Mani. Absolute Pressure» 53.3 kPa (400 mmHg, 15.75 inHg) or more?	Make sure that the EGR control valve, manifold absolute pressure sensor and throttle body are installed securely.	Go to step **2**.
2	**CHECK EGR CONTROL VALVE.** Remove the EGR control valve.	Are there any holes, clogged lines or foreign matters in the EGR system?	Repair the EGR system.	Replace EGR control valve. <Ref. to EC(H4DO(w/o HEV))-23, EGR Control Valve.>

CJ:DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-110, DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

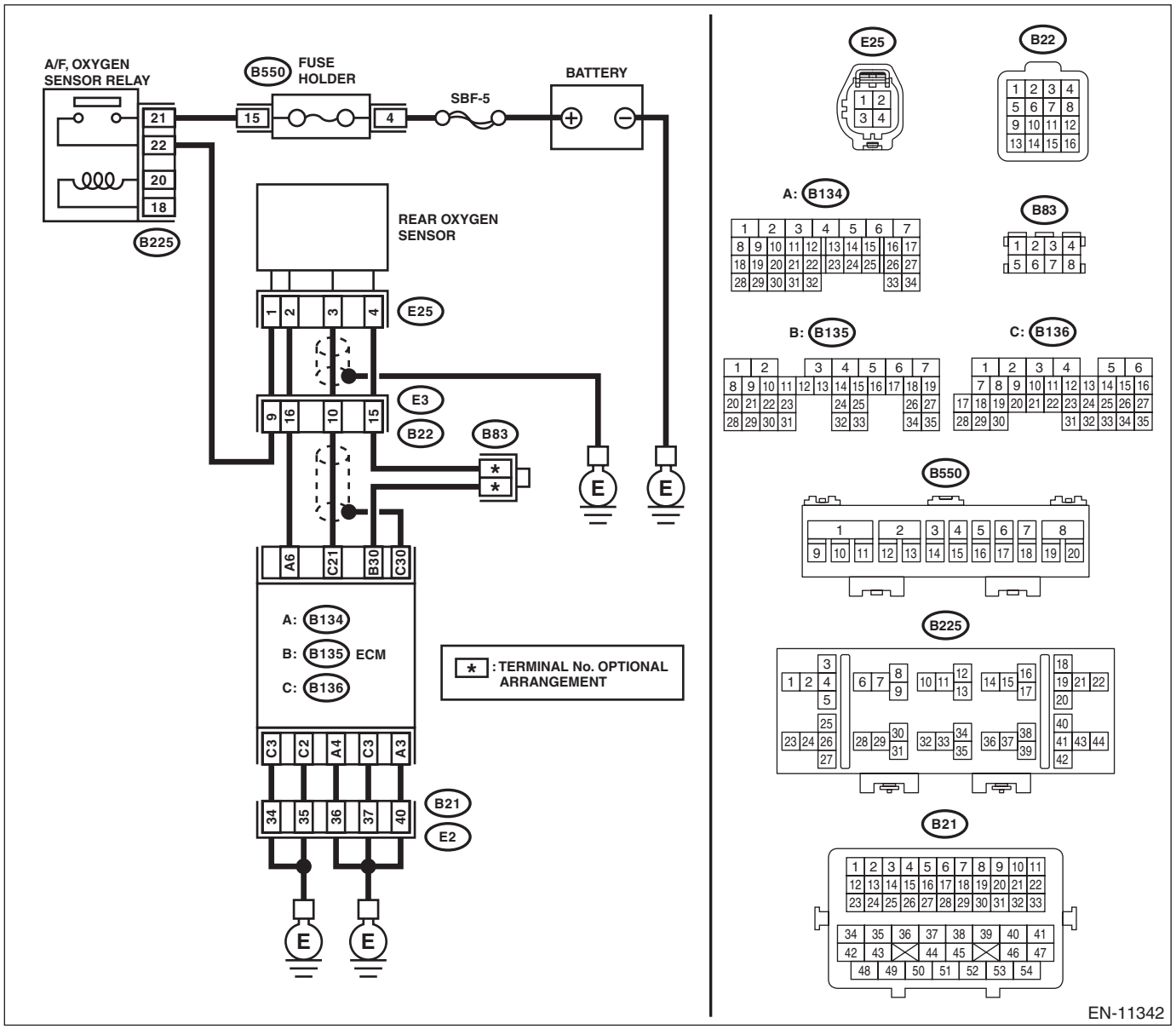
- Engine stalls.
- Idle mixture is out of specifications.

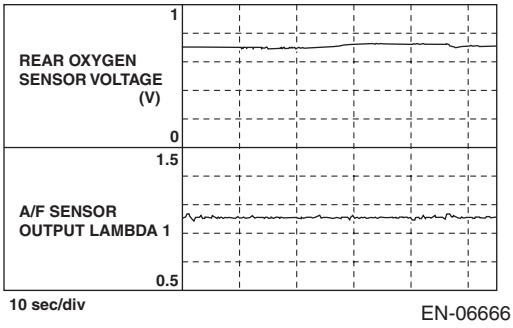
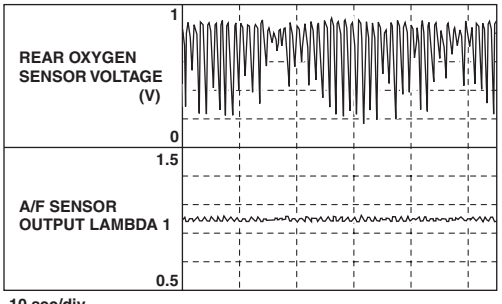
CAUTION:

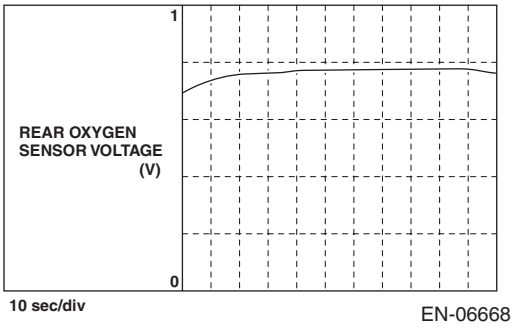
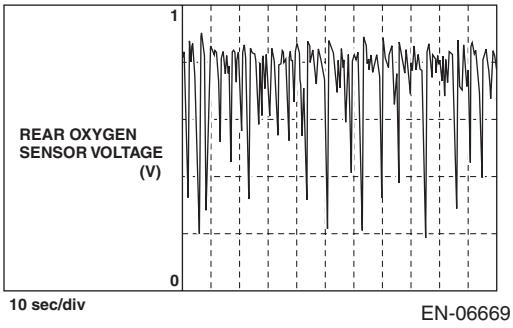
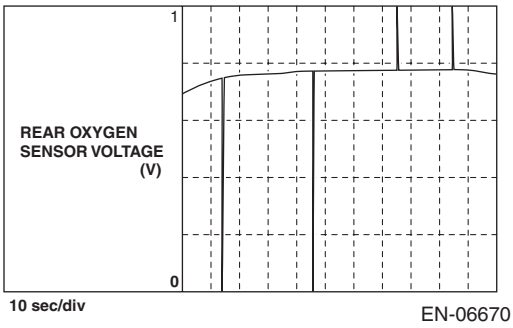
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK EXHAUST SYSTEM.** Check for gas leaks or air suction caused by loose or dislocated nuts and bolts, and open hole at exhaust pipes. NOTE: Check the following positions. • Between cylinder head and front exhaust pipe • Between front exhaust pipe and front catalytic converter • Between front catalytic converter and rear catalytic converter • Loose or improperly attached front oxygen (A/F) sensor or rear oxygen sensor	Is there any fault in exhaust system?	Repair or replace the exhaust system. <Ref. to EX(H4DO(w/o HEV))-2, General Description.>	Go to step **2**.
2	**CHECK WAVEFORM DATA ON THE SUBARU SELECT MONITOR (WHILE DRIVING).** 1) Drive at a constant speed between 80 — 112 km/h (50 — 70 MPH). 2) After 5 minutes have elapsed in the condition of step 1), use the Subaru Select Monitor while still driving to read the waveform data. • At normal condition  EN-06666 • At abnormal condition (numerous inversion)  EN-06667	Is a normal waveform displayed?	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.	Go to step **3**.

	Step	Check	Yes	No
3	**CHECK WAVEFORM DATA ON THE SUBARU SELECT MONITOR (WHILE IDLING).** 1) Run the engine at idle. 2) In the condition of step 1), use the Subaru Select Monitor to read the waveform data. • At normal condition  EN-06668 • At abnormal condition 1 (numerous inversion)  EN-06669 • At abnormal condition 2 (noise input)  EN-06670	Is a normal waveform displayed?	Go to step **4**.	• The waveform is displayed at abnormal condition 1: Go to step **4**. • The waveform is displayed at abnormal condition 2: Go to step **5**.
4	**CHECK CATALYTIC CONVERTER.**	Is the catalytic converter damaged?	Replace the catalytic converter. <Ref. to EC(H4DO(w/o HEV))-8, Front Catalytic Converter.>	Go to step **5**.
5	**CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **6**.

	Step	Check	Yes	No
6	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM connector and rear oxygen sensor connector. ***Connector & terminal*** ***(B136) No. 21 — (E25) No. 3:*** ***(B135) No. 30 — (E25) No. 4:***	Is the resistance less than 1 Ω?	Go to step **7**.	Repair the harness and connector. NOTE: Repair the following locations. • Open circuit in harness between ECM connector and rear oxygen sensor connector • Poor contact of coupling connector
7	**CHECK REAR OXYGEN SENSOR SHIELD.** 1) Turn the ignition switch to OFF. 2) Expose the rear oxygen sensor connector body side harness sensor shield. 3) Measure the resistance between sensor shield and chassis ground.	Is the resistance less than 1 Ω?	Go to step **8**.	Repair the open circuit of rear oxygen sensor harness.
8	**CHECK ENGINE OIL AMOUNT AND EXHAUST GAS.** 1) Check the engine oil amount. <Ref. to LU(H4DO(w/o HEV))-12, INSPECTION, Engine Oil.> 2) Check exhaust gas during idling.	Does the engine oil amount drop or white smoke emit from the muffler?	Check the engine, and repair the defective part. <Ref. to ME(H4DO(w/o HEV))-421, INSPECTION, Engine Trouble in General.> After repairing the engine, replace the front catalytic converter. <Ref. to EX(H4DO(w/o HEV))-6, Front Exhaust Pipe.> After the catalytic converter is replaced, perform step 2 to check the normal waveform is displayed, and then exit the procedure.	Go to step **9**.
9	**CHECK IGNITION SYSTEM.** 1) Check the spark plug. <Ref. to IG(H4DO(w/o HEV))-7, INSPECTION, Spark Plug.> 2) Check the status of the ignition coil connector and the spark plug terminal.	Is there any fault in the ignition system?	After repairing the ignition system, replace the front catalytic converter. <Ref. to EX(H4DO(w/o HEV))-6, Front Exhaust Pipe.> After the catalytic converter is replaced, perform step 2 to check the normal waveform is displayed, and then exit the procedure.	Go to step **10**.

	Step	Check	Yes	No
10	**CHECK FUEL SYSTEM.** 1) Refer to and check the items in “Insufficient fuel supply to fuel injector (except for “a. Fuel pump does not operate.”)” and “Leakage or blow out of fuel”. <Ref. to FU(H4DO(w/o HEV))-171, INSPECTION, Fuel System Trouble in General.> 2) Check throttle body. <Ref. to FU(H4DO(w/o HEV))-17, INSPECTION, Throttle Body.> 3) Check intake manifold. <Ref. to FU(H4DO(w/o HEV))-42, INSPECTION, Intake Manifold.>	Is there any fault in the fuel system?	After repairing the fuel system, replace the front catalytic converter. <Ref. to EX(H4DO(w/o HEV))-6, Front Exhaust Pipe.> After the catalytic converter is replaced, perform step 2 to check the normal waveform is displayed, and then exit the procedure.	Go to step **11**.
11	**CHECK DTC.**	Is any other DTC displayed?	Check the appropriate DTC using the “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).> After checking the DTC, replace the front catalytic converter. <Ref. to EX(H4DO(w/o HEV))-6, Front Exhaust Pipe.> After the catalytic converter is replaced, perform step 2 to check the normal waveform is displayed, and then exit the procedure.	Replace the rear oxygen sensor. <Ref. to FU(H4DO(w/o HEV))-96, Rear Oxygen Sensor.>

CK:DTC P0441 EVAPORATIVE EMISSION CONT. SYS. INCORRECT PURGE FLOW

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-112, DTC P0441 EVAPORATIVE EMISSION CONT. SYS. INCORRECT PURGE FLOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK PURGE CONTROL SOLENOID VALVE.** Operate the purge control solenoid valve using the Subaru Select Monitor. NOTE: For detailed procedures, refer to "System Operation Check Mode". <Ref. to EN(H4DO w/o HEV)(diag)-66, System Operation Check Mode.>	Does the purge control solenoid valve operate?	Go to step **3**.	Replace the purge control solenoid valve. <Ref. to EC(H4DO(w/o HEV))-18, Purge Control Solenoid Valve.>
3	**CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE.** 1) Turn the ignition switch to OFF. 2) Check the delivery (test) mode fuse is removed.	Are there holes, cracks, clogging, or disconnection, misconnection of hoses or pipes in evaporative emission control system?	Repair or replace the hoses or pipes.	Repair the poor contact of ECM connector.

CL:DTC P0451 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/ SWITCH RANGE/PERFORMANCE

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-115, DTC P0451 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check the appropriate DTC using the “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK CURRENT DATA.** 1) Turn the ignition switch to ON (engine OFF). 2) Using the Subaru Select Monitor or general scan tool, read the value in «Absolute Evap Sys. Pressure» and «Mani. Absolute Pressure», and compare them with the actual atmospheric pressure. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual. • To read the actual atmospheric pressure, connect the Subaru Select Monitor or general scan tool to the other known good vehicle.	Is the difference with the actual atmospheric pressure 2.4 kPa (18 mmHg, 0.7 inHg) or more?	Replace the part that showed larger deviation from the actual atmospheric pressure than the other. • If deviations in value for «Absolute Evap Sys. Pressure» is larger: Replace the leak check valve assembly. <Ref. to EC(H4DO(w/o HEV))-43, Leak Check Valve Assembly.> • If deviations in value for «Mani. Absolute Pressure» is larger: Replace the manifold absolute pressure sensor. <Ref. to FU(H4DO(w/o HEV))-76, Manifold Absolute Pressure Sensor.>	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.

CM:DTC P0452 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/ SWITCH LOW

DTC DETECTING CONDITION:

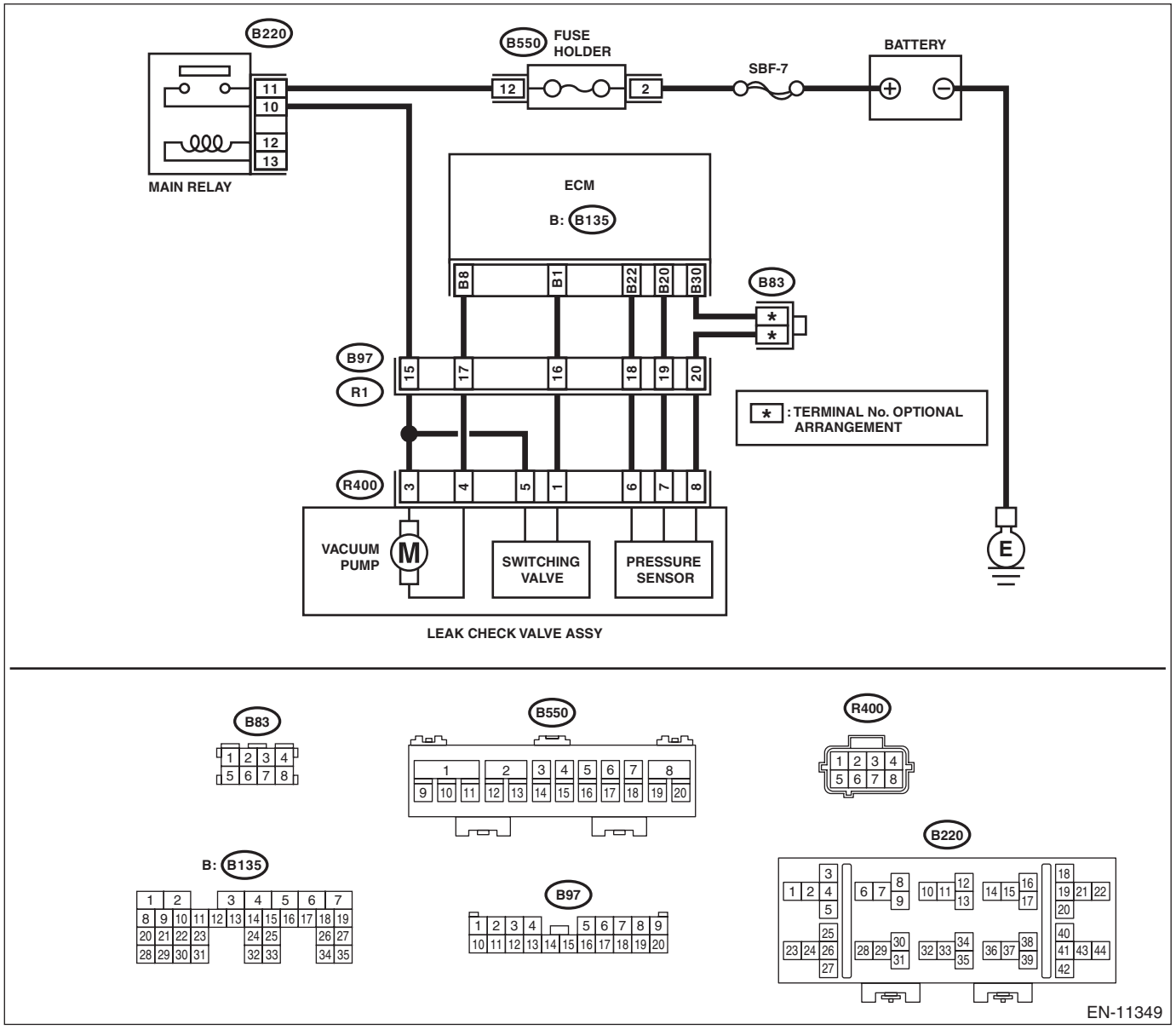
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-117, DTC P0452 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Turn the ignition switch to ON. 2) Read the value of «Atmosphere Pressure» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value in «Atmosphere Pressure» 34 kPa (255 mmHg, 10 inHg) or less?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK POWER SUPPLY OF LEAK CHECK VALVE ASSEMBLY.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the leak check valve assembly. 3) Turn the ignition switch to ON. 4) Measure the voltage between the leak check valve assembly connector and chassis ground. ***Connector & terminal*** ***(R400) No. 6 (+) — Chassis ground (–):***	Is the voltage 4.5 V or more?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and the leak check valve assembly connector • Poor contact of ECM connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 20 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **4**.	Repair the short circuit to ground in harness between ECM connector and leak check valve assembly connector.
4	**CHECK FOR POOR CONTACT.** Check for poor contact of leak check valve assembly connector.	Is there poor contact in the leak check valve assembly connector?	Repair the poor contact in the leak check valve assembly connector.	Replace the leak check valve assembly. <Ref. to EC(H4DO(w/o HEV))-43, Leak Check Valve Assembly.>

CN:DTC P0453 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/ SWITCH HIGH

DTC DETECTING CONDITION:

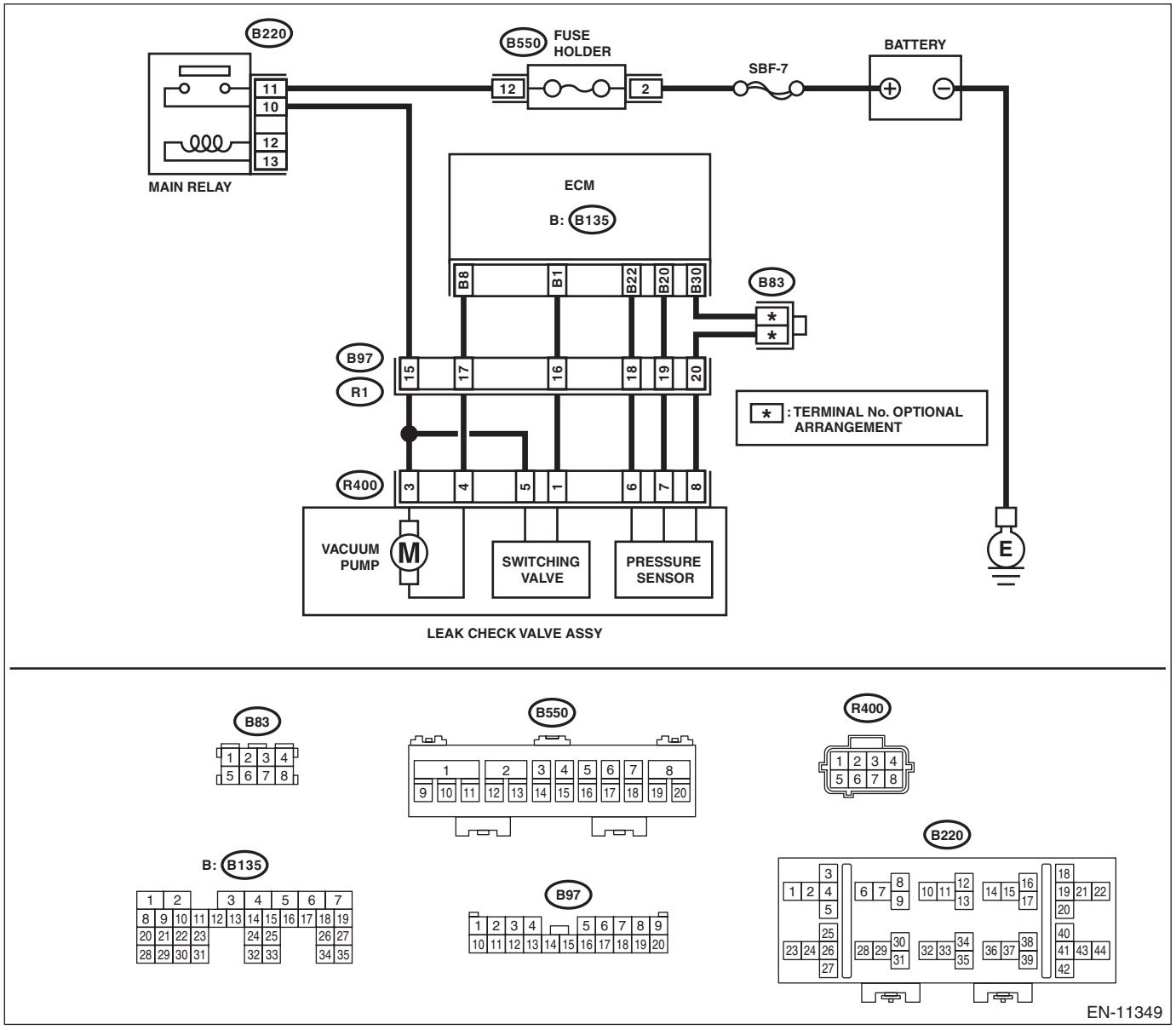
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-118, DTC P0453 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Turn the ignition switch to ON. 2) Read the value of «Atmosphere Pressure» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value in «Atmosphere Pressure» 125 kPa (938 mmHg, 36.9 inHg) or more?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and the leak check valve assembly. 3) Measure the resistance of harness between ECM connector and the leak check valve assembly connector. ***Connector & terminal*** ***(B135) No. 20 — (R400) No. 7:*** ***(B135) No. 30 — (R400) No. 8:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and the leak check valve assembly connector • Poor contact of coupling connector • Poor contact of joint connector
3	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM and the leak check valve assembly connector.	Is there poor contact in ECM and the leak check valve assembly connector?	Repair the poor contact of ECM and the leak check valve assembly connector.	Go to step **4**.
4	**CHECK LEAK CHECK VALVE ASSEMBLY.** Check the pressure sensor of the leak check valve assembly. <Ref. to EC(H4DO(w/o HEV))-60, CHECK PRESSURE SENSOR, INSPECTION, Leak Check Valve Assembly.>	Is the pressure sensor of the leak check valve assembly OK?	Repair the short circuit to power in harness between ECM connector and leak check valve assembly connector.	Replace the leak check valve assembly. <Ref. to EC(H4DO(w/o HEV))-43, Leak Check Valve Assembly.>

CO:DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-119, DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Fuel odor
- There is a hole of more than 1.0 mm (0.04 in) dia. in evaporation system or fuel tank.
- Fuel filler cap loose or lost

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK FUEL FILLER CAP.** 1) Turn the ignition switch to OFF. 2) Check the fuel filler cap. NOTE: The DTC is stored in memory if fuel filler cap is or was loose or if the cap chain has caught while tightening.	Is the fuel filler cap tightened securely?	Go to step **2**.	Tighten fuel filler cap securely.
2	**CHECK FUEL FILLER CAP.**	Is the fuel filler cap genuine?	Go to step **3**.	Replace with a genuine fuel filler cap.
3	**CHECK FUEL FILLER PIPE GASKET.**	Is there any damage to the seal between fuel filler cap and fuel filler pipe?	Repair or replace the fuel filler cap and fuel filler pipe. <Ref. to FU(H4DO(w/o HEV))-132, Fuel Filler Pipe.>	Go to step **4**.
4	**CHECK PURGE CONTROL SOLENOID VALVE.** Check air-tightness of the purge control solenoid valve. <Ref. to EC(H4DO(w/o HEV))-21, INSPECTION, Purge Control Solenoid Valve.>	Is the purge control solenoid valve OK?	Go to step **5**.	Replace the purge control solenoid valve. <Ref. to EC(H4DO(w/o HEV))-18, Purge Control Solenoid Valve.>
5	**CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE.**	Are there holes on the evaporation line?	Repair or replace the evaporation line. <Ref. to FU(H4DO(w/o HEV))-164, Fuel Delivery and Evaporation Lines.>	Go to step **6**.
6	**CHECK CANISTER.**	Are there holes on the canister?	Replace the canister. <Ref. to EC(H4DO(w/o HEV))-10, Canister.>	Go to step **7**.

	Step	Check	Yes	No
7	**CHECK LEAK CHECK VALVE ASSEMBLY.**	Are there damage or holes on the leak check valve assembly?	Replace the leak check valve assembly. <Ref. to EC(H4DO(w/o HEV))-43, Leak Check Valve Assembly.>	Go to step **8**.
8	**CHECK FUEL TANK.** Remove the fuel tank. <Ref. to FU(H4DO(w/o HEV))-116, Fuel Tank.>	Are there damage or holes on the fuel tank?	Repair or replace the fuel tank. <Ref. to FU(H4DO(w/o HEV))-116, Fuel Tank.>	Go to step **9**.
9	**CHECK ANY OTHER MECHANICAL TROUBLE IN EVAPORATIVE EMISSION CONTROL SYSTEM.**	Are there holes, cracks, clogging, or disconnection, misconnection of hoses or pipes in evaporative emission control system?	Repair or replace the hoses or pipes.	Repair the poor contact of ECM connector.

CP:DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK)

NOTE:
For the diagnostic procedure, refer to DTC P0455. <Ref. to EN(H4DO w/o HEV)(diag)-236, DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CQ:DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-125, DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

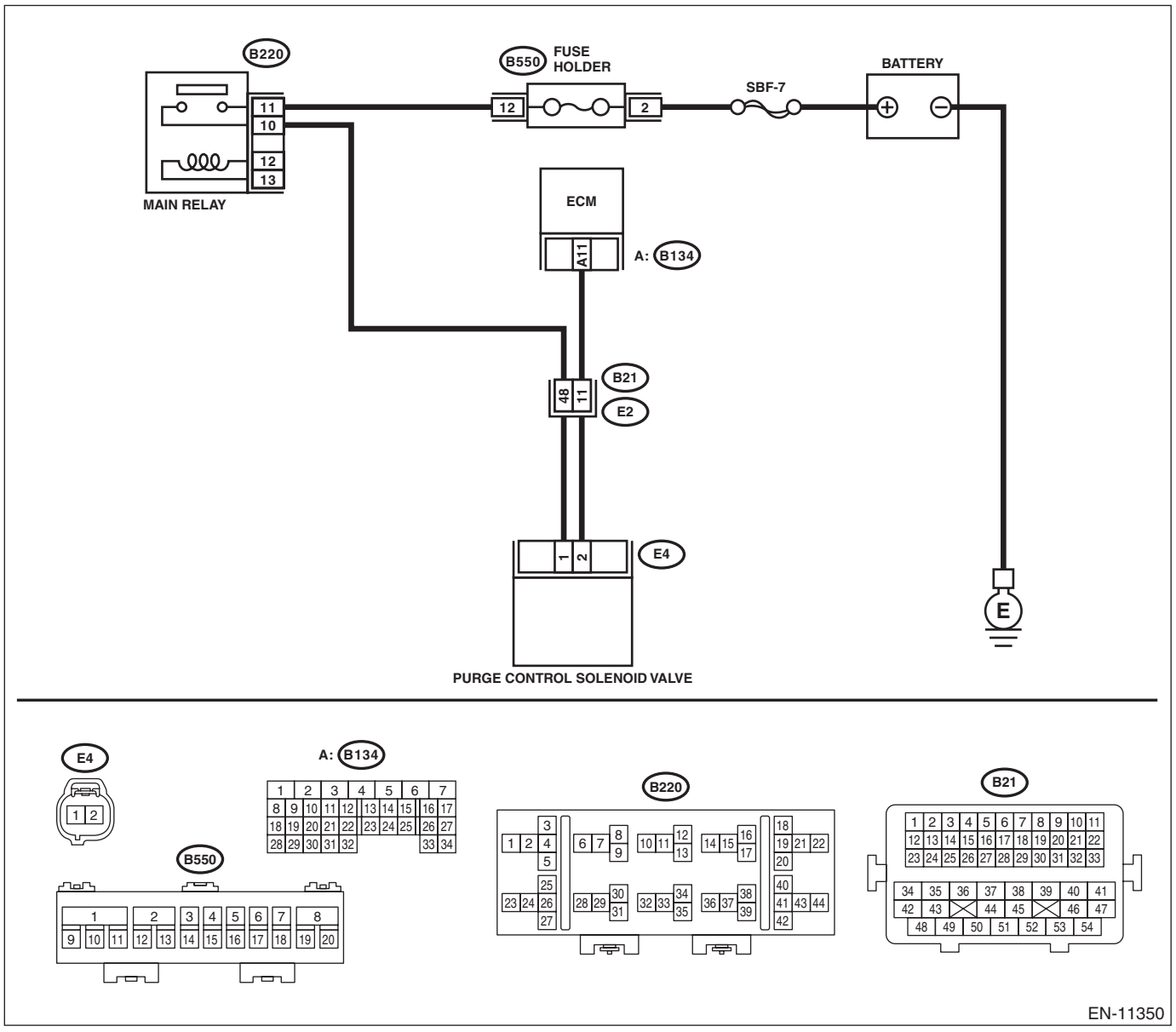
Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL OF ECM.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B137) No. 6 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **2**.	Go to step **3**.
2	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM connector.	Is there poor contact of ECM connector?	Repair the poor contact of ECM connector.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary open or short circuit of harness or temporary poor contact of connector may be the cause.
3	**CHECK POWER SUPPLY TO PURGE CONTROL SOLENOID VALVE.** Measure the voltage between purge control solenoid valve connector and engine ground. ***Connector & terminal*** ***(E4) No. 1 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **4**.	Repair the power supply circuit.
4	**CHECK HARNESS BETWEEN ECM AND PURGE CONTROL SOLENOID VALVE CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and purge control solenoid valve. 3) Measure the resistance between the purge control solenoid valve connector and engine ground. ***Connector & terminal*** ***(E4) No. 2 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the short circuit to ground in harness between ECM connector and purge control solenoid valve connector.
5	**CHECK HARNESS BETWEEN ECM AND PURGE CONTROL SOLENOID VALVE CONNECTOR.** Measure the resistance of harness between ECM connector and purge control solenoid valve. ***Connector & terminal*** ***(B134) No. 11 — (E4) No. 2:***	Is the resistance less than 1 Ω?	Go to step **6**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and purge control solenoid valve connector • Poor contact of coupling connector

	Step	Check	Yes	No
6	**CHECK PURGE CONTROL SOLENOID VALVE.** 1) Remove the purge control solenoid valve. 2) Measure the resistance between purge control solenoid valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 10 — 100 Ω?	Repair the poor contact of purge control solenoid valve connector.	Replace the purge control solenoid valve. <Ref. to EC(H4DO(w/o HEV))-18, Purge Control Solenoid Valve.>

CR:DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-126, DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

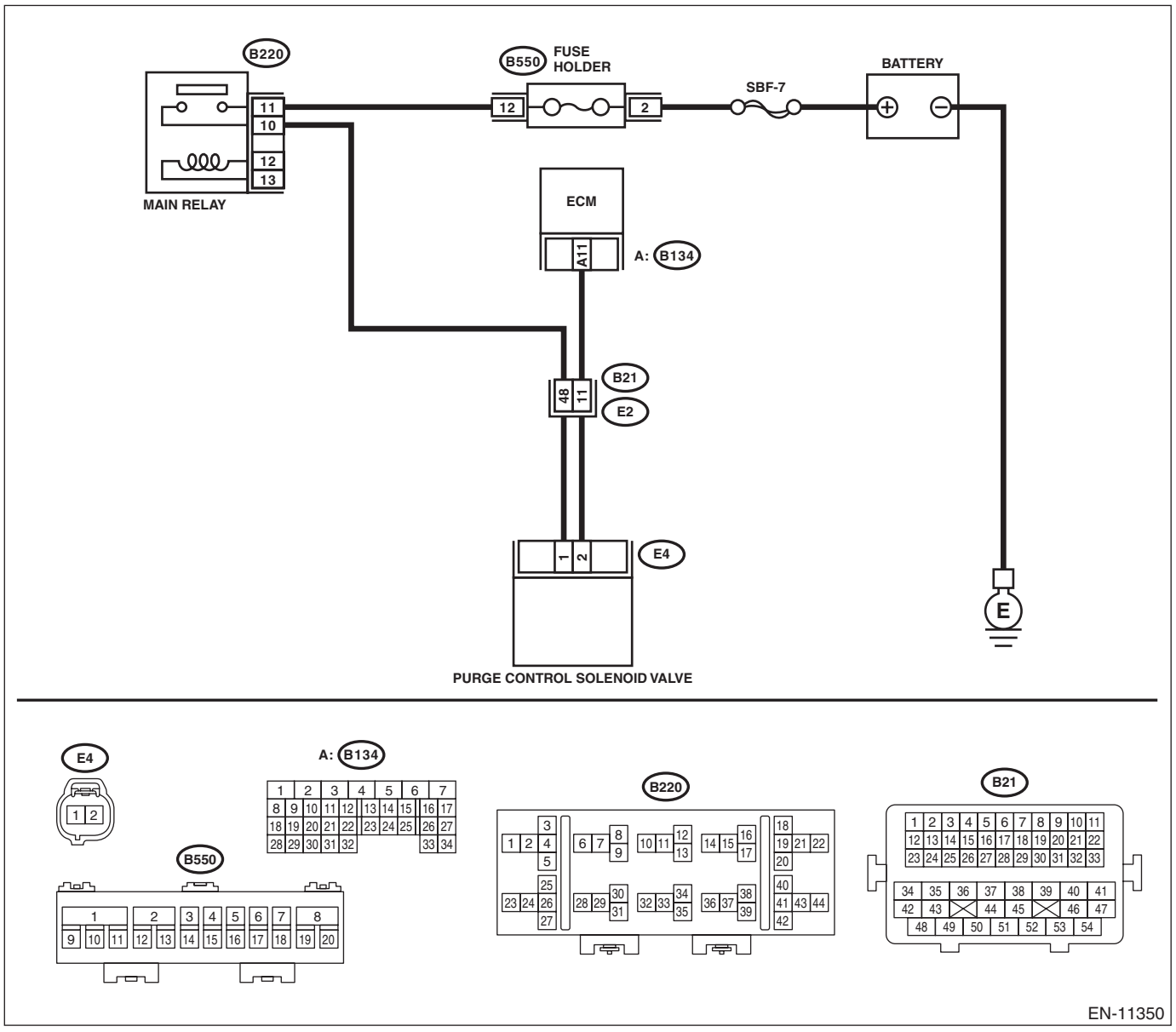
Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND PURGE CONTROL SOLENOID VALVE CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and purge control solenoid valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 11 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM connector and purge control solenoid valve connector.	Go to step **2**.
2	**CHECK PURGE CONTROL SOLENOID VALVE.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between purge control solenoid valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance less than 1 Ω?	Replace the purge control solenoid valve. <Ref. to EC(H4DO(w/o HEV))-18, Purge Control Solenoid Valve.>	Repair the poor contact of ECM connector.

CS:DTC P0461 FUEL LEVEL SENSOR “A” CIRCUIT RANGE/PERFORMANCE

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-127, DTC P0461 FUEL LEVEL SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

Step		Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check the appropriate DTC using the “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Replace the fuel level sensor and fuel sub level sensor. <Ref. to FU(H4DO(w/o HEV))-143, Fuel Level Sensor.> <Ref. to FU(H4DO(w/o HEV))-146, Fuel Sub Level Sensor.>

CT:DTC P0462 FUEL LEVEL SENSOR “A” CIRCUIT LOW

NOTE:
For the diagnostic procedure, refer to DTC P0463. <Ref. to EN(H4DO w/o HEV)(diag)-244, DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CU:DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-129, DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

Step		Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is DTC P0462 or P0463 displayed on the Subaru Select Monitor?	Check the combination meter. <Ref. to IDI(diag)-2, Basic Diagnostic Procedure.>	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.

CV:DTC P0500 VEHICLE SPEED SENSOR “A”

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-130, DTC P0500 VEHICLE SPEED SENSOR “A”, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

Step		Check	Yes	No
1	**CHECK DTC OF VDC.** Check DTC of VDC.	Is DTC of VDC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-40, List of Diagnostic Trouble Code (DTC).>	Repair the poor contact of ECM connector.

CW:DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-131, DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Hard to start the engine.
- Engine does not start.
- Improper idling
- Engine stalls.

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK AIR CLEANER ELEMENT.** 1) Turn the ignition switch to OFF. 2) Check the air cleaner element.	Is there excessive clogging on air cleaner element?	Replace the air cleaner element. <Ref. to IN(H4DO(w/o HEV))-4, Air Cleaner Element.>	Go to step **3**.
3	**CHECK ELECTRONIC THROTTLE CONTROL.** 1) Remove the electronic throttle control. <Ref. to FU(H4DO(w/o HEV))-14, REMOVAL, Throttle Body.> 2) Check the electronic throttle control.	Are foreign matter found inside electronic throttle control?	Remove foreign matter from electronic throttle control.	Perform the diagnosis of DTC P2101. <Ref. to EN(H4DO w/o HEV)(diag)-320, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CX:DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-132, DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

Engine keeps running at higher speed than specified idle speed.

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK AIR INTAKE SYSTEM.** 1) Start and idle the engine. 2) Check the following items. • Loose installation of intake manifold and throttle body • Cracks of intake manifold gasket and throttle body gasket • Disconnection of vacuum hoses	Is there any fault in air intake system?	Repair air suction and leaks.	Go to step **3**.
3	**CHECK ELECTRONIC THROTTLE CONTROL.** 1) Turn the ignition switch to OFF. 2) Remove the electronic throttle control. <Ref. to FU(H4DO(w/o HEV))-14, REMOVAL, Throttle Body.> 3) Check the electronic throttle control.	Are foreign matter found inside electronic throttle control?	Remove foreign matter from electronic throttle control.	Perform the diagnosis of DTC P2101. <Ref. to EN(H4DO w/o HEV)(diag)-320, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CY:DTC P050A COLD START IDLE AIR CONTROL SYSTEM PERFORMANCE

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-133, DTC P050A COLD START IDLE AIR CONTROL SYSTEM PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

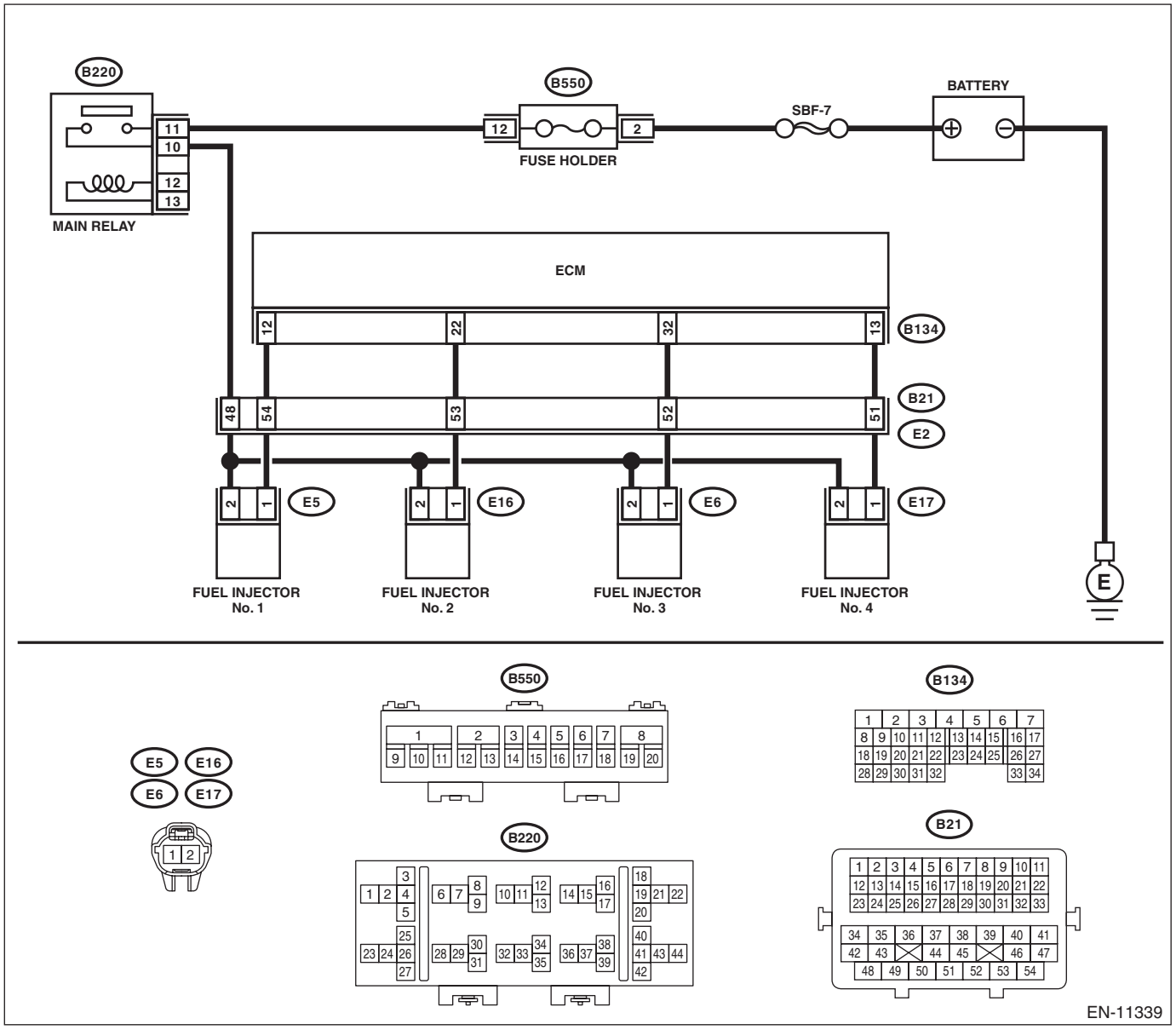
- Engine keeps running at higher speed than specified idle speed.
- Engine keeps running at a lower speed than the specified idle speed.
- Engine stalls.

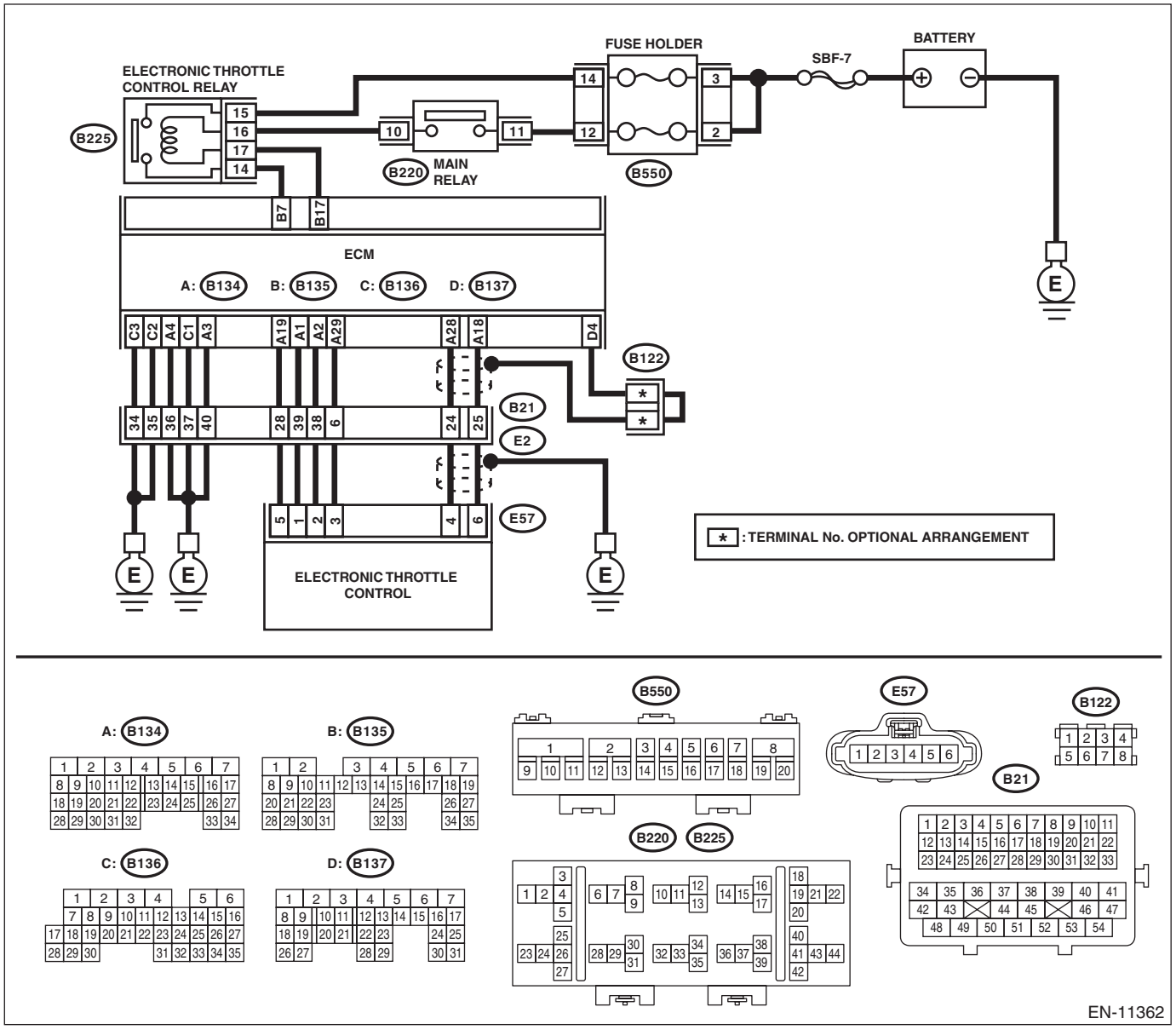
CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>





Step		Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK ENGINE OIL.**	Is there a proper amount of engine oil?	Go to step **3**.	Replace engine oil. <Ref. to LU(H4DO(w/o HEV))-13, REPLACEMENT, Engine Oil.>
3	**CHECK EXHAUST SYSTEM.**	Are there holes or loose bolts on exhaust system?	Repair the exhaust system.	Go to step **4**.

	Step	Check	Yes	No
4	**CHECK AIR INTAKE SYSTEM.**	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair the air intake system.	Go to step **5**.
5	**CHECK FUEL PRESSURE.** **WARNING:** **Place "NO OPEN FLAMES" signs near the working area.** **CAUTION:** **Be careful not to spill fuel.** Measure the fuel pressure. <Ref. to ME(H4DO(w/o HEV))-35, INSPECTION, Fuel Pressure.> **CAUTION:** **Release fuel pressure before removing the fuel pressure gauge.**	Is the measured value 340 — 400 kPa (3.5 — 4.1 kg/cm^2, 49 — 58 psi)?	Go to step **6**.	Check the fuel pump and fuel delivery line. <Ref. to FU(H4DO(w/o HEV))-142, INSPECTION, Fuel Pump.> <Ref. to FU(H4DO(w/o HEV))-170, INSPECTION, Fuel Delivery and Evaporation Lines.>
6	**CHECK ENGINE COOLANT TEMPERATURE SENSOR.** 1) Start the engine and warm up completely. 2) Read the value of «Coolant Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Coolant Temp.» 75°C (167°F) or more?	Go to step **7**.	Replace the engine coolant temperature sensor. <Ref. to FU(H4DO(w/o HEV))-51, Engine Coolant Temperature Sensor.>
7	**CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.** 1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F). 2) For CVT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Read the value of «Mass Air Flow» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Mass Air Flow» 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)?	Go to step **8**.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DO(w/o HEV))-73, Mass Air Flow and Intake Air Temperature Sensor.>

	Step	Check	Yes	No
8	**CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.** 1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F). 2) For CVT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Open the front hood. 6) Measure the ambient temperature. 7) Read the value of «Intake Air Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Subtract ambient temperature from «Intake Air Temp.». Is the obtained value –10 — 50°C (–18 — 90°F)?	Go to step **9**.	Check the mass air flow and intake air temperature sensor. <Ref. to FU(H4DO(w/o HEV))-73, Mass Air Flow and Intake Air Temperature Sensor.>
9	**CHECK OUTPUT SIGNAL OF ECM.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground on faulty cylinders. ***Connector & terminal*** ***#1 (B134) No. 12 (+) — Chassis ground (–):*** ***#2 (B134) No. 22 (+) — Chassis ground (–):*** ***#3 (B134) No. 32 (+) — Chassis ground (–):*** ***#4 (B134) No. 13 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **14**.	Go to step **10**.
10	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector on faulty cylinders. 3) Measure the resistance between fuel injector connector and engine ground on faulty cylinders. ***Connector & terminal*** ***#1 (E5) No. 1 — Engine ground:*** ***#2 (E16) No. 1 — Engine ground:*** ***#3 (E6) No. 1 — Engine ground:*** ***#4 (E17) No. 1 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **11**.	Repair the short circuit to ground in harness between ECM connector and fuel injector connector.
11	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** Measure the resistance of harness between ECM and fuel injector connector on faulty cylinders. ***Connector & terminal*** ***#1 (B134) No. 12 — (E5) No. 1:*** ***#2 (B134) No. 22 — (E16) No. 1:*** ***#3 (B134) No. 32 — (E6) No. 1:*** ***#4 (B134) No. 13 — (E17) No. 1:***	Is the resistance less than 1 Ω?	Go to step **12**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and fuel injector connector • Poor contact of coupling connector

	Step	Check	Yes	No
12	**CHECK FUEL INJECTOR.** Measure the resistance between fuel injector terminals on faulty cylinder. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 5 — 20 Ω?	Go to step **13**.	Replace the faulty fuel injector. <Ref. to FU(H4DO(w/o HEV))-79, Fuel Injector.>
13	**CHECK POWER SUPPLY LINE.** 1) Turn the ignition switch to ON. 2) Measure the voltage between fuel injector and engine ground on faulty cylinders. ***Connector & terminal*** ***#1 (E5) No. 2 (+) — Engine ground (–):*** ***#2 (E16) No. 2 (+) — Engine ground (–):*** ***#3 (E6) No. 2 (+) — Engine ground (–):*** ***#4 (E17) No. 2 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Repair the poor contact of all connectors in fuel injector circuit.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between the main relay connector and fuel injector connector on faulty cylinders • Poor contact of coupling connector • Poor contact of main relay connector
14	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector on faulty cylinders. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground on faulty cylinders. ***Connector & terminal*** ***#1 (B134) No. 12 (+) — Chassis ground (–):*** ***#2 (B134) No. 22 (+) — Chassis ground (–):*** ***#3 (B134) No. 32 (+) — Chassis ground (–):*** ***#4 (B134) No. 13 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in harness between ECM connector and fuel injector.	Go to step **15**.
15	**CHECK FUEL INJECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between fuel injector terminals on faulty cylinder. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 5 — 20 Ω?	Go to step **16**.	Replace the faulty fuel injector. <Ref. to FU(H4DO(w/o HEV))-79, Fuel Injector.>
16	**CHECK INSTALLATION CONDITION OF CAMSHAFT POSITION SENSOR/CRANKSHAFT POSITION SENSOR.**	Is the camshaft position sensor or crankshaft position sensor loosely installed?	Tighten the camshaft position sensor or crankshaft position sensor. <Ref. to FU(H4DO(w/o HEV))-61, INSTALLATION, Camshaft Position Sensor.> <Ref. to FU(H4DO(w/o HEV))-56, INSTALLATION, Crankshaft Position Sensor.>	Go to step **17**.

	Step	Check	Yes	No
17	**CHECK CRANKSHAFT POSITION SENSOR PLATE.**	Is the crankshaft position sensor plate rusted or does it have broken teeth?	Replace the crankshaft position sensor plate. <Ref. to ME(H4DO(w/o HEV))-304, Cylinder Block.>	Go to step **18**.
18	**CHECK INSTALLATION CONDITION OF TIMING CHAIN.** Turn the crankshaft using ST, and align the alignment mark on crank sprocket with alignment mark on cylinder block. ST 18252AA000 CRANKSHAFT SOCKET	Is the timing chain dislocated from its proper position?	Correct the installation condition of timing chain. <Ref. to ME(H4DO(w/o HEV))-169, Timing Chain Assembly.>	Go to step **19**.
19	**CHECK ELECTRONIC THROTTLE CONTROL RELAY.** 1) Turn the ignition switch to OFF. 2) Remove the electronic throttle control relay. 3) Connect the battery to terminals No. 16 and No. 17 of electronic throttle control relay. 4) Measure the resistance between electronic throttle control relay terminals. ***Terminals*** ***No. 14 — No. 15:***	Is the resistance less than 1 Ω?	Go to step **20**.	Replace the electronic throttle control relay. <Ref. to FU(H4DO(w/o HEV))-106, Electronic Throttle Control Relay.>
20	**CHECK POWER SUPPLY OF ELECTRONIC THROTTLE CONTROL RELAY.** Measure the voltage between electronic throttle control relay connector and chassis ground. ***Connector & terminal*** ***(B225) No. 15 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **21**.	Repair the open or ground short circuit of power supply circuit.
21	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.** 1) Disconnect the connector from ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control relay connector and chassis ground. ***Connector & terminal*** ***(B225) No. 17 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM connector and electronic throttle control relay connector.	Go to step **22**.
22	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between electronic throttle control relay connector and chassis ground. ***Connector & terminal*** ***(B225) No. 14 — Chassis ground:*** ***(B225) No. 17 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **23**.	Repair the short circuit to ground in harness between ECM connector and electronic throttle control relay connector.
23	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.** Measure the resistance of harness between ECM connector and electronic throttle control relay connector. ***Connector & terminal*** ***(B135) No. 17 — (B225) No. 17:*** ***(B135) No. 7 — (B225) No. 14:***	Is the resistance less than 1 Ω?	Go to step **24**.	Repair the open circuit in harness between ECM connector and electronic throttle control relay connector.

	Step	Check	Yes	No
24	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 19 — Chassis ground:*** ***(B134) No. 18 — Chassis ground:*** ***(B134) No. 18 — (B137) No. 4:*** ***(B134) No. 28 — Chassis ground:*** ***(B134) No. 28 — (B137) No. 4:***	Is the resistance 1 MΩ or more?	Go to step **25**.	Repair the ground short circuit of harness between ECM connector and electronic throttle control connector.
25	**CHECK SHORT CIRCUIT INSIDE THE ECM.** 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 6 — Engine ground:*** ***(E57) No. 4 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **26**.	Repair the ground short circuit of harness between ECM connector and electronic throttle control connector. Replace the ECM if defective. <Ref. to FU(H4DO(w/o HEV))-100, Engine Control Module (ECM).>
26	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM connector and electronic throttle control connector. ***Connector & terminal*** ***(B134) No. 18 — (E57) No. 6:*** ***(B134) No. 28 — (E57) No. 4:*** ***(B134) No. 29 — (E57) No. 3:***	Is the resistance less than 1 Ω?	Go to step **27**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and electronic throttle control connector • Poor contact of coupling connector
27	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 3 — Engine ground:***	Is the resistance less than 5 Ω?	Go to step **28**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM connector and engine ground • Poor contact of ECM connector • Poor contact of coupling connector

	Step	Check	Yes	No
28	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 6 (+) — Engine ground (–):*** ***(E57) No. 4 (+) — Engine ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between ECM connector and electronic throttle control connector.	Go to step **29**.
29	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connectors. ***Connector & terminal*** ***(B134) No. 19 — (B134) No. 18:*** ***(B134) No. 19 — (B134) No. 28:***	Is the resistance 1 MΩ or more?	Go to step **30**.	Repair the short circuit to power in the harness between ECM connector and electronic throttle control connector.
30	**CHECK SENSOR OUTPUT.** 1) Connect all connectors. 2) Turn the ignition switch to ON. 3) Read the value of «Main-Throttle Sensor» using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.>	Is the value of «Main-Throttle Sensor» 0.81 — 0.87 V?	Go to step **31**.	Repair the poor contact of electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4DO(w/o HEV))-14, Throttle Body.>
31	**CHECK SENSOR OUTPUT.** Read the value of «Sub-Throttle Sensor» using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.>	Is the value of «Sub-Throttle Sensor» 1.64 — 1.70 V?	Go to step **32**.	Repair the poor contact of electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4DO(w/o HEV))-14, Throttle Body.>
32	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance between ECM connector and electronic throttle control connector. ***Connector & terminal*** ***(B134) No. 2 — (E57) No. 2:*** ***(B134) No. 1 — (E57) No. 1:***	Is the resistance less than 1 Ω?	Go to step **33**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and electronic throttle control connector • Poor contact of coupling connector

	Step	Check	Yes	No
33	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 2 (+) — Engine ground (–):*** ***(E57) No. 1 (+) — Engine ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between ECM connector and electronic throttle control connector.	Go to step **34**.
34	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 2 — Engine ground:*** ***(E57) No. 1 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **35**.	Repair the ground short circuit of harness between ECM connector and electronic throttle control connector.
35	**CHECK HARNESS BETWEEN ELECTRONIC THROTTLE CONTROL CONNECTOR.** Measure the resistance between electronic throttle control connectors. ***Connector & terminal*** ***(E57) No. 2 — (E57) No. 1:***	Is the resistance 1 MΩ or more?	Go to step **36**.	Repair the short circuit in harness between ECM connector and electronic throttle control connector.
36	**CHECK ELECTRONIC THROTTLE CONTROL GROUND CIRCUIT.** Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 3 — Chassis ground:*** ***(B134) No. 4 — Chassis ground:*** ***(B136) No. 1 — Chassis ground:*** ***(B136) No. 2 — Chassis ground:*** ***(B136) No. 3 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **37**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM connector and engine ground • Poor contact of coupling connector
37	**CHECK ELECTRONIC THROTTLE CONTROL.** Measure the resistance between electronic throttle control terminals. ***Terminals*** ***No. 2 — No. 1:***	Is the resistance 50 Ω or less?	Go to step **38**.	Replace the electronic throttle control. <Ref. to FU(H4DO(w/o HEV))-14, Throttle Body.>
38	**CHECK ELECTRONIC THROTTLE CONTROL.** Move the throttle valve to the fully open and fully closed positions with fingers. Check that the valve returns to the specified position when releasing fingers.	Does the valve return to the specified position? Standard value: 3 mm (0.12 in) from fully closed position	Repair the poor contact of ECM connector.	Replace the electronic throttle control. <Ref. to FU(H4DO(w/o HEV))-14, Throttle Body.>

CZ:DTC P050B COLD START IGNITION TIMING PERFORMANCE

NOTE:
For the diagnostic procedure, refer to DTC P050A. <Ref. to EN(H4DO w/o HEV)(diag)-247, DTC P050A COLD START IDLE AIR CONTROL SYSTEM PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DA:DTC P0512 STARTER REQUEST CIRCUIT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-136, DTC P0512 STARTER REQUEST CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

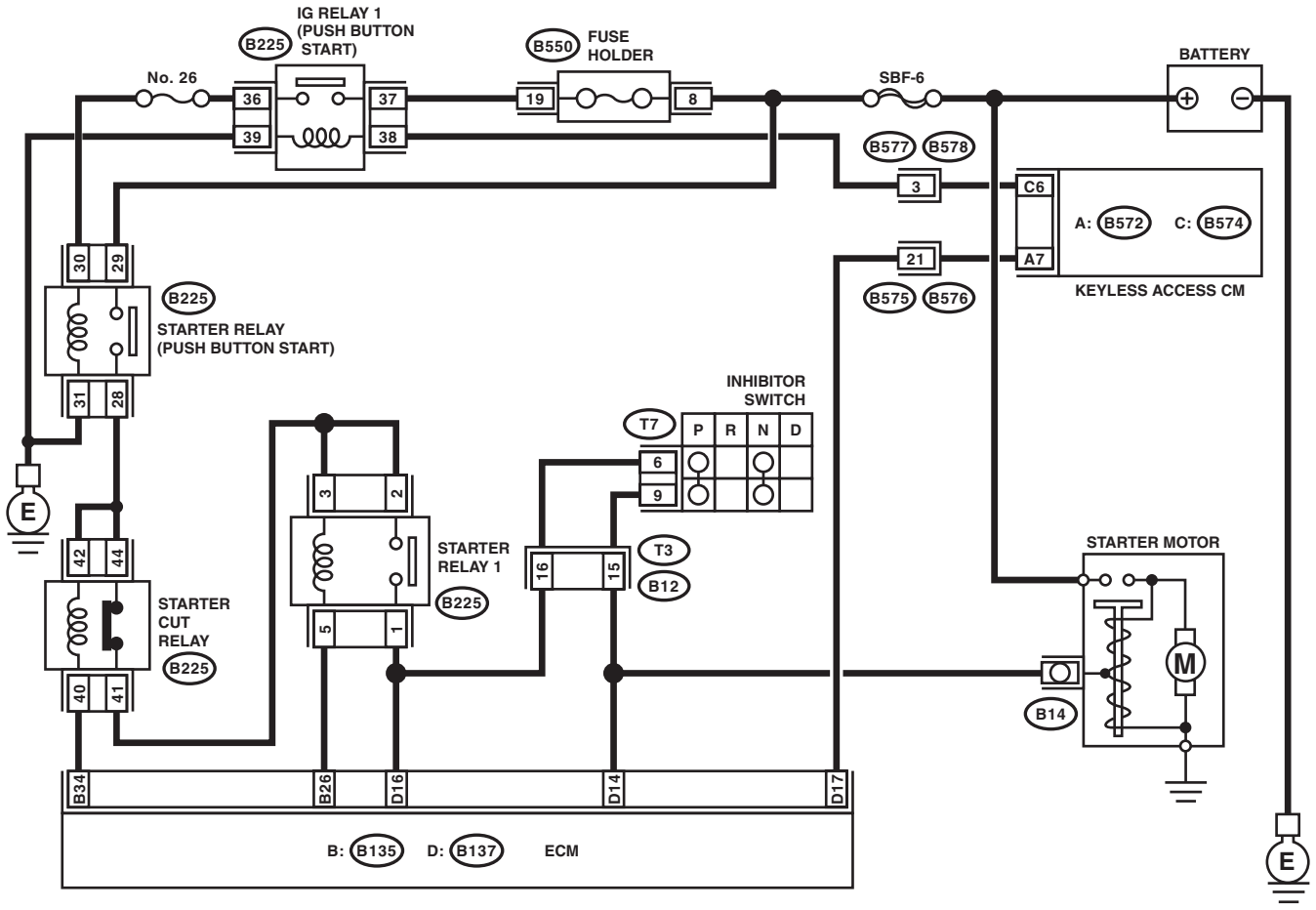
Failure of engine to start

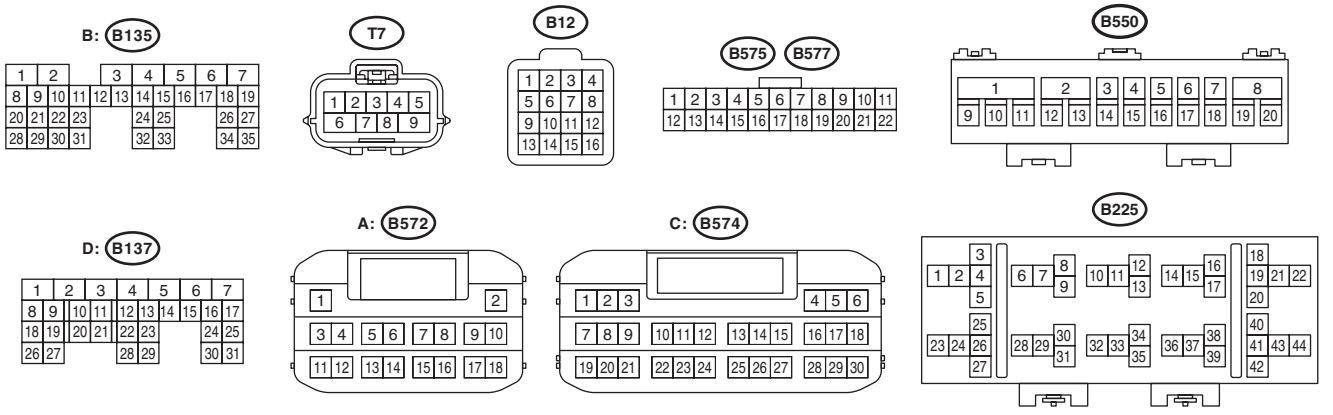
CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(HEV)-114, WITH PUSH BUTTON START, WIRING DIAGRAM, Engine Electrical System.>





EN-11364

	Step	Check	Yes	No
1	**CHECK PUSH BUTTON IGNITION SWITCH.** Operate the push button ignition switch.	Does it operate smoothly without catch?	Go to step **2**.	Replace the push button ignition switch. <Ref. to SL-114, Push Button Ignition Switch.>
2	**CHECK DTC.** 1) Clear the memory using the Subaru Select Monitor. <Ref. to EN(H4DO w/o HEV)(diag)-65, Clear Memory Mode.> 2) Start and idle the engine for three minutes or more.	Is the same DTC as current diagnosis output?	Go to step **3**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
3	**CHECK HARNESS BETWEEN ECM AND KEYLESS ACCESS CM.** 1) Turn the ignition to OFF. 2) Disconnect the connector from ECM. 3) Turn the ignition to ON. 4) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B137) No. 17 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power supply in harness between ECM connector and keyless access CM connector.	Repair the poor contact of ECM connector.

DB:DTC P0516 BATTERY TEMPERATURE SENSOR CIRCUIT LOW

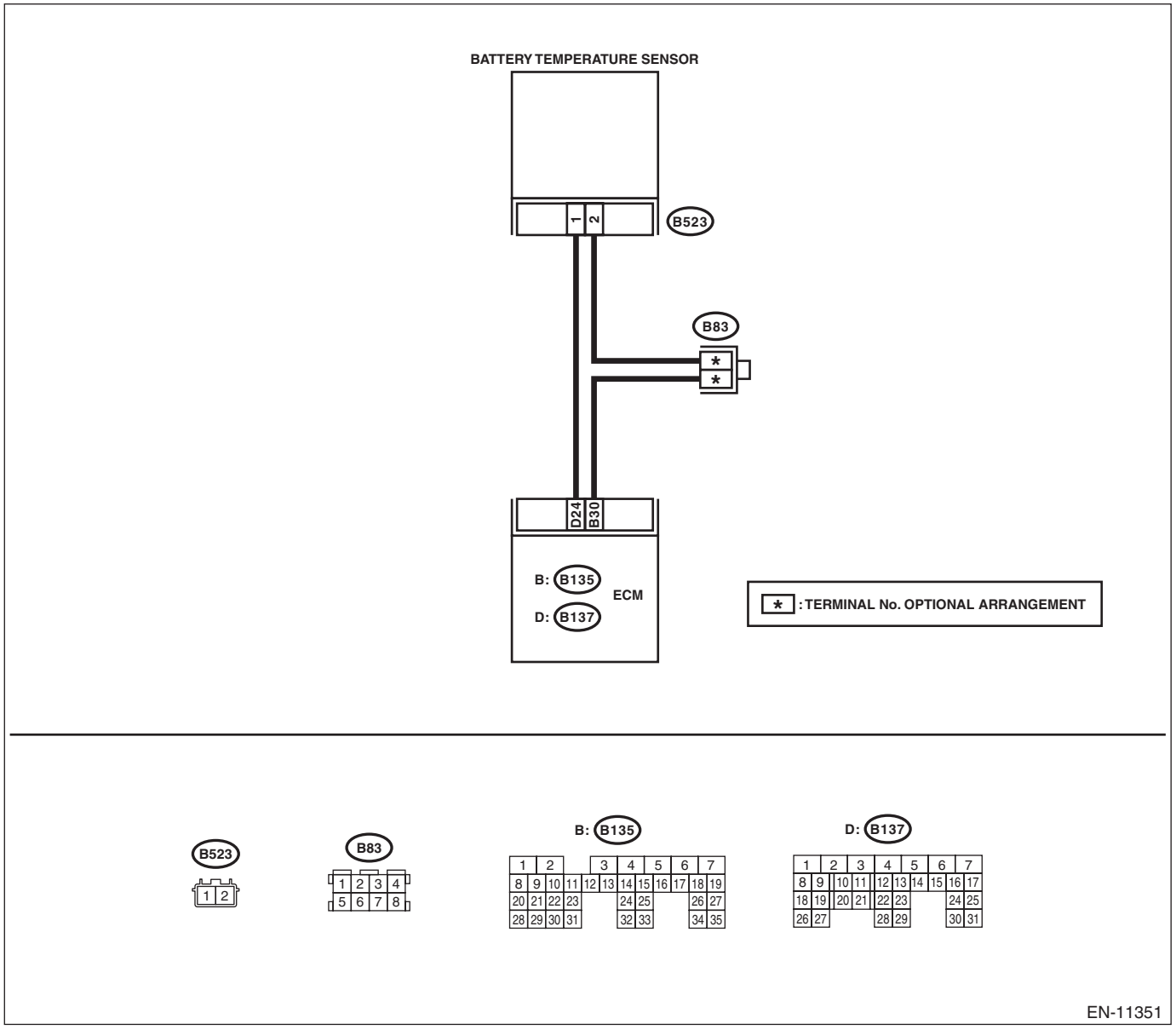
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-137, DTC P0516 BATTERY TEMPERATURE SENSOR CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «Battery temperature» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.>	Is the value of «Battery temperature» 100°C (212°F) or more?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK HARNESS BETWEEN ECM AND BATTERY TEMPERATURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and battery temperature sensor. 3) Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B137) No. 24 — Chassis ground:***	Is the resistance 1 MΩ or more?	Replace the battery temperature sensor. <Ref. to SC(H4DO(w/o HEV))-61, Battery Current & Temperature Sensor.>	Repair the short circuit to ground in the harness between the ECM connector and battery temperature sensor connector.

DC:DTC P0517 BATTERY TEMPERATURE SENSOR CIRCUIT HIGH

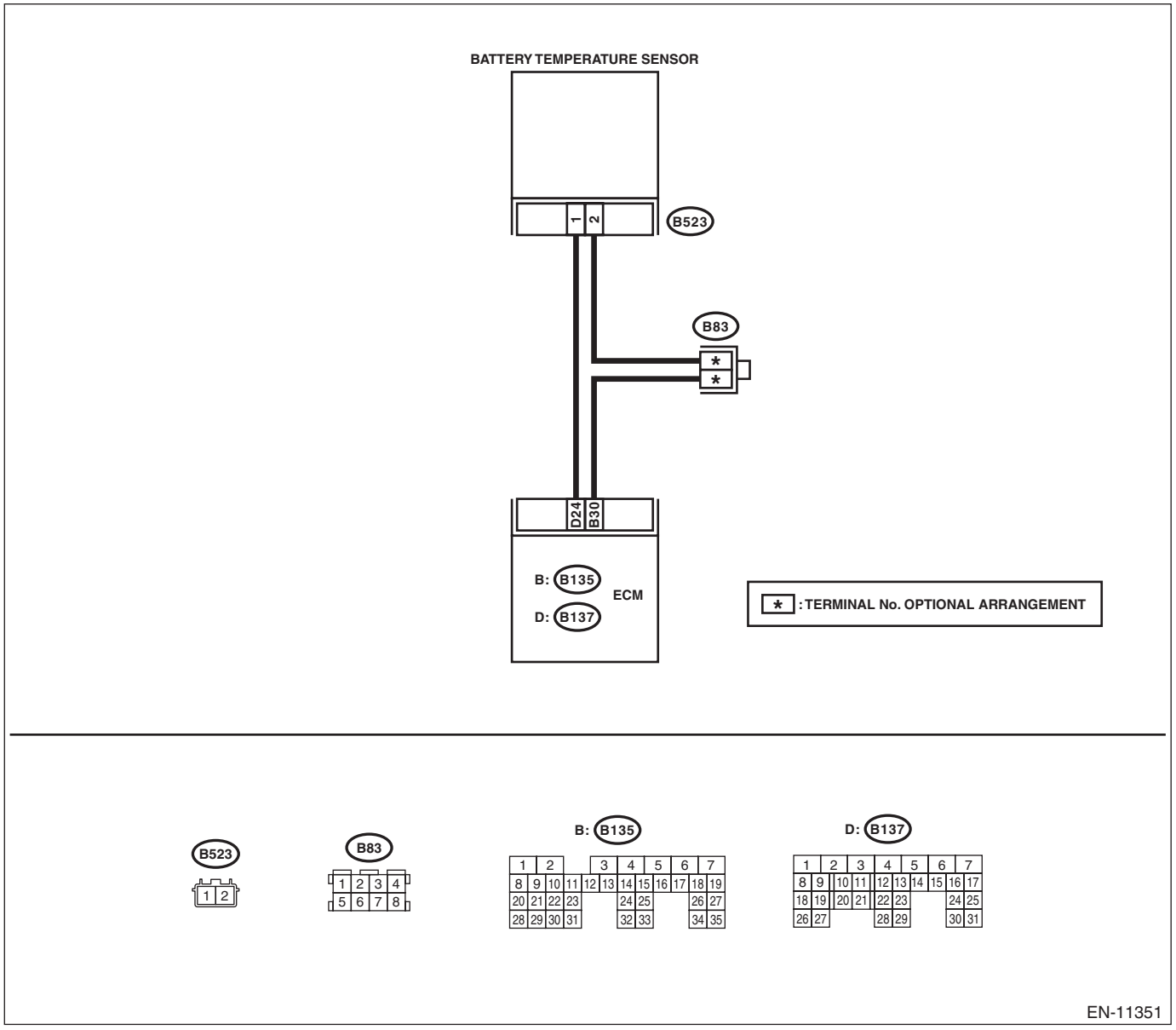
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-138, DTC P0517 BATTERY TEMPERATURE SENSOR CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «Battery temperature» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.>	Is the value of «Battery temperature» –40°C (–40°F) or less?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK FOR POOR CONTACT.** Check for poor contact between the ECM and battery temperature sensor connectors.	Is there poor contact of the ECM or battery temperature sensor connectors?	Repair any poor contact between the ECM and battery temperature sensor connectors.	Go to step **3**.
3	**CHECK HARNESS BETWEEN ECM AND BATTERY TEMPERATURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and battery temperature sensor. 3) Measure the resistance of harness between ECM connector and battery temperature sensor connector. ***Connector & terminal*** ***(B137) No. 24 — (B523) No. 1:*** ***(B135) No. 30 — (B523) No. 2:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and battery temperature sensor connector • Poor contact of joint connector
4	**CHECK HARNESS BETWEEN ECM AND BATTERY TEMPERATURE SENSOR CONNECTOR.** 1) Connect all connectors. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B137) No. 24 (+) — Chassis ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in harness between ECM connector and battery temperature sensor connector.	Replace the battery temperature sensor. <Ref. to SC(H4DO(w/o HEV))-61, Battery Current & Temperature Sensor.>

DD:DTC P0560 SYSTEM VOLTAGE

DTC DETECTING CONDITION:

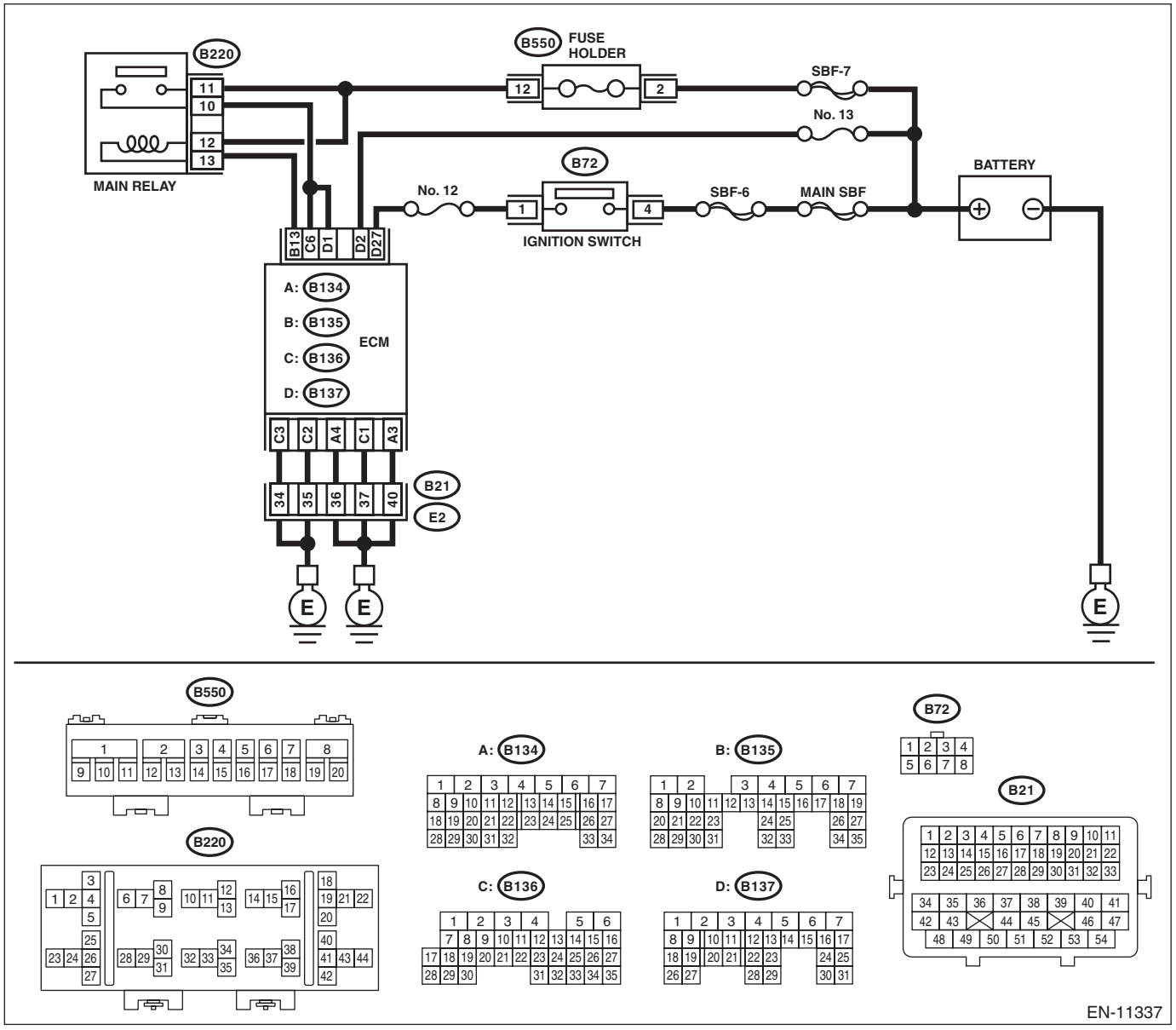
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-139, DTC P0560 SYSTEM VOLTAGE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



Step		Check	Yes	No
1	**CHECK INPUT SIGNAL OF ECM.** 1) Turn the ignition switch to OFF. 2) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B137) No. 2 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the poor contact of ECM connector.	Go to step **2**.

	Step	Check	Yes	No
2	**CHECK HARNESS BETWEEN ECM AND MAIN FUSE BOX CONNECTOR.** 1) Disconnect the connector from ECM. 2) Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B137) No. 2 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **3**.	Repair the short circuit to ground in harness between ECM connector and battery terminal.
3	**CHECK FUSE NO. 13 (MAIN FUSE BOX).**	Is the fuse blown out?	Replace the fuse.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and battery • Poor contact of ECM connector • Poor contact of battery terminal

DE:DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-140, DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Engine does not start.
- Engine stalls.

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No
1 **CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.

DF:DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR

NOTE:
For the diagnostic procedure, refer to DTC P0606. <Ref. to EN(H4DO w/o HEV)(diag)-266, DTC P0606 CONTROL MODULE PROCESSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DG:DTC P0606 CONTROL MODULE PROCESSOR

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-142, DTC P0606 CONTROL MODULE PROCESSOR, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

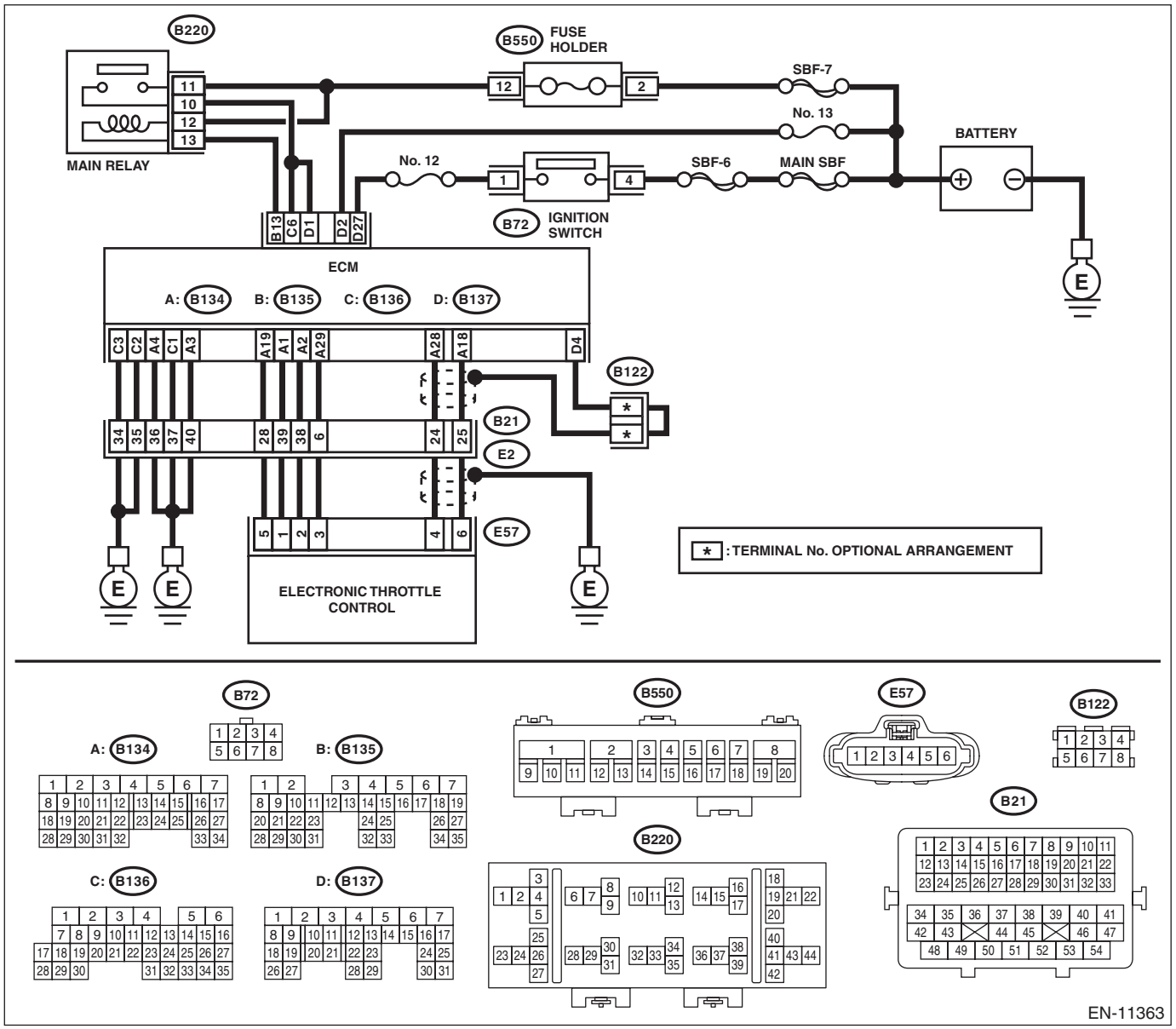
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK INPUT VOLTAGE OF ECM.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 6 (+) — Chassis ground (–):*** ***(B137) No. 1 (+) — Chassis ground (–):***	Is the voltage 10 — 13 V?	Go to step **2**.	Repair the open or ground short circuit of power supply circuit.
2	**CHECK INPUT VOLTAGE OF ECM.** 1) Start the engine. 2) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 6 (+) — Chassis ground (–):*** ***(B137) No. 1 (+) — Chassis ground (–):***	Is the voltage 13 — 15 V?	Go to step **3**.	Repair the open or ground short circuit of power supply circuit.
3	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance of harness between ECM connector and electronic throttle control connector. ***Connector & terminal*** ***(B134) No. 19 — (E57) No. 5:*** ***(B134) No. 29 — (E57) No. 3:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and electronic throttle control connector • Poor contact of coupling connector
4	**CHECK ECM GROUND HARNESS.** 1) Connect all connectors. 2) Turn the ignition to ON. 3) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 3 (+) — Chassis ground (–):*** ***(B134) No. 4 (+) — Chassis ground (–):*** ***(B136) No. 1 (+) — Chassis ground (–):*** ***(B136) No. 2 (+) — Chassis ground (–):*** ***(B136) No. 3 (+) — Chassis ground (–):***	Is the voltage less than 1 V?	Check the connector for poor contact and check the harness. Replace the ECM if no fault is found. <Ref. to FU(H4DO(w/o HEV))-100, Engine Control Module (ECM).>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in ground circuit • Further tightening of the engine ground terminal • Poor contact of coupling connector

DH:DTC P060A INTERNAL CONTROL MODULE MONITORING PROCESSOR PERFORMANCE

NOTE:
For the diagnostic procedure, refer to DTC P0606. <Ref. to EN(H4DO w/o HEV)(diag)-266, DTC P0606 CONTROL MODULE PROCESSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DI: DTC P060B INTERNAL CONTROL MODULE A/D PROCESSING PERFORMANCE

NOTE:
For the diagnostic procedure, refer to DTC P0606. <Ref. to EN(H4DO w/o HEV)(diag)-266, DTC P0606 CONTROL MODULE PROCESSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DJ:DTC P0616 STARTER RELAY CIRCUIT LOW

DTC DETECTING CONDITION:

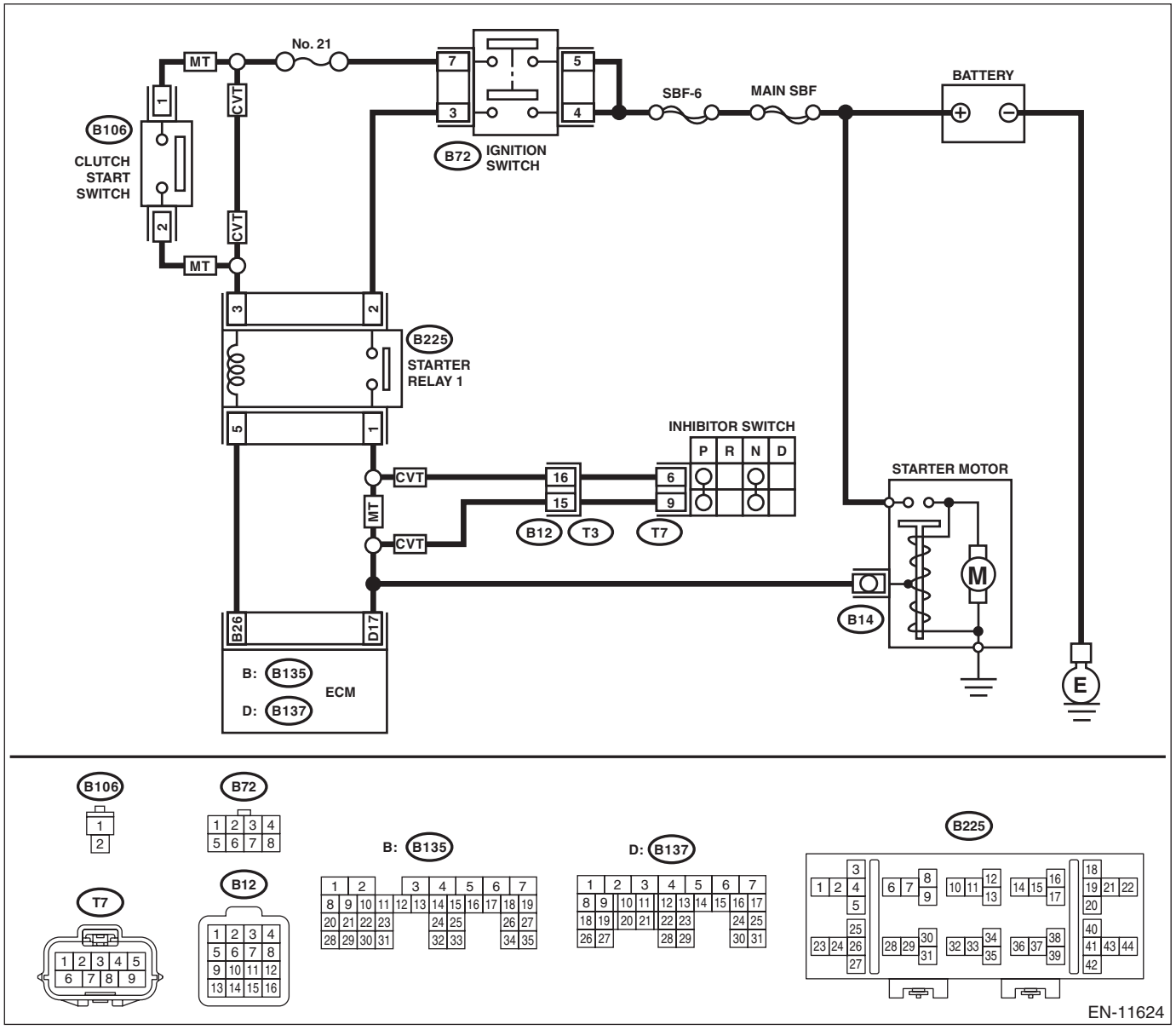
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-148, DTC P0616 STARTER RELAY CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK HARNESS BETWEEN ECM AND STARTER RELAY 1 CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Remove the starter relay 1. 3) Disconnect the connectors from ECM and starter motor. 4) Measure the resistance of harness between ECM connector and starter relay 1 connector. ***Connector & terminal*** ***(B136) No. 16 — (B225) No. 1:*** NOTE: For CVT model, place the select lever in "P" range or "N" range.	Is the resistance less than 1 Ω?	Go to step **3**.	NOTE: Check the following item and repair or replace if necessary. • Open circuit of harness between ECM connector and starter relay 1 connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND STARTER RELAY 1 CONNECTOR.** Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B137) No. 17 — Chassis ground:***	Is the resistance 1 MΩ or more?	Repair the poor contact of ECM connector.	Repair the short circuit to ground in harness between ECM connector and starter relay 1 connector.

DK:DTC P0617 STARTER RELAY CIRCUIT HIGH

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-149, DTC P0617 STARTER RELAY CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

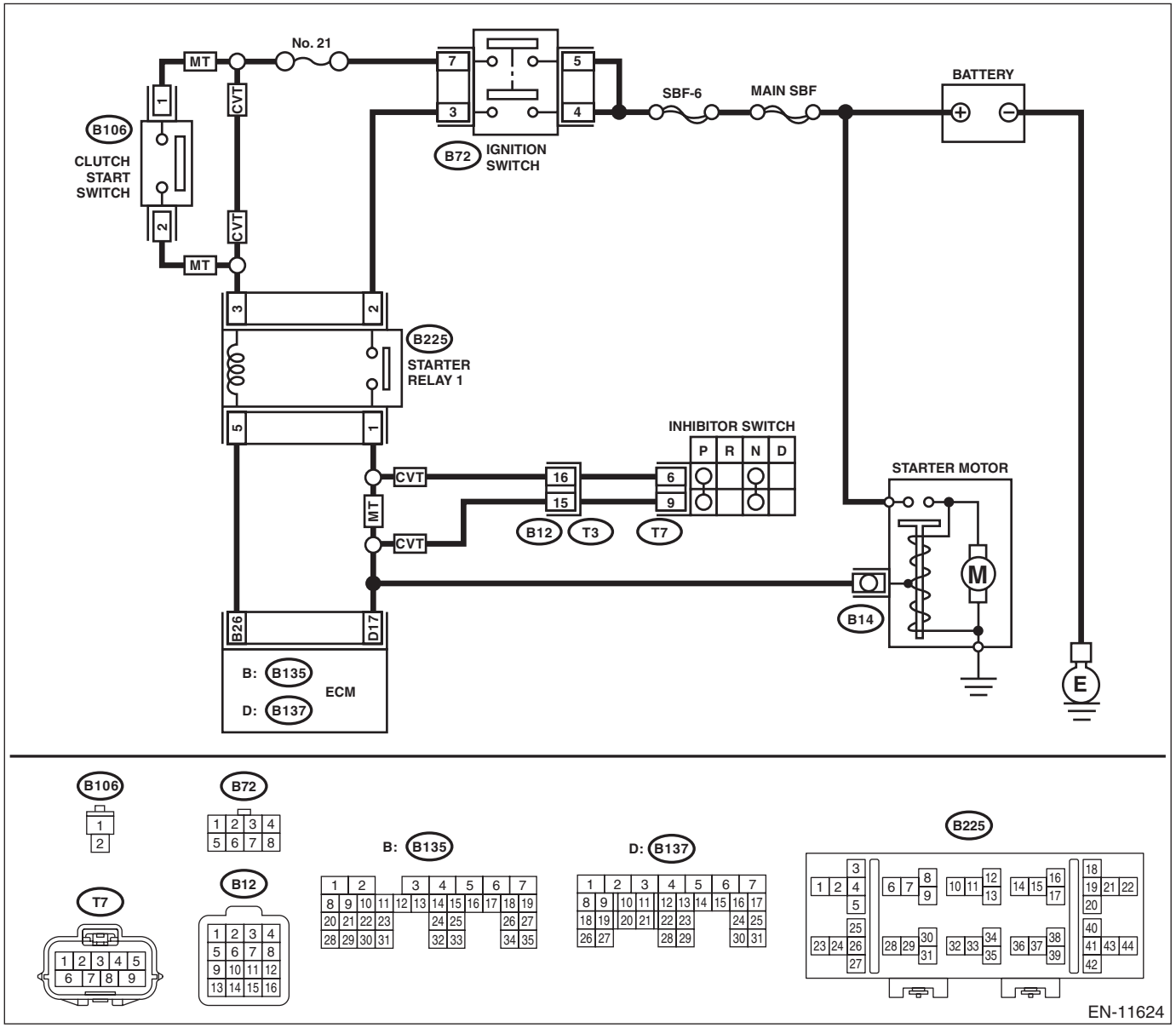
Failure of engine to start

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK HARNESS BETWEEN ECM AND STARTER RELAY 1 CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 16 (+) — Chassis ground (–):*** NOTE: For CVT model, place the select lever in "P" range or "N" range.	Is the voltage 10 V or more?	Repair the short circuit to power in harness between ECM connector and starter relay 1 connector.	Repair the poor contact of ECM connector.

DL:DTC P062F INTERNAL CONTROL MODULE EEPROM ERROR

NOTE:
For the diagnostic procedure, refer to DTC P0606. <Ref. to EN(H4DO w/o HEV)(diag)-266, DTC P0606 CONTROL MODULE PROCESSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DM:DTC P0685 ECM/PCM POWER RELAY CONTROL CIRCUIT/OPEN

DTC DETECTING CONDITION:

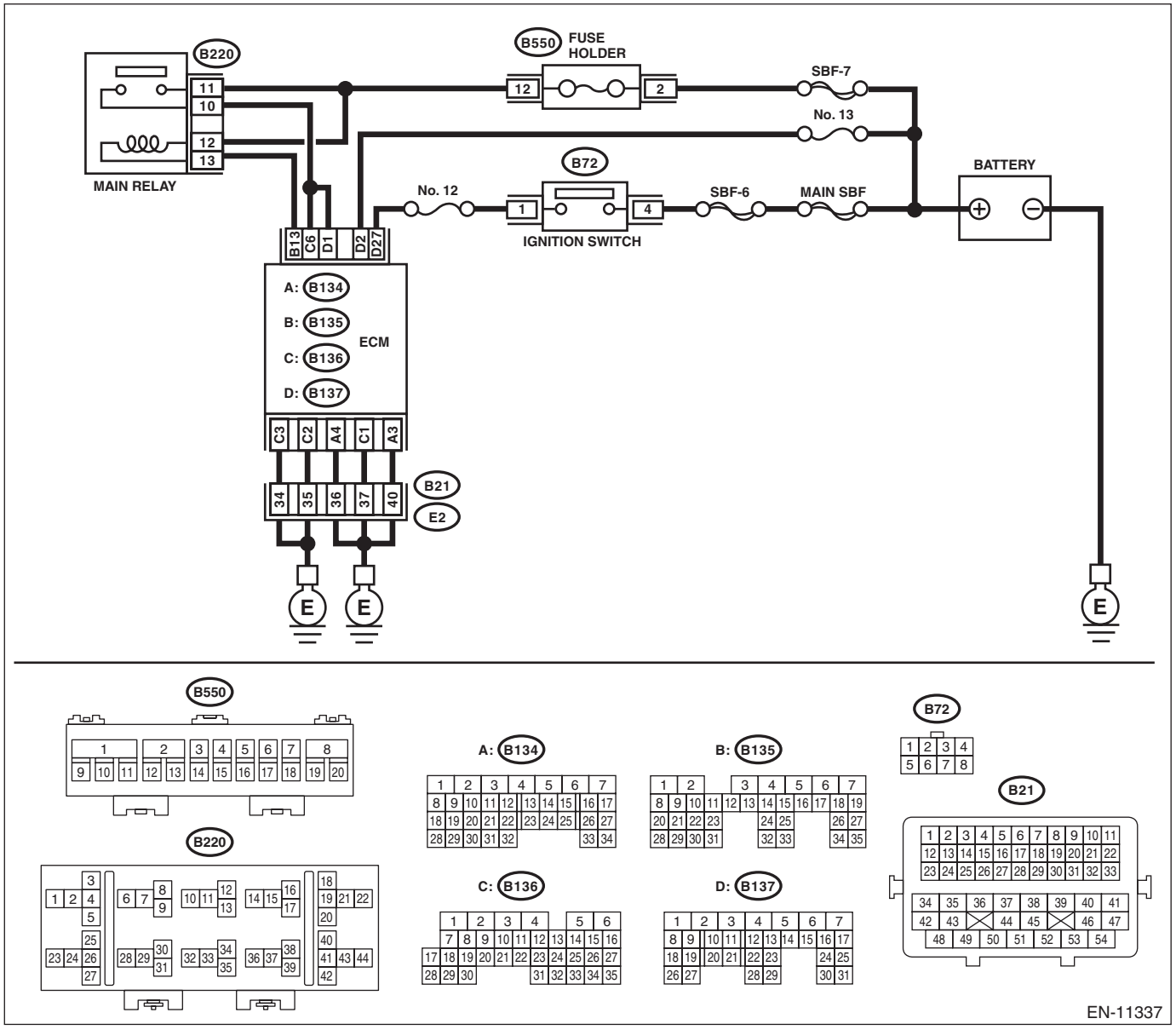
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-151, DTC P0685 ECM/PCM POWER RELAY CONTROL CIRCUIT/OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



Step		Check	Yes	No
1	**CHECK ECM CONNECTOR.** Check the connecting condition of ECM connector.	Is the ECM connector correctly connected?	Go to step **2**.	Connect the ECM connector correctly.

	Step	Check	Yes	No
2	**CHECK HARNESS BETWEEN ECM AND MAIN RELAY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the voltage between ECM connector and engine ground. ***Connector & terminal*** ***(B136) No. 6 (+) — Engine ground (–):*** ***(B137) No. 1 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Repair the harness and connector. NOTE: In this case, repair the following item: • Short circuit to power supply in harness between ECM connector and main relay connector • Defective main relay	Go to step **3**.
3	**CHECK HARNESS BETWEEN ECM AND MAIN RELAY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Remove the main relay. 3) Disconnect the connector from ECM. 4) Measure the resistance between the ECM connector and engine ground. ***Connector & terminal*** ***(B135) No. 13 — Engine ground:***	Is the resistance 1 MΩ or more?	Repair the poor contact of ECM connector.	Repair the short circuit to ground in harness between ECM connector and main relay connector.

DN:DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST)

NOTE:
For the diagnostic procedure, refer to CVT section. <Ref. to CVT(w/o HEV)(diag)-2, Basic Diagnostic Procedure.>

DO:DTC P081A STARTER DISABLE CIRCUIT LOW

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-153, DTC P081A STARTER DISABLE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

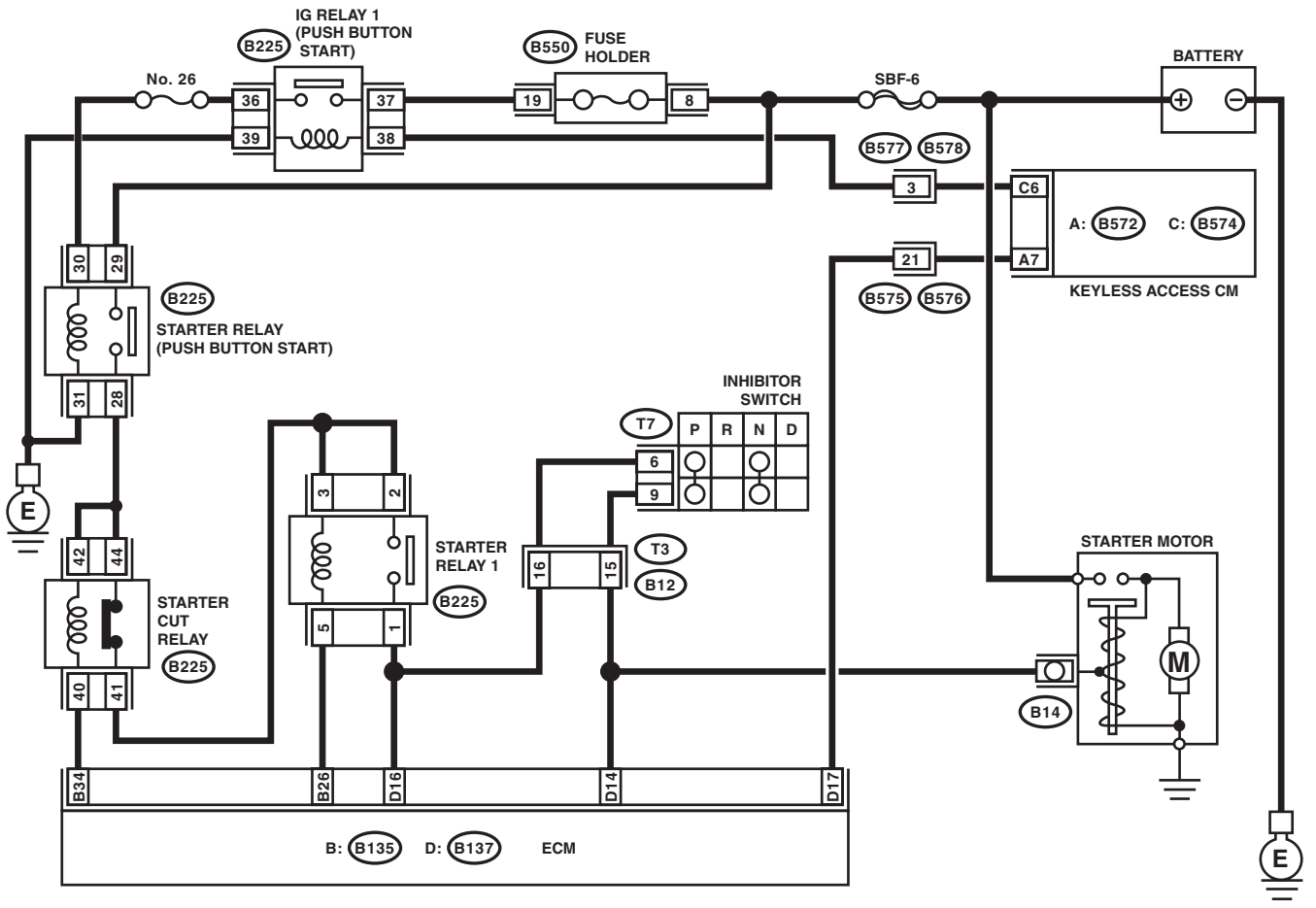
TROUBLE SYMPTOM:

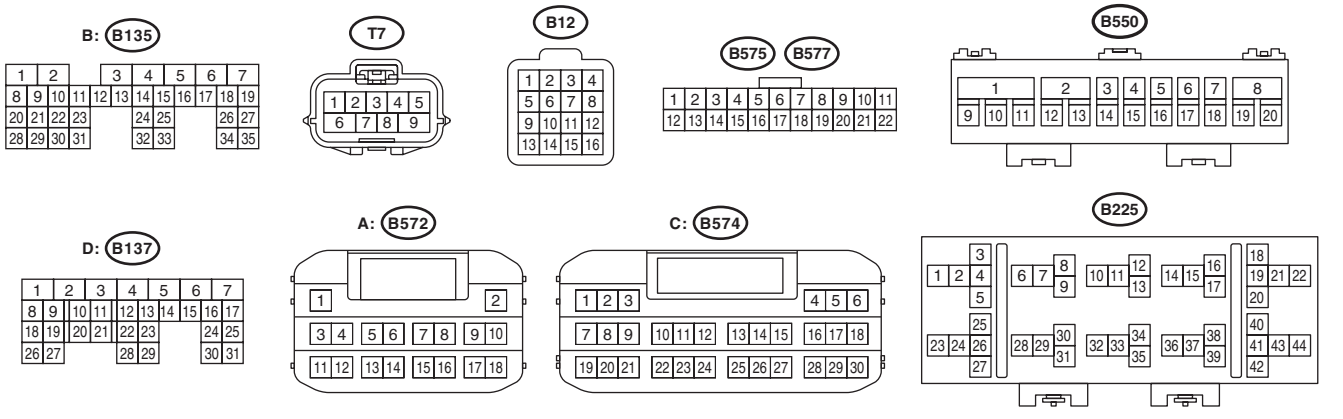
Failure of engine to start

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:
Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>





EN-11364

	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN STARTER RELAY (PUSH BUTTON START) CONNECTOR AND STARTER CUT RELAY CONNECTOR.** 1) Turn the ignition to OFF. 2) Remove the starter relay (push button start) and starter cut relay. 3) Measure the resistance of harness between starter relay (push button start) connector and starter cut relay connector. ***Connector & terminal*** ***(B225) No. 28 — (B225) No. 42:***	Is the resistance less than 1 Ω?	Go to step **2**.	Repair the open circuit in harness between starter relay (push button start) connector and starter cut relay connector.
2	**CHECK HARNESS BETWEEN ECM AND STARTER CUT RELAY CONNECTOR.** 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM connector and starter cut relay connector. ***Connector & terminal*** ***(B135) No. 34 — (B225) No. 40:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the open circuit of harness between ECM connector and starter cut relay connector.
3	**CHECK STARTER CUT RELAY.** 1) Connect the battery to starter cut relay terminals No. 40 and No. 42. 2) Measure the resistance between starter cut relay terminals. ***Terminals*** ***No. 41 — No. 44:***	Is the resistance 1 MΩ or more?	Repair the poor contact of ECM connector.	Replace the starter cut relay. <Ref. to SL-124, Starter Cut Relay.>

DP:DTC P0851 PARK/NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-154, DTC P0851 PARK/NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

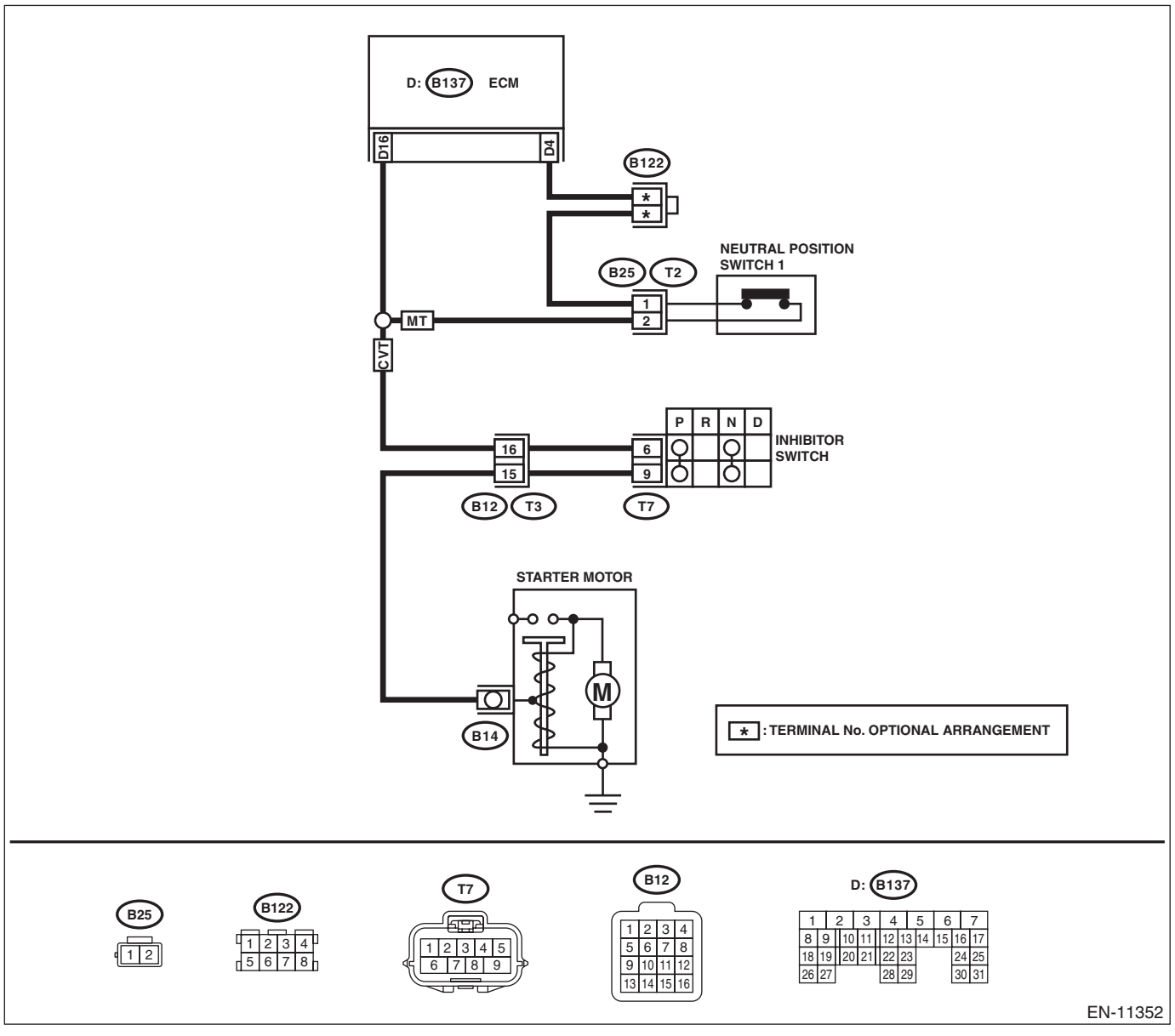
Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK SELECT CABLE.**	Is there any fault in select cable?	Repair or adjust the select cable. <Ref. to CS-51, Select Cable.>	Go to step **2**.
2	**CHECK INPUT SIGNAL OF ECM.** 1) Turn the ignition switch to ON. 2) Place the select lever in other than "P" range and "N" range. 3) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B137) No. 16 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the poor contact of ECM connector.	Go to step **3**.
3	**CHECK HARNESS BETWEEN ECM AND TRANSMISSION HARNESS CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and transmission harness connector (T3). 3) Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B137) No. 16 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **4**.	Repair the short circuit to ground in harness between ECM connector and transmission harness connector.
4	**CHECK TRANSMISSION HARNESS CONNECTOR.** 1) Disconnect the connector from inhibitor switch. 2) Measure the resistance between transmission harness connector and engine ground. ***Connector & terminal*** ***(T3) No. 16 — Engine ground:***	Is the resistance 1 MΩ or more?	Replace the inhibitor switch. <Ref. to CVT(TR580)-96, Inhibitor Switch.>	Repair short circuit to ground in harness between transmission harness connector and inhibitor switch connector.

DQ:DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-155, DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

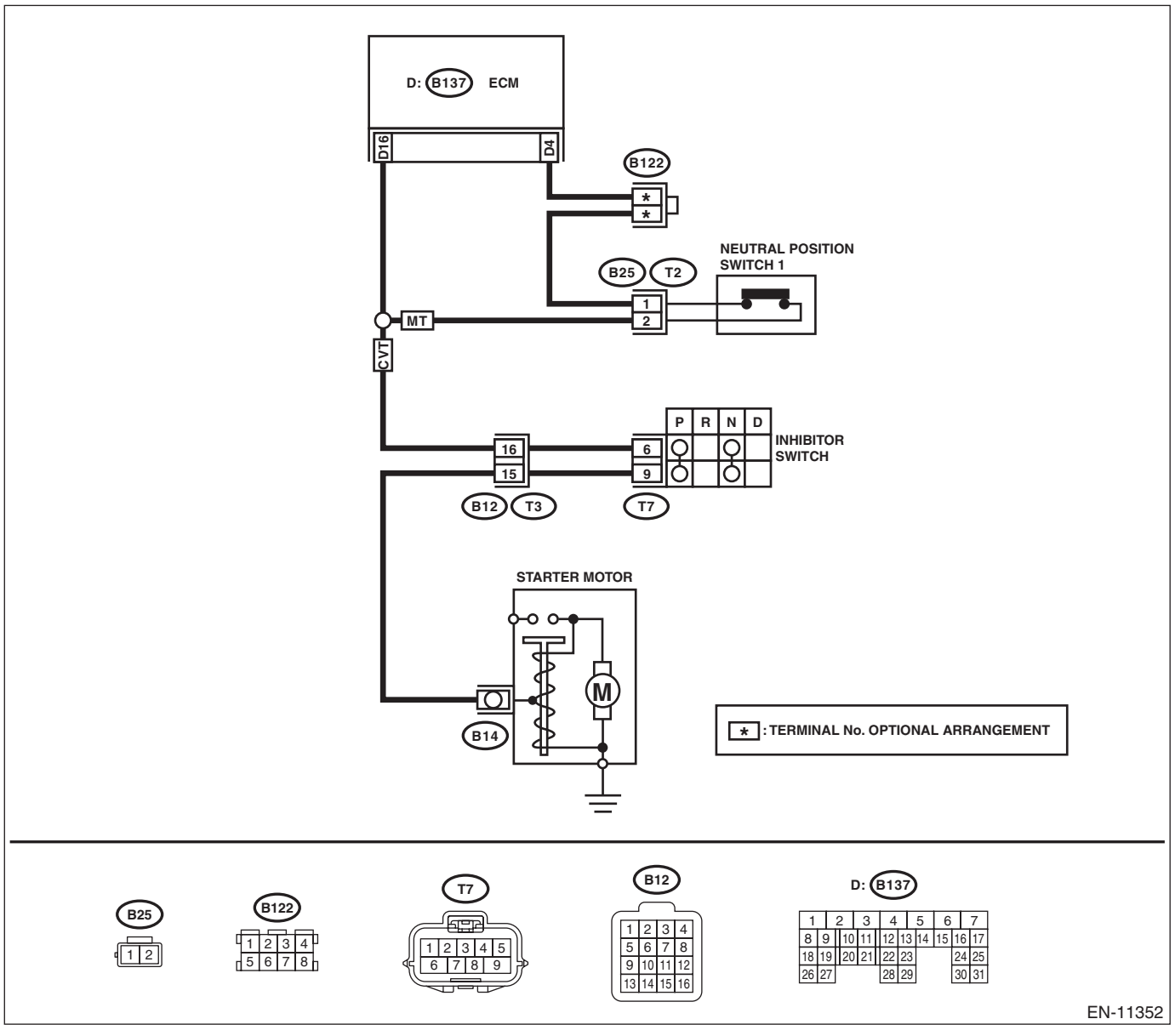
Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK INPUT SIGNAL OF ECM.** 1) Turn the ignition switch to ON. 2) Place the shift lever in a position other than neutral. 3) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B137) No. 16 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the poor contact of ECM connector.	Go to step **2**.
2	**CHECK HARNESS BETWEEN ECM AND NEUTRAL POSITION SWITCH 1 CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and neutral position switch 1. 3) Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B137) No. 16 — Chassis ground:***	Is the resistance 1 MΩ or more?	Replace the neutral position switch 1. <Ref. to 5MT-35, Switches and Harness.>	Repair the short circuit to ground in harness between ECM connector and neutral position switch 1 connector.

DR:DTC P0852 PARK/NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-156, DTC P0852 PARK/NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

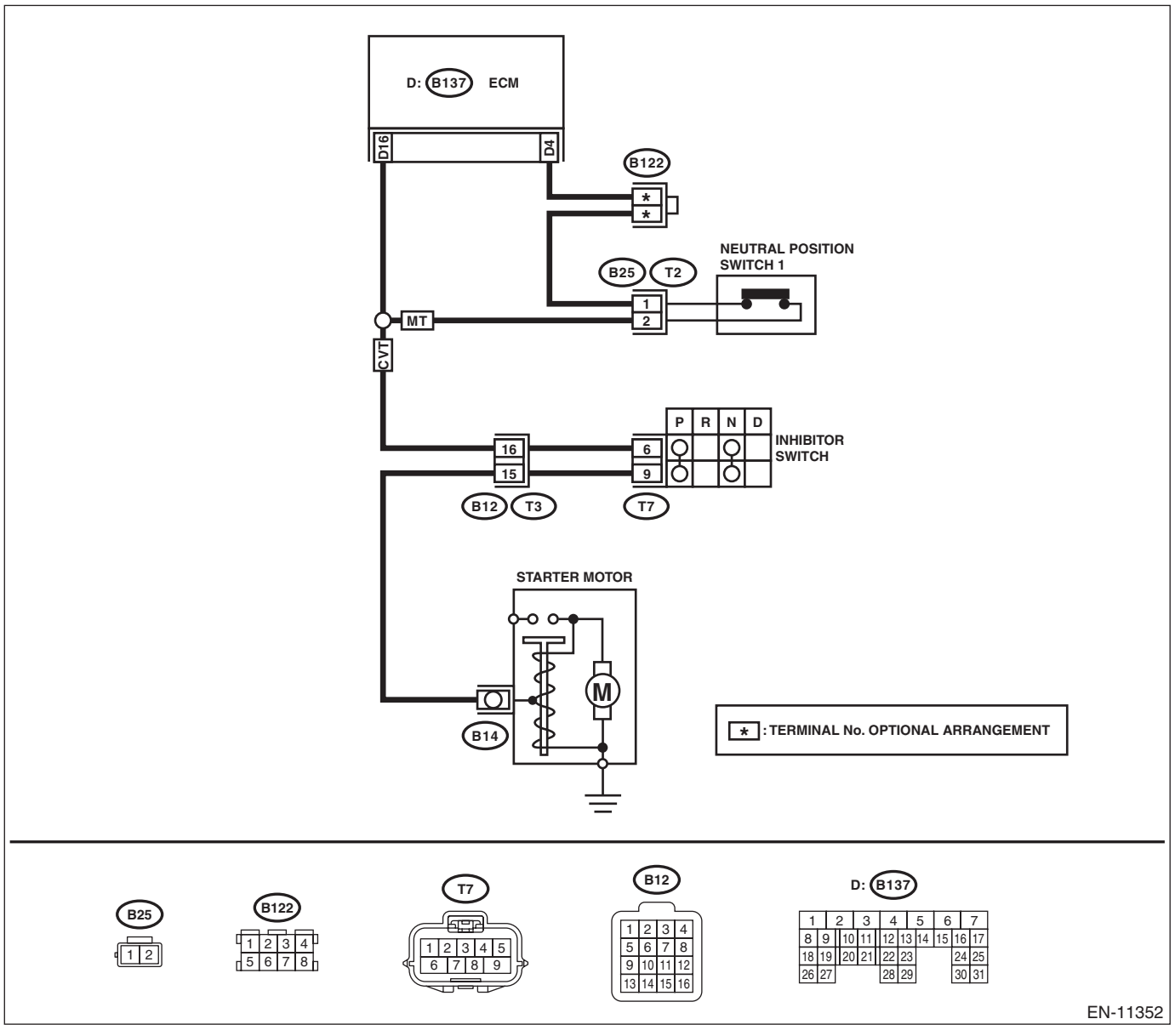
Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK SELECT CABLE.**	Is there any fault in select cable?	Repair or adjust the select cable. <Ref. to CS-51, Select Cable.>	Go to step **2**.
2	**CHECK INPUT SIGNAL OF ECM.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground with select lever at "P" range and "N" range. ***Connector & terminal*** ***(B137) No. 16 (+) — Chassis ground (–):***	Is the voltage less than 1 V?	Repair the poor contact of ECM connector.	Go to step **3**.
3	**CHECK HARNESS BETWEEN ECM AND INHIBITOR SWITCH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and inhibitor switch. 3) Measure the resistance of harness between ECM connector and inhibitor switch connector. ***Connector & terminal*** ***(B137) No. 16 — (T7) No. 6:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and inhibitor switch connector • Poor contact of coupling connector
4	**CHECK INHIBITOR SWITCH GROUND LINE.** Measure the resistance of harness between inhibitor switch connector and engine ground. ***Connector & terminal*** ***(T7) No. 9 — Engine ground:***	Is the resistance less than 5 Ω?	Replace the inhibitor switch. <Ref. to CVT(TR580)-96, Inhibitor Switch.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between inhibitor switch connector and starter motor ground line • Poor contact of coupling connector • Poor contact of starter motor connector • Poor contact of starter motor ground • Starter motor

DS:DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-157, DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

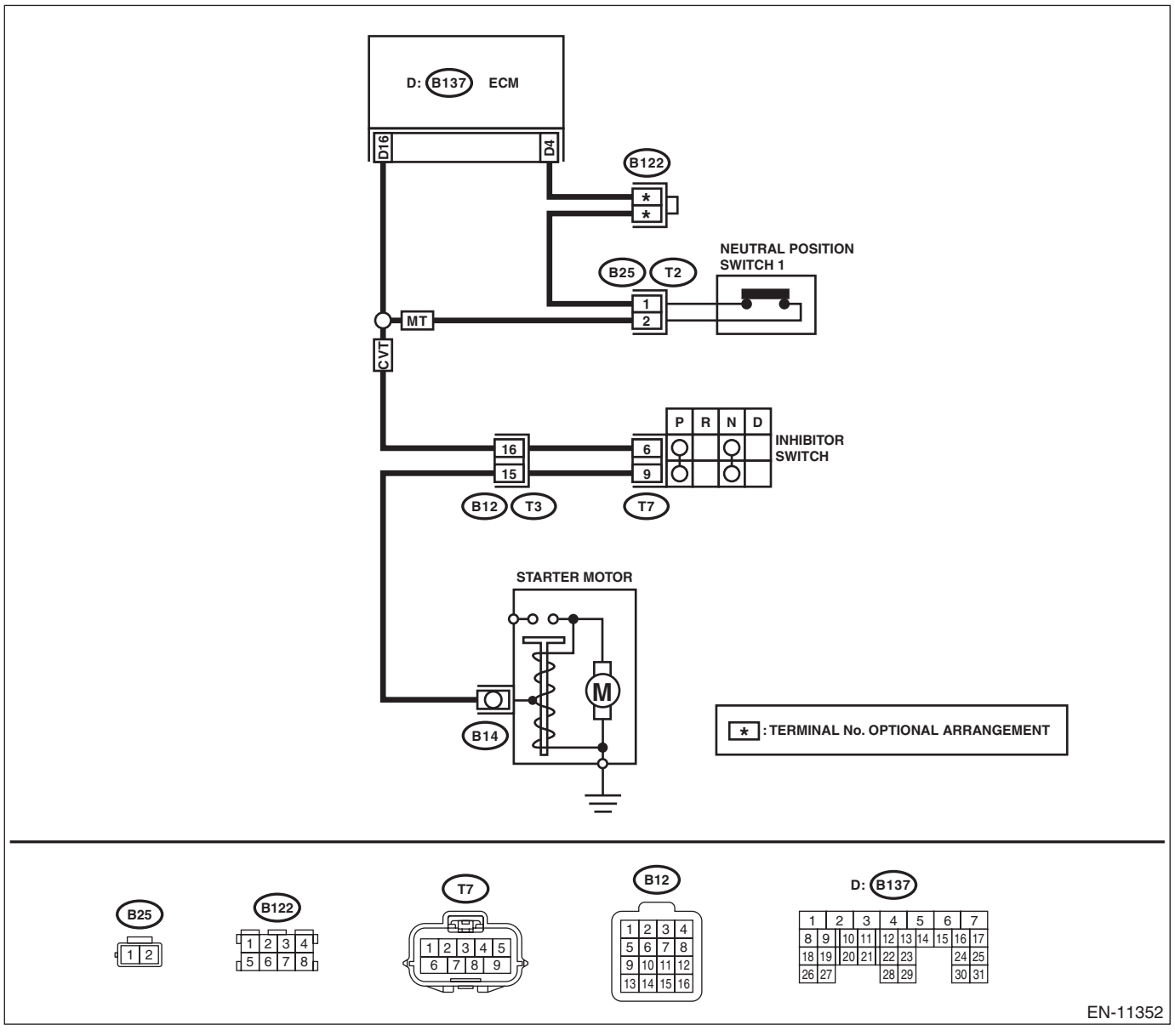
Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK INPUT SIGNAL OF ECM.** 1) Turn the ignition switch to ON. 2) Place the shift lever in neutral. 3) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 35 (+) — Chassis ground (–):***	Is the voltage less than 1 V?	Repair the poor contact of ECM connector.	Go to step **2**.
2	**CHECK HARNESS BETWEEN ECM AND NEUTRAL POSITION SWITCH 1 CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and neutral position switch 1. 3) Measure the resistance of harness between ECM connector and neutral position switch 1 connector. ***Connector & terminal*** ***(B137) No. 16 — (B25) No. 2:*** ***(B137) No. 4 — (B25) No. 1:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and neutral position switch 1 connector • Poor contact of coupling connector
3	**CHECK NEUTRAL POSITION SWITCH 1.** 1) Place the shift lever in neutral. 2) Measure the resistance between neutral position switch 1 terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance less than 1 Ω?	Repair the poor contact of neutral position switch 1 connector.	Replace the neutral position switch 1. <Ref. to 5MT-35, Switches and Harness.>

DT:DTC P1160 RETURN SPRING FAILURE

NOTE:
For the diagnostic procedure, refer to DTC P2101. <Ref. to EN(H4DO w/o HEV)(diag)-320, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DU:DTC P1449 EVAPORATIVE EMISSION CONT. SYS. AIR FILTER CLOG

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-159, DTC P1449 EVAPORATIVE EMISSION CONT. SYS. AIR FILTER CLOG, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check the appropriate DTC using the “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK DRAIN TUBE B OF LEAK CHECK VALVE ASSEMBLY.**	Is the drain tube B of leak check valve assembly clogged?	Replace the drain tube B of leak check valve assembly. <Ref. to EC(H4DO(w/o HEV))-43, Leak Check Valve Assembly.>	Go to step **3**.
3	**CHECK DRAIN HOSE AND DRAIN TUBE C BETWEEN LEAK CHECK VALVE ASSEMBLY AND DRAIN SEPARATOR.**	Is the drain hose or the drain tube C between leak check valve assembly and drain separator clogged?	Replace the drain hose or the drain tube C between leak check valve assembly and drain separator. <Ref. to EC(H4DO(w/o HEV))-62, Drain Separator.>	Go to step **4**.
4	**CHECK DRAIN SEPARATOR.**	Is the drain separator clogged?	Replace the drain separator. <Ref. to EC(H4DO(w/o HEV))-62, Drain Separator.>	Go to step **5**.
5	**CHECK INTAKE HOSE AND CONNECTOR BETWEEN DRAIN SEPARATOR AND VEHICLE BODY.**	Is the intake hose or the connector between drain separator and vehicle body clogged?	Replace the intake hose or the connector between drain separator and vehicle body. <Ref. to EC(H4DO(w/o HEV))-62, Drain Separator.>	Replace the leak check valve assembly. <Ref. to EC(H4DO(w/o HEV))-43, Leak Check Valve Assembly.>

DV:DTC P1451 EVAPORATIVE EMISSION CONT. SYS.

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-160, DTC P1451 EVAPORATIVE EMISSION CONT. SYS., Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK DRAIN TUBE BETWEEN CANISTER AND LEAK CHECK VALVE ASSEMBLY.**	Is the drain tube between canister and leak check valve assembly clogged?	Replace the drain tube between the canister and leak check valve assembly. <Ref. to EC(H4DO(w/o HEV))-10, Canister.>	Go to step **2**.
2	**CHECK HOSES BETWEEN CANISTER AND FUEL TANK.**	Are the hoses between the canister and fuel tank clogged?	Replace the hoses between the canister and fuel tank. <Ref. to EC(H4DO(w/o HEV))-10, Canister.> <Ref. to FU(H4DO(w/o HEV))-116, Fuel Tank.>	Replace the canister. <Ref. to EC(H4DO(w/o HEV))-10, Canister.> After the operation is complete, go to the next step. Go to step **3**.
3	**CHECK EVAPORATIVE EMISSION CONTROL SYSTEM.** Perform drive cycle I. <Ref. to EN(H4DO w/o HEV)(diag)-61, DRIVE CYCLE I, PROCEDURE, Drive Cycle.>	Is DTC P1451 displayed on the display?	Replace the leak check valve assembly. <Ref. to EC(H4DO(w/o HEV))-43, Leak Check Valve Assembly.>	End.

DW:DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT)

NOTE:
For the diagnostic procedure, refer to DTC P1498. <Ref. to EN(H4DO w/o HEV)(diag)-288, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DX:DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT)

NOTE:
For the diagnostic procedure, refer to DTC P1499. <Ref. to EN(H4DO w/o HEV)(diag)-291, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DY:DTC P1494 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT)

NOTE:
For the diagnostic procedure, refer to DTC P1498. <Ref. to EN(H4DO w/o HEV)(diag)-288, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DZ:DTC P1495 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT)

NOTE:
For the diagnostic procedure, refer to DTC P1499. <Ref. to EN(H4DO w/o HEV)(diag)-291, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

EA:DTC P1496 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT)

NOTE:
For the diagnostic procedure, refer to DTC P1498. <Ref. to EN(H4DO w/o HEV)(diag)-288, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

EB:DTC P1497 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT)

NOTE:
For the diagnostic procedure, refer to DTC P1499. <Ref. to EN(H4DO w/o HEV)(diag)-291, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

EC:DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-161, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H4DO w/o HEV)-163, DTC P1494 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H4DO w/o HEV)-163, DTC P1496 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H4DO w/o HEV)-163, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

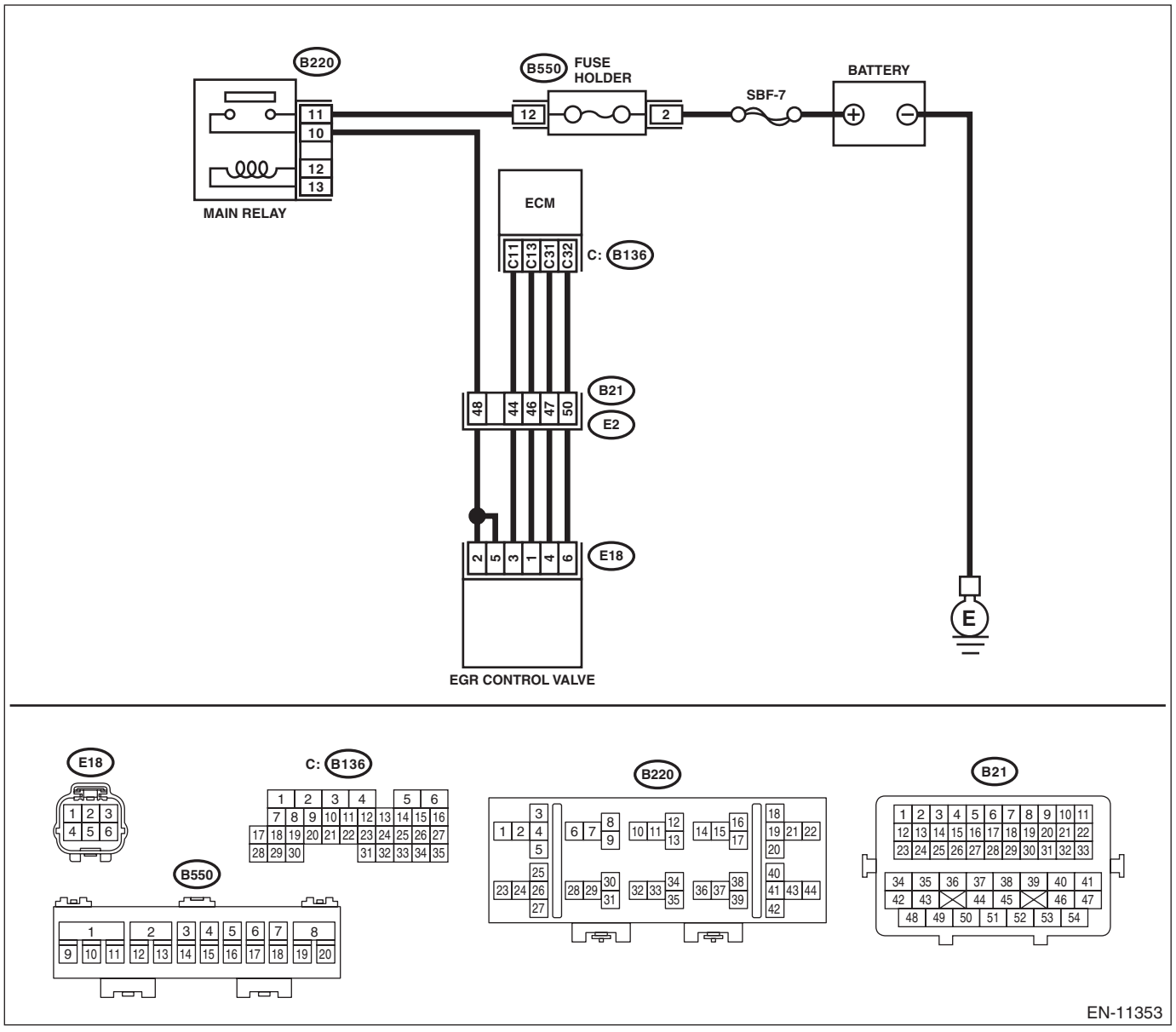
TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance
- Engine breathing

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:
Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



Step		Check	Yes	No
1	**CHECK POWER SUPPLY TO EGR CONTROL VALVE.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the EGR control valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between EGR control valve connector and engine ground. ***Connector & terminal*** ***(E18) No. 2 (+) — Engine ground (–):*** ***(E18) No. 5 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **2**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between EGR control valve and main relay connector • Poor contact of coupling connector

	Step	Check	Yes	No
2	**CHECK HARNESS BETWEEN ECM AND EGR CONTROL VALVE CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connector and EGR control valve connector. ***Connector & terminal*** ***DTC P1492; (B136) No. 11 — (E18) No. 3:*** ***DTC P1494; (B136) No. 13 — (E18) No. 1:*** ***DTC P1496; (B136) No. 31 — (E18) No. 4:*** ***DTC P1498; (B136) No. 32 — (E18) No. 6:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM connector and EGR control valve connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND EGR CONTROL VALVE CONNECTOR.** 1) Disconnect the connector from ECM. 2) Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***DTC P1492; (B136) No. 11 — Chassis ground:*** ***DTC P1494; (B136) No. 13 — Chassis ground:*** ***DTC P1496; (B136) No. 31 — Chassis ground:*** ***DTC P1498; (B136) No. 32 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **4**.	Repair ground short circuit of harness between ECM connector and EGR control valve connector.
4	**CHECK FOR POOR CONTACT.** Check for poor contact between ECM connector and EGR control valve connector.	Is there poor contact in ECM or EGR control valve connector?	Repair the poor contact of ECM or EGR control valve connector.	Replace EGR control valve. <Ref. to EC(H4DO(w/o HEV))-23, EGR Control Valve.>

ED:DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-162, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H4DO w/o HEV)-163, DTC P1495 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H4DO w/o HEV)-163, DTC P1497 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H4DO w/o HEV)-163, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

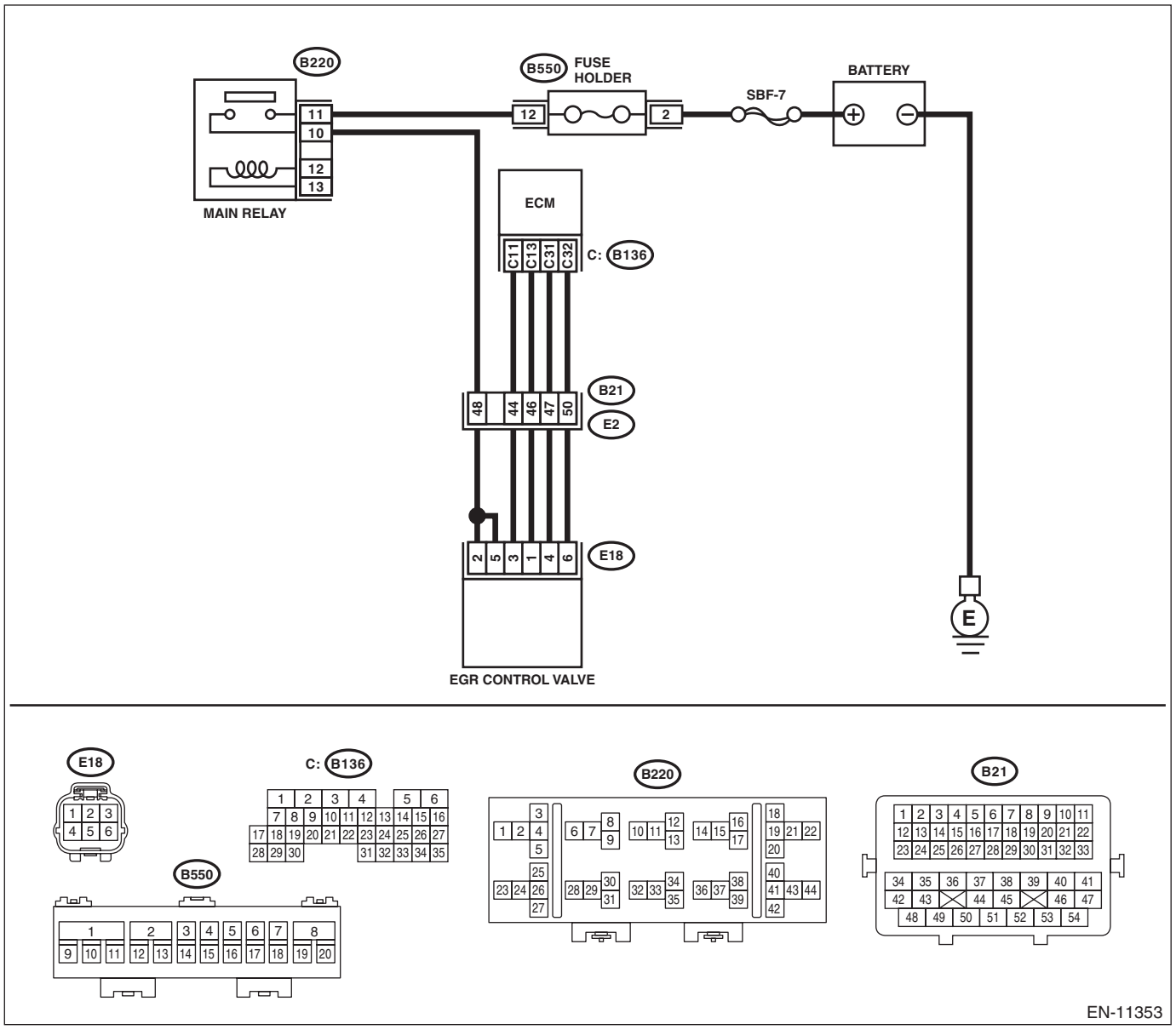
TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance
- Engine breathing

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:
Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



Step		Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND EGR CONTROL VALVE CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and EGR control valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***DTC P1493; (B136) No. 11 (+) — Chassis ground (–):*** ***DTC P1495; (B136) No. 13 (+) — Chassis ground (–):*** ***DTC P1497; (B136) No. 31 (+) — Chassis ground (–):*** ***DTC P1499; (B136) No. 32 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power supply in the harness between the ECM connector and EGR control valve connector.	Go to step **2**.

Step		Check	Yes	No
2	**CHECK EGR CONTROL VALVE.** Measure the resistance between EGR control valve terminals. ***Terminals*** ***DTC P1493; No. 2 — No. 3:*** ***DTC P1495; No. 2 — No. 1:*** ***DTC P1497; No. 5 — No. 4:*** ***DTC P1499; No. 5 — No. 6:***	Is the resistance 20 Ω or more?	Repair the poor contact of ECM connector.	Replace EGR control valve. <Ref. to EC(H4DO(w/o HEV))-23, EGR Control Valve.>

EE:DTC P1530 BATTERY CURRENT SENSOR CIRCUIT LOW

DTC DETECTING CONDITION:

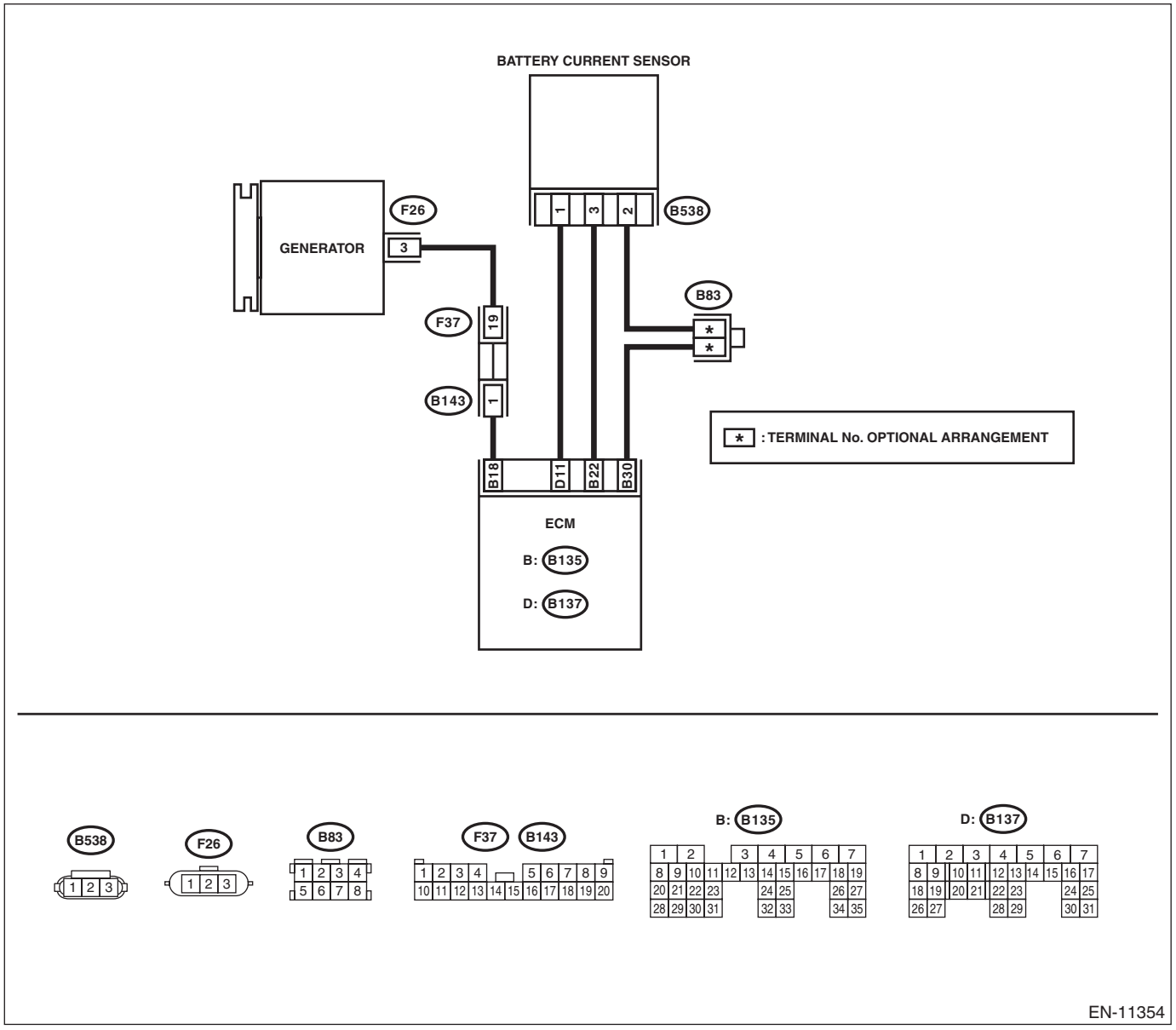
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-164, DTC P1530 BATTERY CURRENT SENSOR CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «Battery current value» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.>	Is the value of «Battery current value» 100 A or more?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK HARNESS BETWEEN ECM AND BATTERY CURRENT SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and battery current sensor. 3) Measure the resistance of the harness between ECM connector and battery current sensor connector. ***Connector & terminal*** ***(B135) No. 22 — (B538) No. 3:*** ***(B137) No. 11 — (B538) No. 1:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the open circuit in the harness between ECM connector and battery current sensor connector.
3	**CHECK HARNESS BETWEEN ECM AND BATTERY CURRENT SENSOR CONNECTOR.** Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 22 — Chassis ground:*** ***(B137) No. 11 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **4**.	Repair the short circuit to ground in the harness between ECM connector and battery current sensor connector.
4	**CHECK FOR POOR CONTACT.** Check for poor contact between the ECM and battery current sensor connectors.	Is there poor contact of the ECM or battery current sensor connectors?	Repair any poor contact between the ECM and battery current sensor connectors.	Replace the battery current sensor. <Ref. to SC(H4DO(w/o HEV))-61, Battery Current & Temperature Sensor.>

EF:DTC P1531 BATTERY CURRENT SENSOR CIRCUIT HIGH

DTC DETECTING CONDITION:

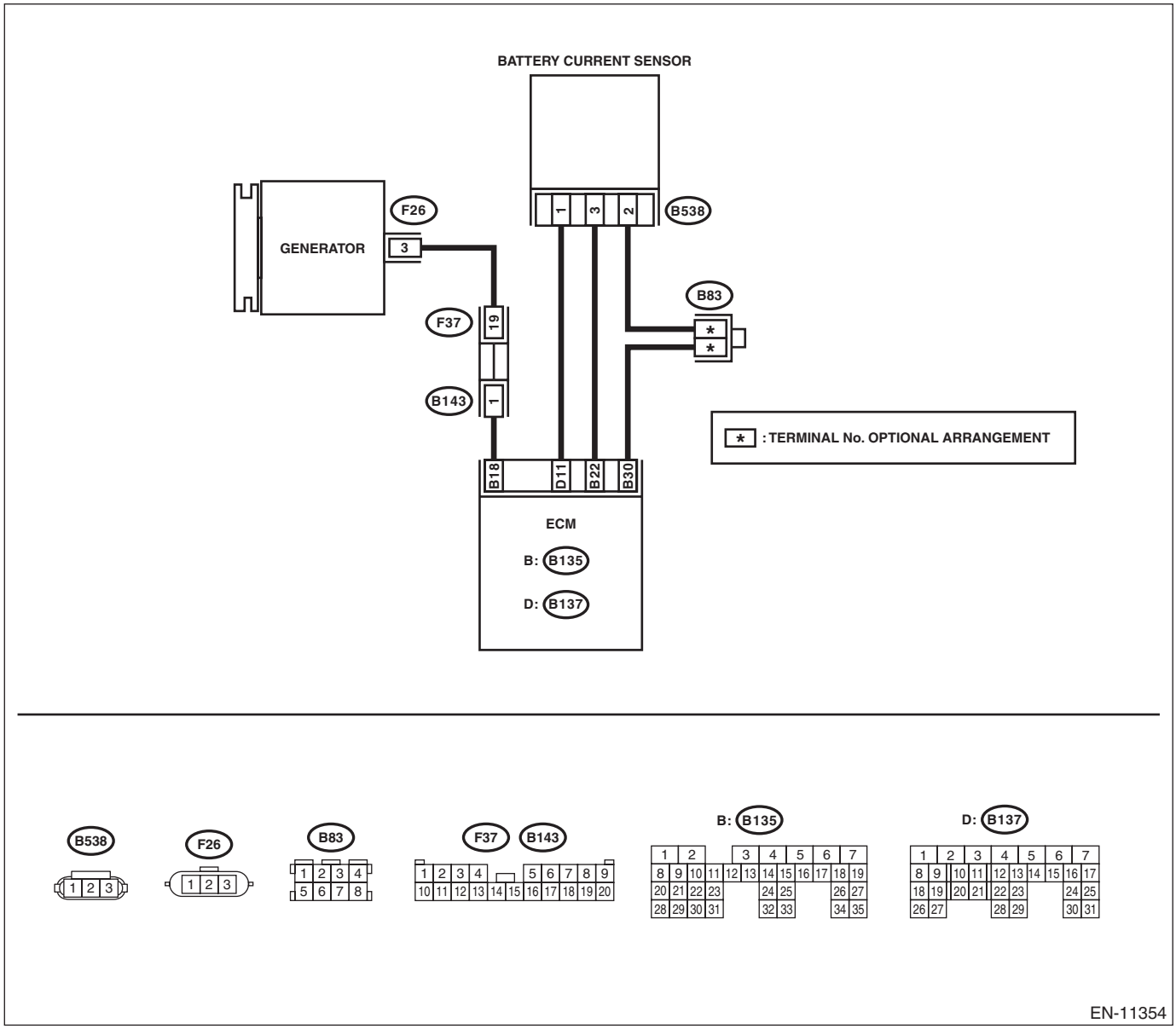
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-165, DTC P1531 BATTERY CURRENT SENSOR CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «Battery current value» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.>	Is the value of «Battery current value» –100 A or less?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK HARNESS BETWEEN ECM AND BATTERY CURRENT SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the battery current sensor. 3) Start the engine. 4) Read the value of «Battery current value» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.>	Is the value of «Battery current value» –100 A or less?	Repair the short circuit to power in the harness between ECM connector and battery current sensor connector.	Go to step **3**.
3	**CHECK HARNESS BETWEEN ECM AND BATTERY CURRENT SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance of the harness between the battery current sensor connector and engine ground. ***Connector & terminal*** ***(B538) No. 2 — Engine ground:***	Is the resistance less than 5 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and battery current sensor connector • Poor contact of joint connector
4	**CHECK FOR POOR CONTACT.** Check for poor contact of the battery current sensor connector.	Is there poor contact of the battery current sensor connector?	Repair the poor contact of the battery current sensor connector.	Replace the battery current sensor. <Ref. to SC(H4DO(w/o HEV))-61, Battery Current & Temperature Sensor.>

EG:DTC P1532 BATTERY CHARGING SYSTEM

DTC DETECTING CONDITION:

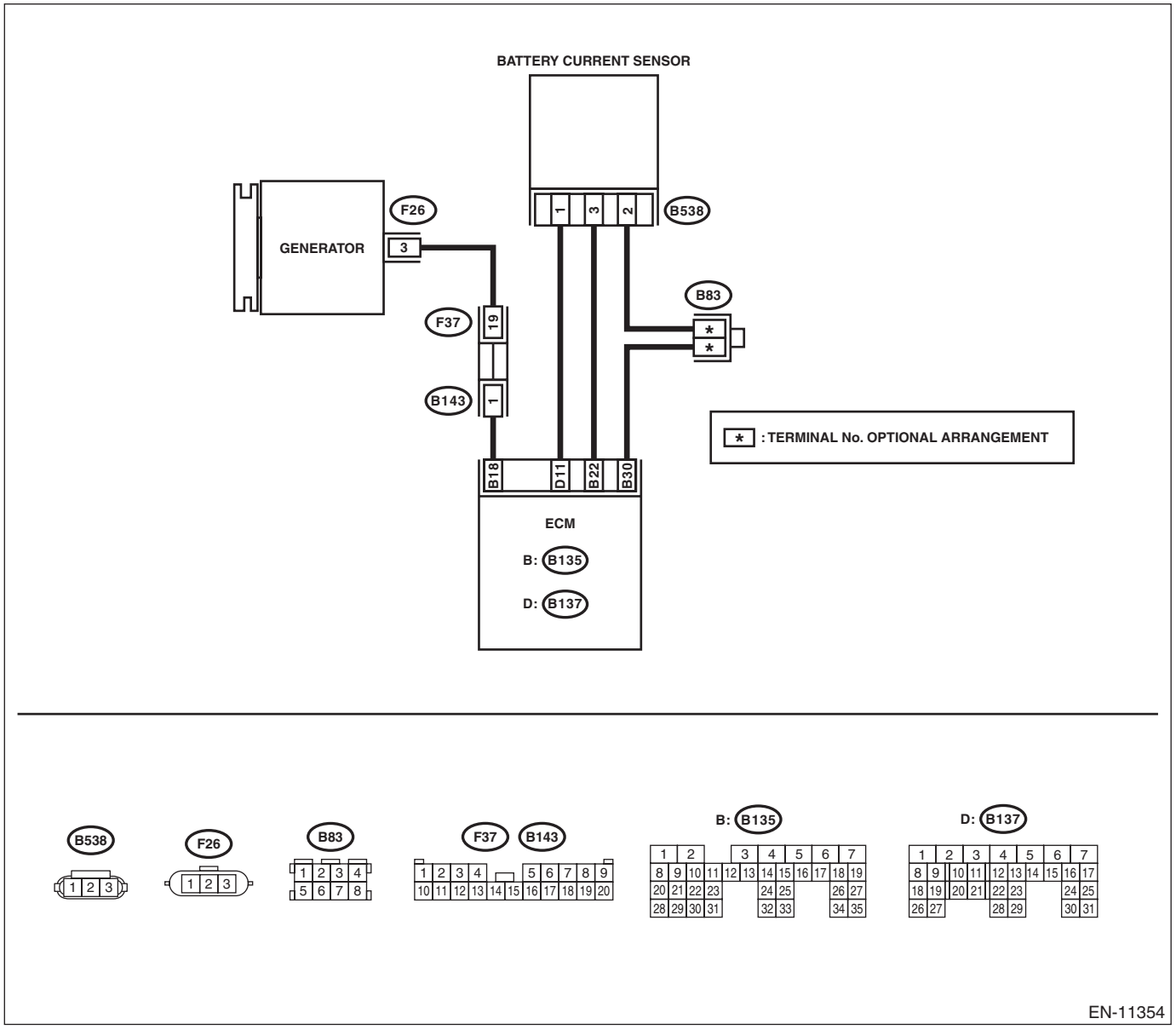
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-166, DTC P1532 BATTERY CHARGING SYSTEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



Step		Check	Yes	No
1	**CHECK INSTALLATION CONDITION OF BATTERY.** Turn the ignition switch to OFF.	Are the positive and negative terminals of battery securely tightened?	Go to step **2**.	Tighten the positive and negative terminals of battery securely.

	Step	Check	Yes	No
2	**CHECK BATTERY TERMINAL.**	Is there any connection of electrical parts to the positive and negative terminals of battery?	Remove the wiring of electrical parts connected to the positive and negative terminals of battery. NOTE: Directly connecting electrical parts to the battery may cause erroneous operation of the battery current sensor.	Go to step **3**.
3	**CHECK INSTALLATION CONDITION OF V-BELT.** Check the installation condition of V-belt. <Ref. to ME(H4DO(w/o HEV))-138, INSPECTION, V-belt.>	Is the V-belt installed properly?	Go to step **4**.	Install the V-belt properly. <Ref. to ME(H4DO(w/o HEV))-122, V-belt.>
4	**CHECK BATTERY VOLTAGE.** 1) Start the engine. 2) Select "High mode" from "Alternator control" in "System Operation Check Mode", and measure the battery voltage after 10 seconds or more have passed. NOTE: For detailed procedures, refer to "System Operation Check Mode". <Ref. to EN(H4DO w/o HEV)(diag)-66, System Operation Check Mode.> 3) Select "Low mode" from "Alternator control" in "System Operation Check Mode", and measure the battery voltage. **CAUTION:** **Do not continue the "Low mode" operation for one minute or more.** NOTE: For detailed procedures, refer to "System Operation Check Mode". <Ref. to EN(H4DO w/o HEV)(diag)-66, System Operation Check Mode.>	Does battery voltage lower from 13.9 — 14.8 V to 12.2 — 13.1 V between step 2) and step 3)?	Go to step **7**.	Go to step **5**.
5	**CHECK HARNESS BETWEEN ECM AND GENERATOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and generator. 3) Measure the resistance of harness between ECM connector and generator connector. ***Connector & terminal*** ***(B135) No. 18 — (F26) No. 3:***	Is the resistance less than 1 Ω?	Go to step **6**.	Repair the open circuit of harness between ECM connector and generator connector.
6	**CHECK HARNESS BETWEEN ECM AND GENERATOR CONNECTOR.** Measure the resistance between generator connector and engine ground. ***Connector & terminal*** ***(F26) No. 3 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **7**.	Repair the ground short circuit of harness between ECM connector and generator connector.
7	**CHECK BATTERY CURRENT SENSOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **8**.

	Step	Check	Yes	No
8	**CHECK HARNESS BETWEEN ECM AND BATTERY CURRENT SENSOR CONNECTOR.** 1) Disconnect the connectors from the ECM and battery current sensor. 2) Measure the resistance of the harness between ECM connector and battery current sensor connector. ***Connector & terminal*** ***(B135) No. 22 — (B538) No. 3:*** ***(B137) No. 11 — (B538) No. 1:***	Is the resistance less than 1 Ω?	Go to step **9**.	Repair the open circuit in the harness between ECM connector and battery current sensor connector.
9	**CHECK HARNESS BETWEEN ECM AND BATTERY CURRENT SENSOR CONNECTOR.** Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 22 — Chassis ground:*** ***(B137) No. 11 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **10**.	Repair the short circuit to ground in the harness between ECM connector and battery current sensor connector.
10	**CHECK HARNESS BETWEEN ECM AND BATTERY CURRENT SENSOR CONNECTOR.** Measure the resistance between ECM connectors. ***Connector & terminal*** ***(B135) No. 22 — (B136) No. 32:***	Is the resistance 1 MΩ or more?	Go to step **11**.	Repair the short circuit to power in the harness between ECM connector and battery current sensor connector.
11	**CHECK HARNESS BETWEEN ECM AND BATTERY CURRENT SENSOR CONNECTOR.** 1) Connect the connector to ECM. 2) Measure the resistance of the harness between the battery current sensor connector and engine ground. ***Connector & terminal*** ***(B538) No. 2 — Engine ground:***	Is the resistance less than 5 Ω?	Go to step **12**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and battery current sensor connector • Poor contact of joint connector
12	**CHECK FOR POOR CONTACT.** Check for poor contact of the battery current sensor connector.	Is there poor contact of the battery current sensor connector?	Repair the poor contact of the battery current sensor connector.	Replace the battery current sensor. <Ref. to SC(H4DO(w/o HEV))-61, Battery Current & Temperature Sensor.>

EH:DTC P2004 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 1)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-168, DTC P2004 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK TUMBLE GENERATOR VALVE RH.** 1) Remove the tumble generator valve assembly RH. 2) Check the tumble generator valve.	Is there any dirt or clogging with foreign objects in the tumble generator valve?	Clean the tumble generator valve.	Replace the tumble generator valve RH. <Ref. to FU(H4DO(w/o HEV))-85, Tumble Generator Valve Assembly.>

EI: DTC P2005 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 2)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-169, DTC P2005 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK TUMBLE GENERATOR VALVE LH.** 1) Remove the tumble generator valve assembly LH. 2) Check the tumble generator valve.	Is there any dirt or clogging with foreign objects in the tumble generator valve?	Clean the tumble generator valve.	Replace the tumble generator valve LH. <Ref. to FU(H4DO(w/o HEV))-85, Tumble Generator Valve Assembly.>

EJ: DTC P2006 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 1)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-170, DTC P2006 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK TUMBLE GENERATOR VALVE RH.** 1) Remove the tumble generator valve assembly RH. 2) Check the tumble generator valve.	Is there any dirt or clogging with foreign objects in the tumble generator valve?	Clean the tumble generator valve.	Replace the tumble generator valve RH. <Ref. to FU(H4DO(w/o HEV))-85, Tumble Generator Valve Assembly.>

EK:DTC P2007 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 2)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-171, DTC P2007 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK TUMBLE GENERATOR VALVE LH.** 1) Remove the tumble generator valve assembly LH. 2) Check the tumble generator valve.	Is there any dirt or clogging with foreign objects in the tumble generator valve?	Clean the tumble generator valve.	Replace the tumble generator valve LH. <Ref. to FU(H4DO(w/o HEV))-85, Tumble Generator Valve Assembly.>

EL:DTC P2009 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 1)

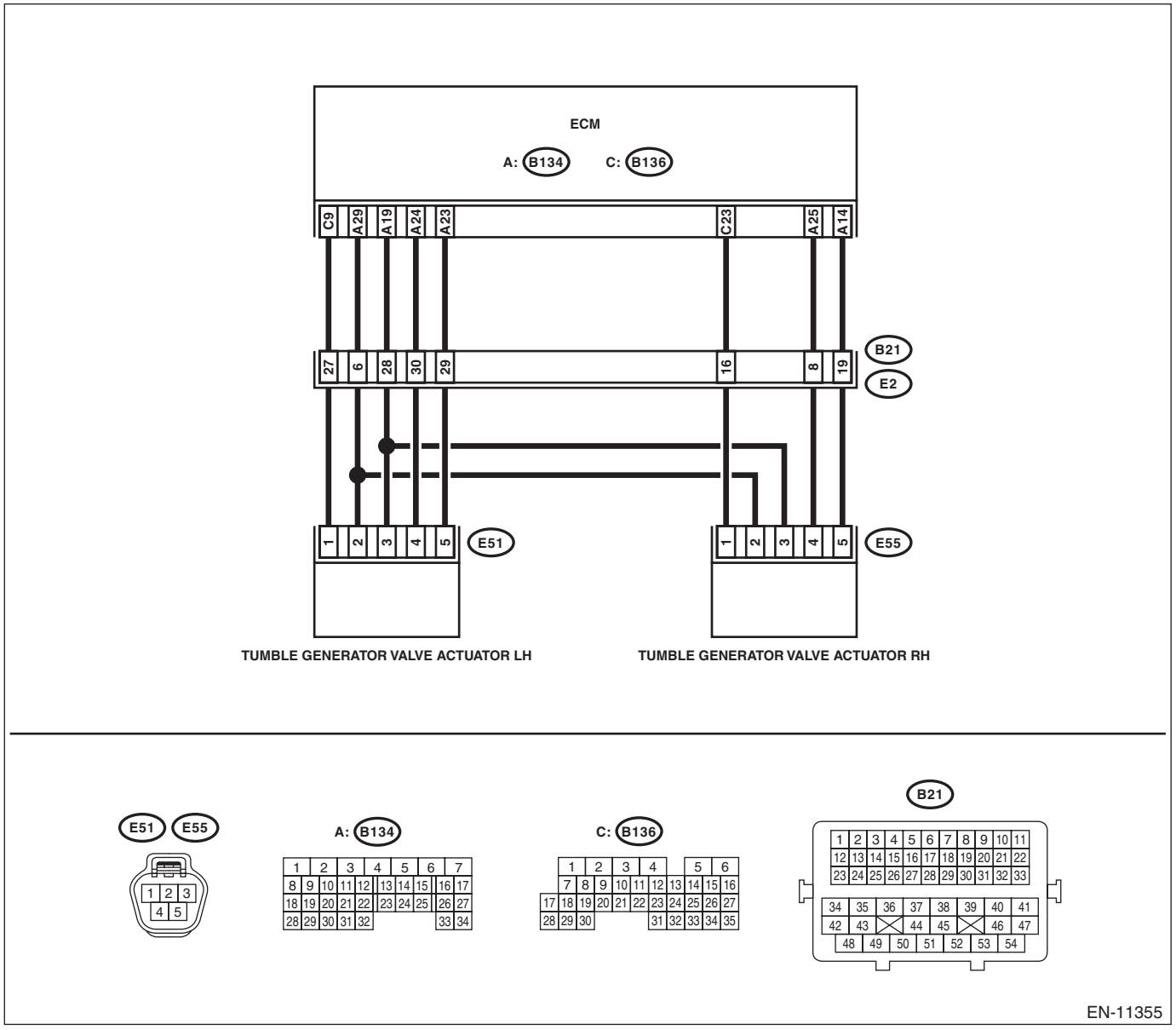
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-172, DTC P2009 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE ACTUATOR RH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 25 (+) — Chassis ground (–):*** ***(B134) No. 14 (+) — Chassis ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in harness between ECM connector and tumble generator valve actuator RH connector.	Replace the tumble generator valve actuator RH. <Ref. to FU(H4DO(w/o HEV))-90, Tumble Generator Valve Actuator.>

EM:DTC P2012 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 2)

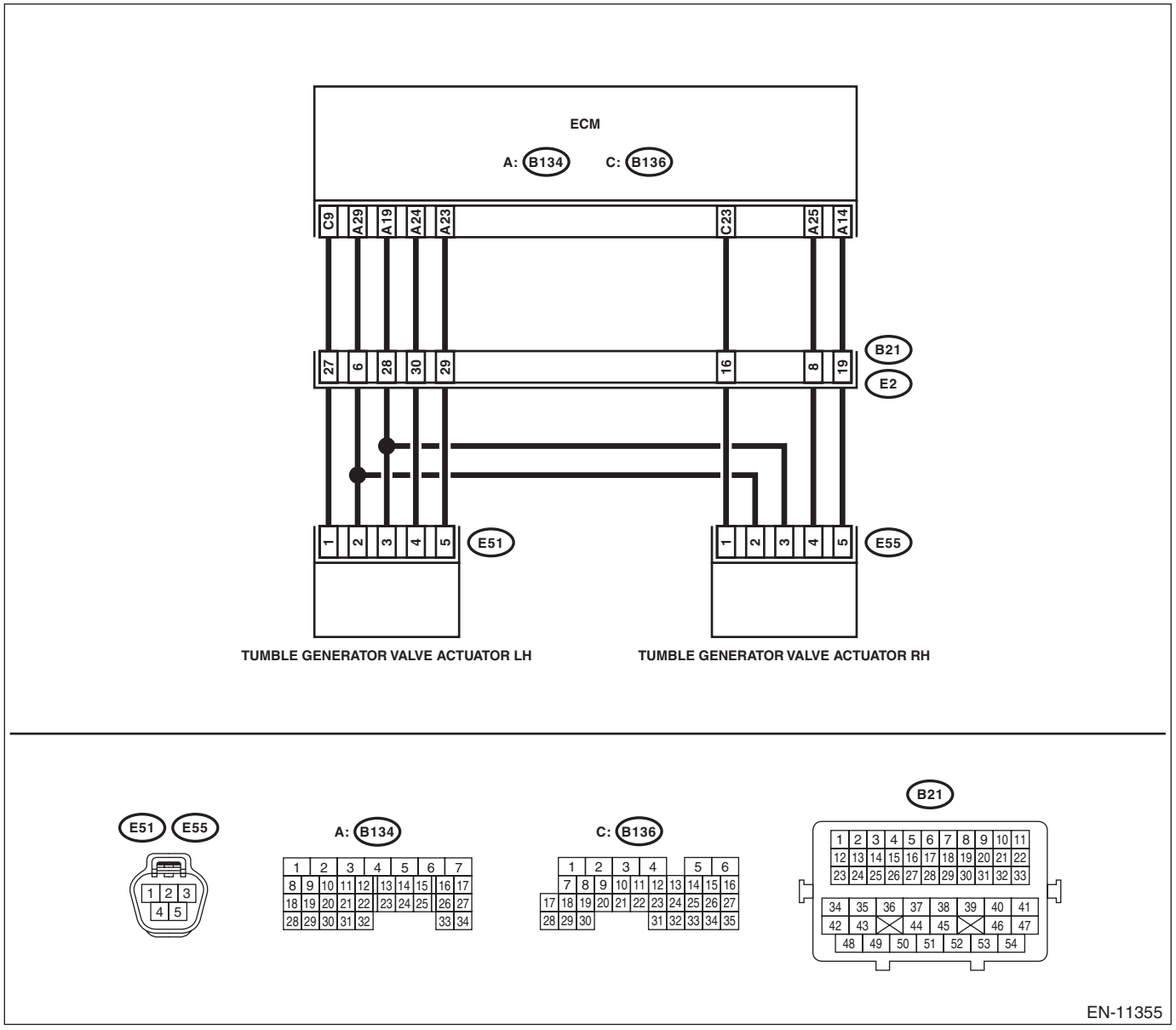
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-173, DTC P2012 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE ACTUATOR LH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 23 (+) — Chassis ground (–):*** ***(B134) No. 24 (+) — Chassis ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in harness between ECM connector and tumble generator valve actuator LH connector.	Replace the tumble generator valve actuator LH. <Ref. to FU(H4DO(w/o HEV))-90, Tumble Generator Valve Actuator.>

EN:DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN (BANK 1)

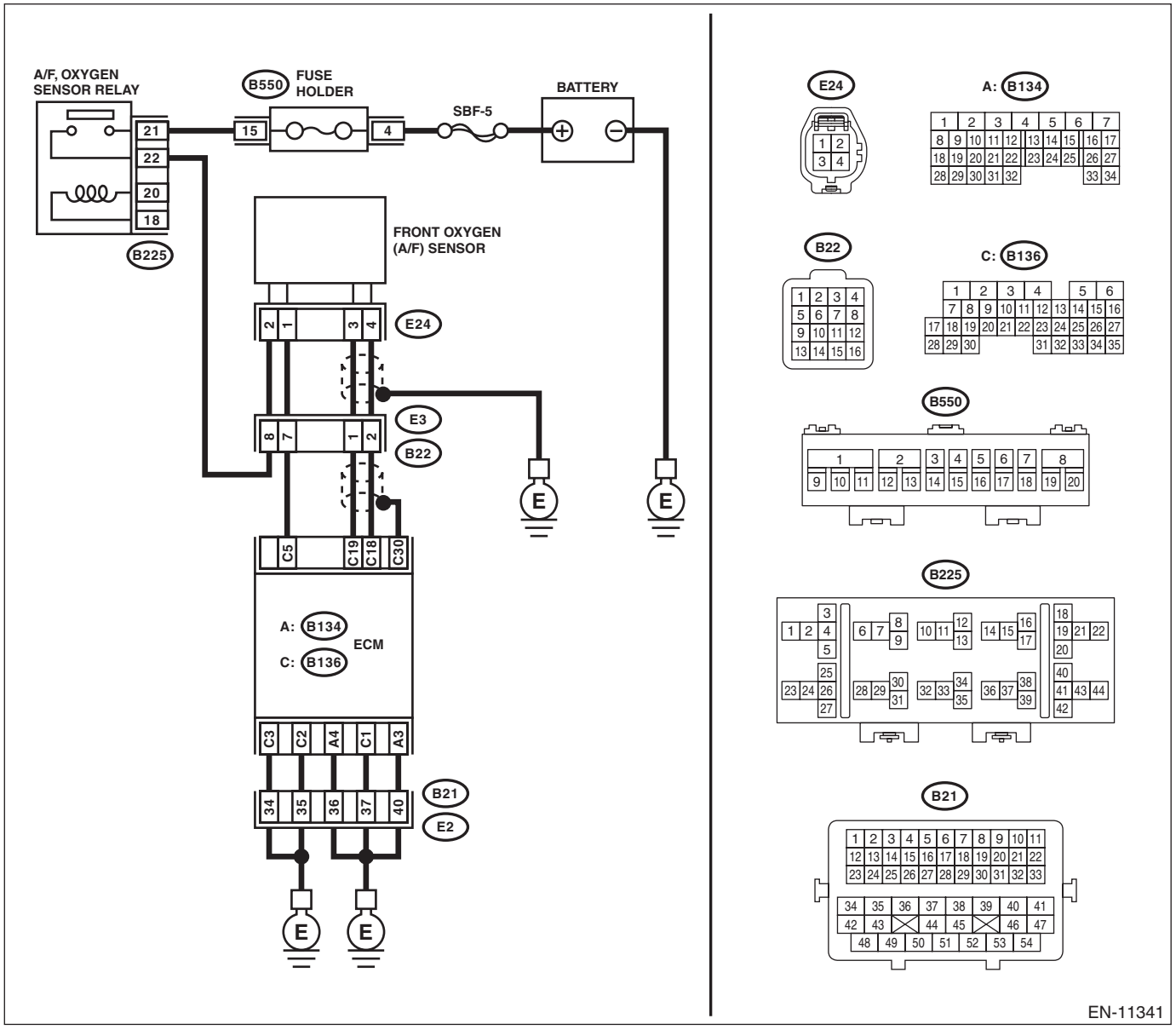
DTC DETECTING CONDITION:

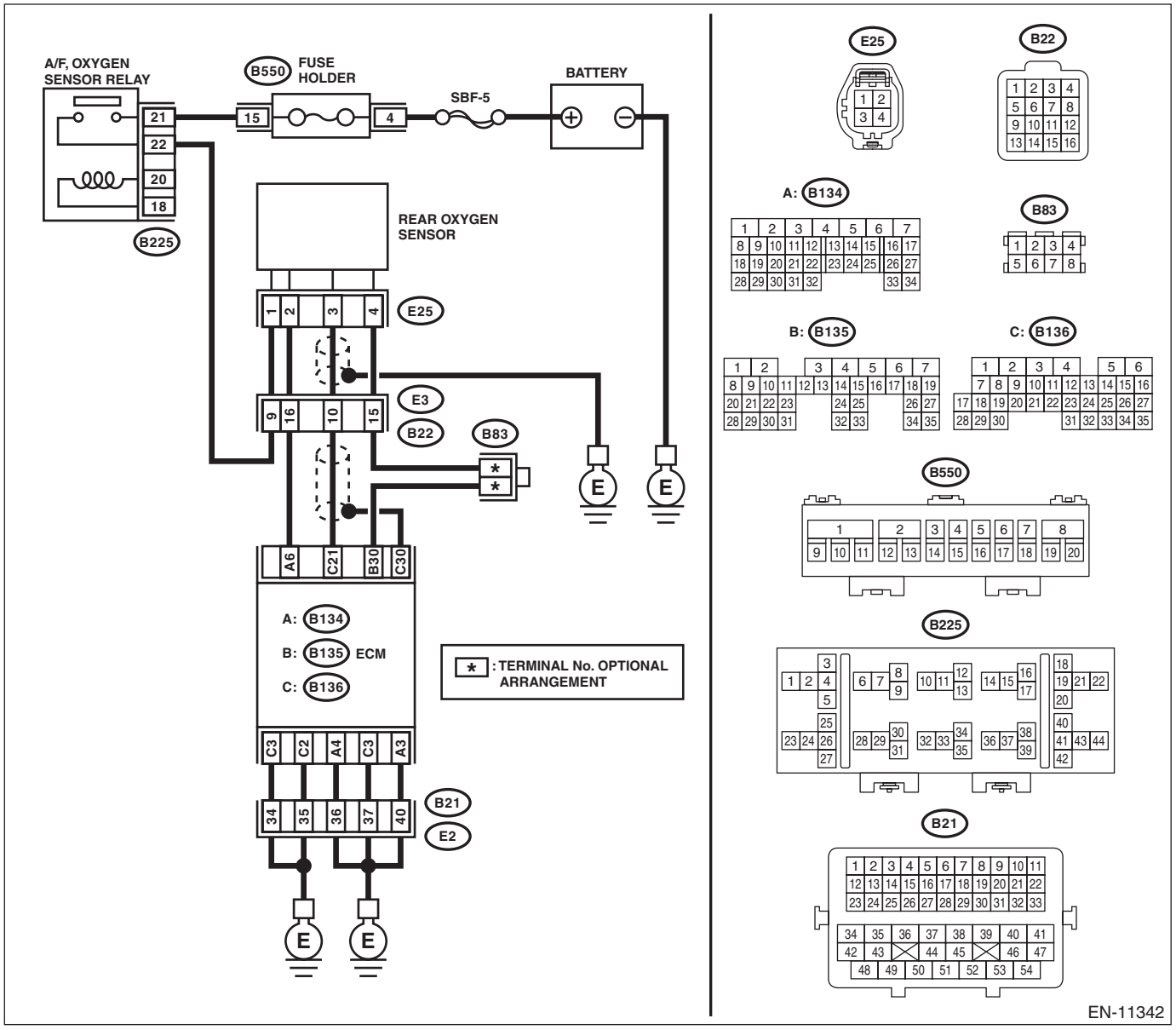
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-174, DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>





Step		Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **3**.

	Step	Check	Yes	No
3	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and front oxygen (A/F) sensor. 3) Measure the resistance of harness between ECM connector and front oxygen (A/F) sensor connector. ***Connector & terminal*** ***(B136) No. 19 — (E24) No. 3:*** ***(B136) No. 18 — (E24) No. 4:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and front oxygen (A/F) sensor connector • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 19 — Chassis ground:*** ***(B136) No. 18 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the short circuit to ground in harness between ECM connector and front oxygen (A/F) sensor connector.
5	**CHECK OUTPUT SIGNAL FOR ECM.** 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. ***Connector & terminal*** ***(E24) No. 3 (+) — Chassis ground (–):***	Is the voltage 4.5 V or more?	Go to step **7**.	Go to step **6**.
6	**CHECK OUTPUT SIGNAL FOR ECM.** Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. ***Connector & terminal*** ***(E24) No. 4 (+) — Chassis ground (–):***	Is the voltage 4.95 V or more?	Go to step **7**.	Go to step **8**.
7	**CHECK OUTPUT SIGNAL FOR ECM.** Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. ***Connector & terminal*** ***(E24) No. 3 (+) — Chassis ground (–):*** ***(E24) No. 4 (+) — Chassis ground (–):***	Is the voltage 8 V or more?	Repair the short circuit to power in the harness between ECM connector and front oxygen (A/F) sensor connector. After repair, replace the ECM. <Ref. to FU(H4DO(w/o HEV))-100, Engine Control Module (ECM).>	Repair the poor contact of ECM connector.
8	**CHECK EXHAUST SYSTEM.**	Are there holes or loose bolts on exhaust system?	Repair the exhaust system.	Go to step **9**.
9	**CHECK AIR INTAKE SYSTEM.**	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair the air intake system.	Go to step **10**.

	Step	Check	Yes	No
10	**CHECK FUEL PRESSURE.** **WARNING:** **Place "NO OPEN FLAMES" signs near the working area.** **CAUTION:** **Be careful not to spill fuel.** 1) Connect the front oxygen (A/F) sensor connector. 2) Measure the fuel pressure. <Ref. to ME(H4DO(w/o HEV))-35, INSPECTION, Fuel Pressure.> **CAUTION:** **Release fuel pressure before removing the fuel pressure gauge.**	Is the measured value 340 — 400 kPa (3.5 — 4.1 kg/cm^2, 49 — 58 psi)?	Go to step **11**.	Check the fuel pump and fuel delivery line. <Ref. to FU(H4DO(w/o HEV))-142, INSPECTION, Fuel Pump.> <Ref. to FU(H4DO(w/o HEV))-170, INSPECTION, Fuel Delivery and Evaporation Lines.>
11	**CHECK ENGINE COOLANT TEMPERATURE SENSOR.** 1) Start the engine and warm up completely. 2) Read the value of «Coolant Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Coolant Temp.» 75°C (167°F) or more?	Go to step **12**.	Replace the engine coolant temperature sensor. <Ref. to FU(H4DO(w/o HEV))-51, Engine Coolant Temperature Sensor.>
12	**CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.** 1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F). 2) For CVT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Read the value of «Mass Air Flow» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Mass Air Flow» 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)?	Go to step **13**.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DO(w/o HEV))-73, Mass Air Flow and Intake Air Temperature Sensor.>

	Step	Check	Yes	No
13	**CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.** 1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F). 2) For CVT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Open the front hood. 6) Measure the ambient temperature. 7) Read the value of «Intake Air Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Subtract ambient temperature from «Intake Air Temp.». Is the obtained value –10 — 50°C (–18 — 90°F)?	Go to step **14**.	Check the mass air flow and intake air temperature sensor. <Ref. to FU(H4DO(w/o HEV))-73, Mass Air Flow and Intake Air Temperature Sensor.>
14	**CHECK REAR OXYGEN SENSOR DATA.** 1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), and keep the engine speed at 3,000 rpm. (2 minutes maximum) 2) Read the value of «Rear O2 Sensor» using the Subaru Select Monitor or a general scan tool. NOTE: • Depress the clutch pedal. (MT model) • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Rear O2 Sensor» 0.490 V or more?	Go to step **15**.	Go to step **16**.
15	**CHECK REAR OXYGEN SENSOR DATA.** 1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), and rapidly reduce the engine speed from 3,000 rpm. 2) Read the value of «Rear O2 Sensor» using the Subaru Select Monitor or a general scan tool. NOTE: • Depress the clutch pedal. (MT model) • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Rear O2 Sensor» 0.250 V or less?	Go to step **17**.	Go to step **16**.

	Step	Check	Yes	No
16	**CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **18**.
17	**CHECK FRONT OXYGEN (A/F) SENSOR USING REAR OXYGEN SENSOR SIGNAL.** 1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), then keep the engine idling for 5 minutes or more. 2) Read the value of «Rear O2 Sensor» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value in «Rear O2 Sensor» kept at 0.250 V or less for 5 minutes or more?	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DO(w/o HEV))-92, Front Oxygen (A/F) Sensor.>	Go to step **18**.
18	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM connector and rear oxygen sensor connector. ***Connector & terminal*** ***(B136) No. 21 — (E25) No. 3:*** ***(B135) No. 30 — (E25) No. 4:***	Is the resistance less than 1 Ω?	Go to step **19**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and rear oxygen sensor connector • Poor contact of coupling connector
19	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between rear oxygen sensor connector and chassis ground. ***Connector & terminal*** ***(E25) No. 3 (+) — Chassis ground (–):***	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H4DO(w/o HEV))-96, Rear Oxygen Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and rear oxygen sensor connector • Poor contact of ECM connector • Poor contact of coupling connector

EO:DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH (BANK 1)

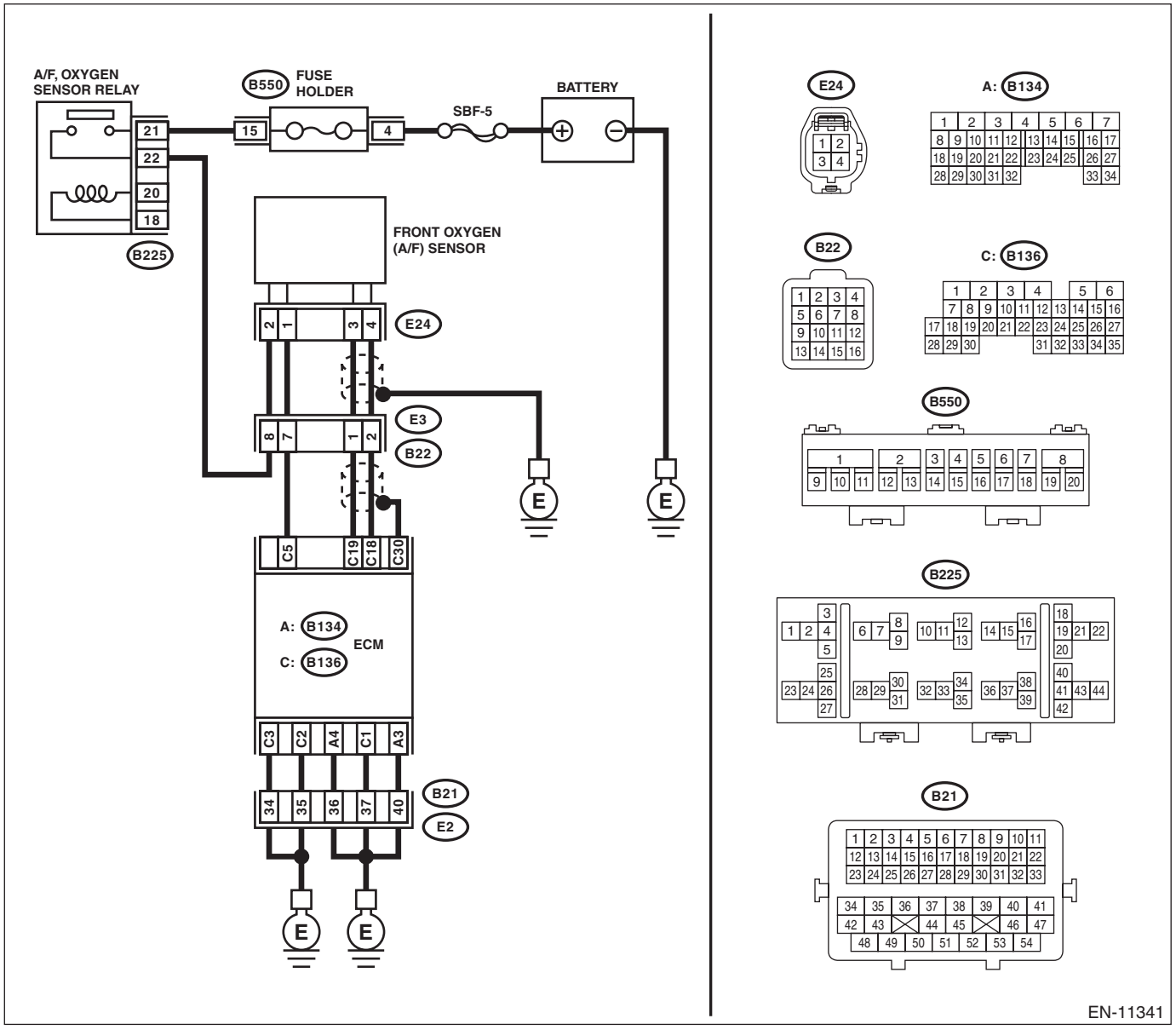
DTC DETECTING CONDITION:

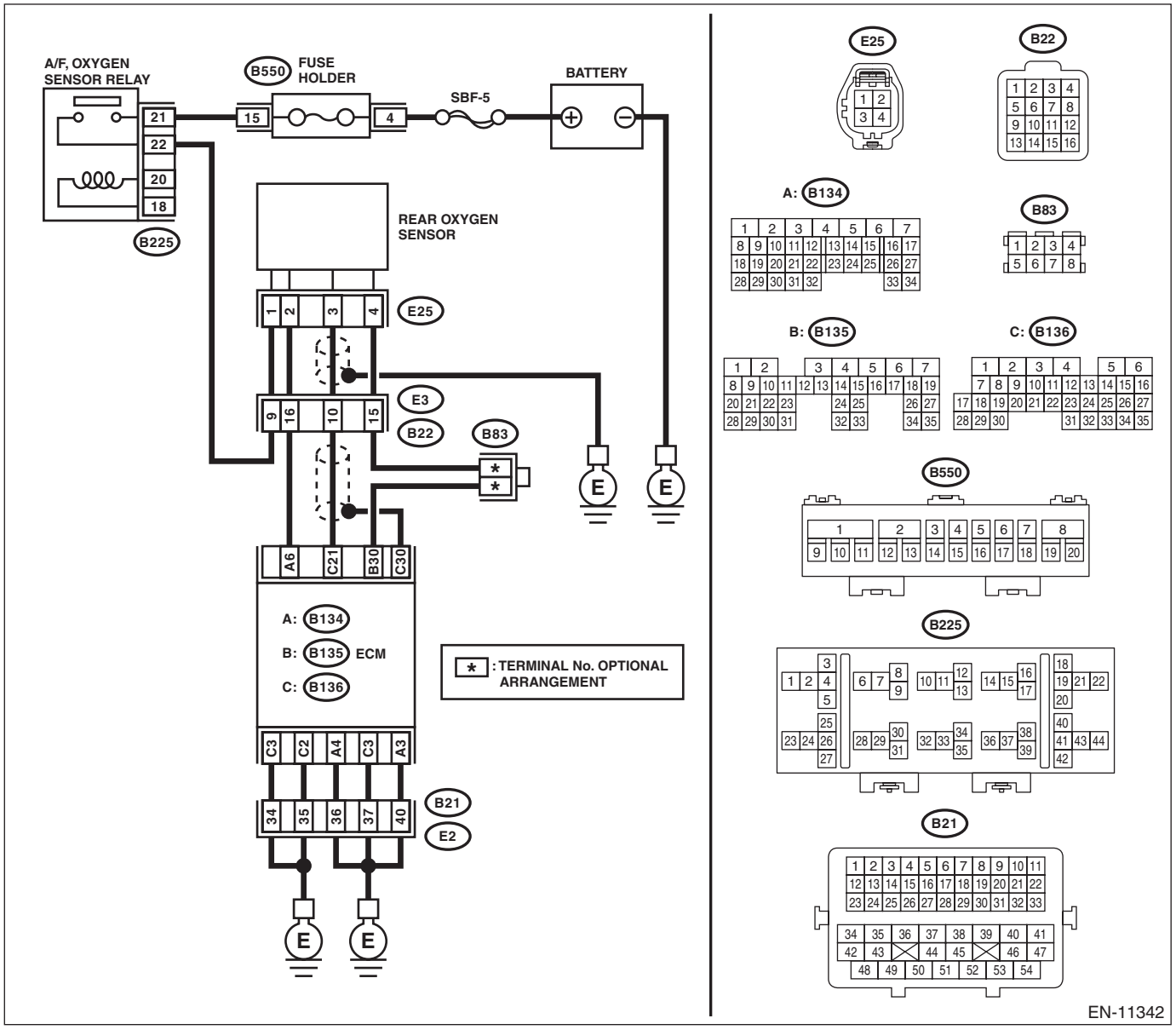
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-175, DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>





Step		Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **3**.

	Step	Check	Yes	No
3	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and front oxygen (A/F) sensor. 3) Measure the resistance of harness between ECM connector and front oxygen (A/F) sensor connector. ***Connector & terminal*** ***(B136) No. 19 — (E24) No. 3:*** ***(B136) No. 18 — (E24) No. 4:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and front oxygen (A/F) sensor connector • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 19 — Chassis ground:*** ***(B136) No. 18 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the short circuit to ground in harness between ECM connector and front oxygen (A/F) sensor connector.
5	**CHECK OUTPUT SIGNAL FOR ECM.** 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. ***Connector & terminal*** ***(E24) No. 3 (+) — Chassis ground (–):***	Is the voltage 4.5 V or more?	Go to step **7**.	Go to step **6**.
6	**CHECK OUTPUT SIGNAL FOR ECM.** Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. ***Connector & terminal*** ***(E24) No. 4 (+) — Chassis ground (–):***	Is the voltage 4.95 V or more?	Go to step **7**.	Go to step **8**.
7	**CHECK OUTPUT SIGNAL FOR ECM.** Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. ***Connector & terminal*** ***(E24) No. 3 (+) — Chassis ground (–):*** ***(E24) No. 4 (+) — Chassis ground (–):***	Is the voltage 8 V or more?	Repair the short circuit to power in the harness between ECM connector and front oxygen (A/F) sensor connector. After repair, replace the ECM. <Ref. to FU(H4DO(w/o HEV))-100, Engine Control Module (ECM).>	Repair the poor contact of ECM connector.
8	**CHECK EXHAUST SYSTEM.**	Are there holes or loose bolts on exhaust system?	Repair the exhaust system.	Go to step **9**.
9	**CHECK AIR INTAKE SYSTEM.**	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair the air intake system.	Go to step **10**.

Step		Check	Yes	No
10	**CHECK FUEL PRESSURE.** **WARNING:** **Place "NO OPEN FLAMES" signs near the working area.** **CAUTION:** **Be careful not to spill fuel.** 1) Connect the front oxygen (A/F) sensor connector. 2) Measure the fuel pressure. <Ref. to ME(H4DO(w/o HEV))-35, INSPECTION, Fuel Pressure.> **CAUTION:** **Release fuel pressure before removing the fuel pressure gauge.**	Is the measured value 340 — 400 kPa (3.5 — 4.1 kg/cm^2, 49 — 58 psi)?	Go to step **11**.	Check the fuel pump and fuel delivery line. <Ref. to FU(H4DO(w/o HEV))-142, INSPECTION, Fuel Pump.> <Ref. to FU(H4DO(w/o HEV))-170, INSPECTION, Fuel Delivery and Evaporation Lines.>
11	**CHECK ENGINE COOLANT TEMPERATURE SENSOR.** 1) Start the engine and warm up completely. 2) Read the value of «Coolant Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Coolant Temp.» 75°C (167°F) or more?	Go to step **12**.	Replace the engine coolant temperature sensor. <Ref. to FU(H4DO(w/o HEV))-51, Engine Coolant Temperature Sensor.>
12	**CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.** 1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F). 2) For CVT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Read the value of «Mass Air Flow» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Mass Air Flow» 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)?	Go to step **13**.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DO(w/o HEV))-73, Mass Air Flow and Intake Air Temperature Sensor.>

	Step	Check	Yes	No
13	**CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.** 1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F). 2) For CVT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Open the front hood. 6) Measure the ambient temperature. 7) Read the value of «Intake Air Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Subtract ambient temperature from «Intake Air Temp.». Is the obtained value –10 — 50°C (–18 — 90°F)?	Go to step **14**.	Check the mass air flow and intake air temperature sensor. <Ref. to FU(H4DO(w/o HEV))-73, Mass Air Flow and Intake Air Temperature Sensor.>
14	**CHECK REAR OXYGEN SENSOR DATA.** 1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), and keep the engine speed at 3,000 rpm. (2 minutes maximum) 2) Read the value of «Rear O2 Sensor» using the Subaru Select Monitor or a general scan tool. NOTE: • Depress the clutch pedal. (MT model) • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Rear O2 Sensor» 0.490 V or more?	Go to step **15**.	Go to step **16**.
15	**CHECK REAR OXYGEN SENSOR DATA.** 1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), and rapidly reduce the engine speed from 3,000 rpm. 2) Read the value of «Rear O2 Sensor» using the Subaru Select Monitor or a general scan tool. NOTE: • Depress the clutch pedal. (MT model) • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Rear O2 Sensor» 0.250 V or less?	Go to step **17**.	Go to step **16**.

	Step	Check	Yes	No
16	**CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **18**.
17	**CHECK FRONT OXYGEN (A/F) SENSOR USING REAR OXYGEN SENSOR SIGNAL.** 1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), then keep the engine idling for 5 minutes or more. 2) Read the value of «Rear O2 Sensor» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value in «Rear O2 Sensor» kept at 0.8 V or more for 5 minutes or more?	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DO(w/o HEV))-92, Front Oxygen (A/F) Sensor.>	Go to step **18**.
18	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM connector and rear oxygen sensor connector. ***Connector & terminal*** ***(B136) No. 21 — (E25) No. 3:*** ***(B135) No. 30 — (E25) No. 4:***	Is the resistance less than 1 Ω?	Go to step **19**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and rear oxygen sensor connector • Poor contact of coupling connector
19	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between rear oxygen sensor connector and chassis ground. ***Connector & terminal*** ***(E25) No. 3 (+) — Chassis ground (–):***	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H4DO(w/o HEV))-96, Rear Oxygen Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and rear oxygen sensor connector • Poor contact of ECM connector • Poor contact of coupling connector

EP:DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/ PERFORMANCE

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-176, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

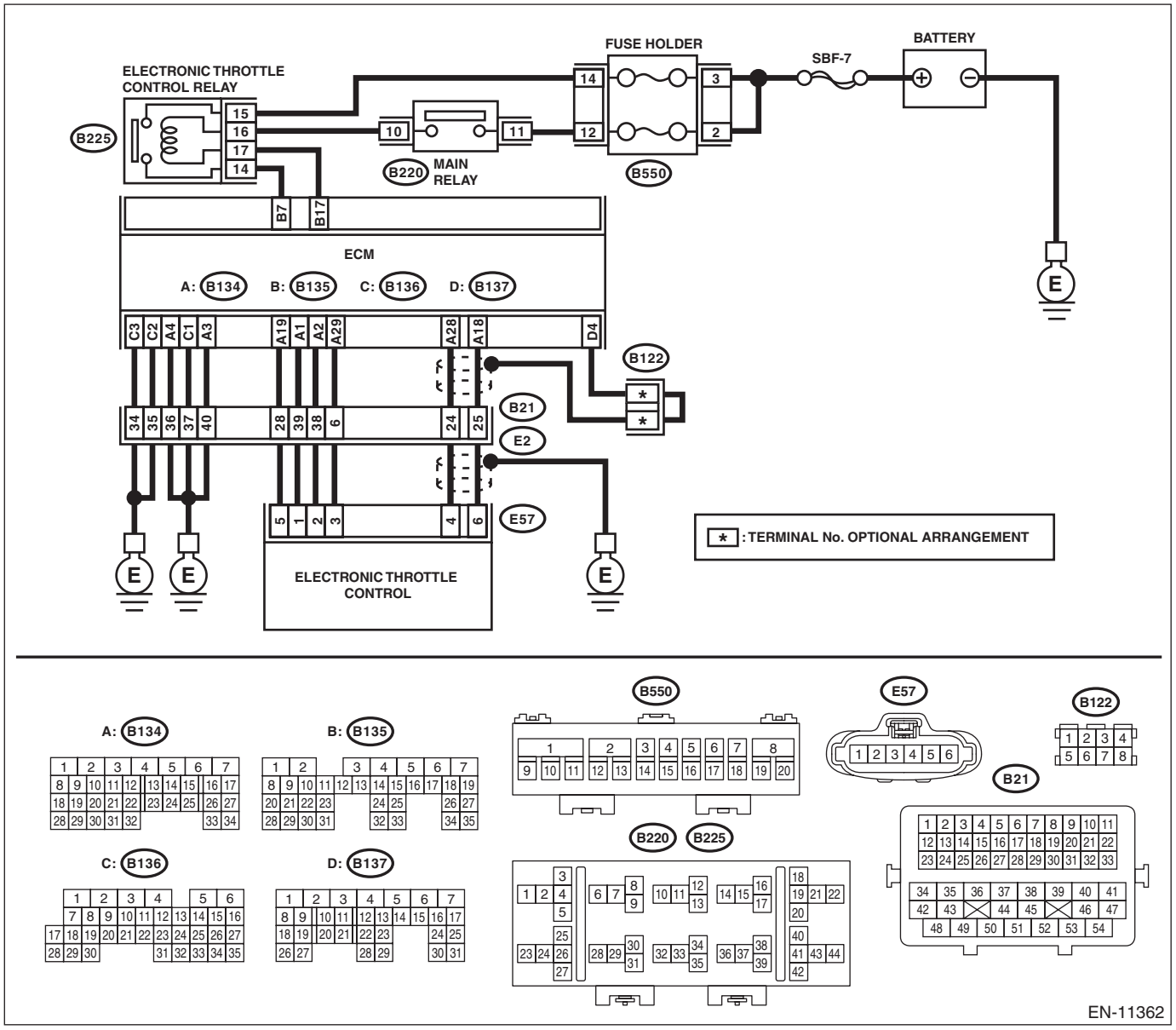
- Improper idling
- Poor driving performance
- Engine stalls.

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK ELECTRONIC THROTTLE CONTROL RELAY.** 1) Turn the ignition switch to OFF. 2) Remove the electronic throttle control relay. 3) Connect the battery to terminals No. 16 and No. 17 of electronic throttle control relay. 4) Measure the resistance between electronic throttle control relay terminals. ***Terminals*** ***No. 14 — No. 15:***	Is the resistance less than 1 Ω?	Go to step **2**.	Replace the electronic throttle control relay. <Ref. to FU(H4DO(w/o HEV))-106, Electronic Throttle Control Relay.>
2	**CHECK POWER SUPPLY OF ELECTRONIC THROTTLE CONTROL RELAY.** Measure the voltage between electronic throttle control relay connector and chassis ground. ***Connector & terminal*** ***(B225) No. 15 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **3**.	Repair the open or ground short circuit of power supply circuit.
3	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.** 1) Disconnect the connector from ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control relay connector and chassis ground. ***Connector & terminal*** ***(B225) No. 17 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM connector and electronic throttle control relay connector.	Go to step **4**.
4	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between electronic throttle control relay connector and chassis ground. ***Connector & terminal*** ***(B225) No. 14 — Chassis ground:*** ***(B225) No. 17 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the short circuit to ground in harness between ECM connector and electronic throttle control relay connector.
5	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.** Measure the resistance between ECM connector and electronic throttle control relay connector. ***Connector & terminal*** ***(B135) No. 17 — (B225) No. 17:*** ***(B135) No. 7 — (B225) No. 14:***	Is the resistance less than 1 Ω?	Go to step **6**.	Repair the open circuit in harness between ECM connector and electronic throttle control relay connector.
6	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from electronic throttle control. 3) Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 19 — Chassis ground:*** ***(B134) No. 18 — Chassis ground:*** ***(B134) No. 18 — (B136) No. 4:*** ***(B134) No. 28 — Chassis ground:*** ***(B134) No. 28 — (B136) No. 4:***	Is the resistance 1 MΩ or more?	Go to step **7**.	Repair the ground short circuit of harness between ECM connector and electronic throttle control connector.

	Step	Check	Yes	No
7	**CHECK SHORT CIRCUIT INSIDE THE ECM.** 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 6 — Engine ground:*** ***(E57) No. 4 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **8**.	Repair the ground short circuit of harness between ECM connector and electronic throttle control connector. Replace the ECM if defective. <Ref. to FU(H4DO(w/o HEV))-100, Engine Control Module (ECM).>
8	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM connector and electronic throttle control connector. ***Connector & terminal*** ***(B134) No. 18 — (E57) No. 6:*** ***(B134) No. 28 — (E57) No. 4:*** ***(B134) No. 29 — (E57) No. 3:***	Is the resistance less than 1 Ω?	Go to step **9**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and electronic throttle control connector • Poor contact of coupling connector
9	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 3 — Engine ground:***	Is the resistance less than 5 Ω?	Go to step **10**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM connector and engine ground • Poor contact of ECM connector • Poor contact of coupling connector
10	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 6 (+) — Engine ground (–):*** ***(E57) No. 4 (+) — Engine ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between ECM connector and electronic throttle control connector.	Go to step **11**.
11	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connectors. ***Connector & terminal*** ***(B134) No. 19 — (B134) No. 18:*** ***(B134) No. 19 — (B134) No. 28:***	Is the resistance 1 MΩ or more?	Go to step **12**.	Repair the short circuit to power in the harness between ECM connector and electronic throttle control connector.

	Step	Check	Yes	No
12	**CHECK SENSOR OUTPUT.** 1) Connect all connectors. 2) Start the engine and warm up completely. 3) Stop the engine, and then turn the ignition switch to ON (engine OFF). 4) Read the value of «Main-Throttle Sensor» using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.>	Is the value of «Main-Throttle Sensor» 0.81 — 0.87 V?	Go to step **13**.	Repair the poor contact of electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4DO(w/o HEV))-14, Throttle Body.>
13	**CHECK SENSOR OUTPUT.** Read the value of «Sub-Throttle Sensor» using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.>	Is the value of «Sub-Throttle Sensor» 1.64 — 1.70 V?	Go to step **14**.	Repair the poor contact of electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4DO(w/o HEV))-14, Throttle Body.>
14	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance between ECM connector and electronic throttle control connector. ***Connector & terminal*** ***(B134) No. 2 — (E57) No. 2:*** ***(B134) No. 1 — (E57) No. 1:***	Is the resistance less than 1 Ω?	Go to step **15**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and electronic throttle control connector • Poor contact of coupling connector
15	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 2 (+) — Engine ground (–):*** ***(E57) No. 1 (+) — Engine ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between ECM connector and electronic throttle control connector.	Go to step **16**.
16	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 2 — Engine ground:*** ***(E57) No. 1 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **17**.	Repair the ground short circuit of harness between ECM connector and electronic throttle control connector.

	Step	Check	Yes	No
17	**CHECK ELECTRONIC THROTTLE CONTROL CONNECTOR HARNESS.** Measure the resistance between electronic throttle control connectors. ***Connector & terminal*** ***(E57) No. 2 — (E57) No. 1:***	Is the resistance 1 MΩ or more?	Go to step **18**.	Repair the short circuit in harness between ECM connector and electronic throttle control connector.
18	**CHECK ELECTRONIC THROTTLE CONTROL GROUND CIRCUIT.** Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 3 — Chassis ground:*** ***(B134) No. 4 — Chassis ground:*** ***(B136) No. 1 — Chassis ground:*** ***(B136) No. 2 — Chassis ground:*** ***(B136) No. 3 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **19**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM connector and engine ground • Poor contact of coupling connector
19	**CHECK ELECTRONIC THROTTLE CONTROL.** Measure the resistance between electronic throttle control terminals. ***Terminals*** ***No. 2 — No. 1:***	Is the resistance 50 Ω or less?	Go to step **20**.	Replace the electronic throttle control. <Ref. to FU(H4DO(w/o HEV))-14, Throttle Body.>
20	**CHECK ELECTRONIC THROTTLE CONTROL.** Move the throttle valve to the fully open and fully closed positions with fingers. Check that the valve returns to the specified position when releasing fingers.	Does the valve return to the specified position? Standard value: 3 mm (0.12 in) from fully closed position	Repair the poor contact of ECM connector.	Replace the electronic throttle control. <Ref. to FU(H4DO(w/o HEV))-14, Throttle Body.>

EQ:DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-177, DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

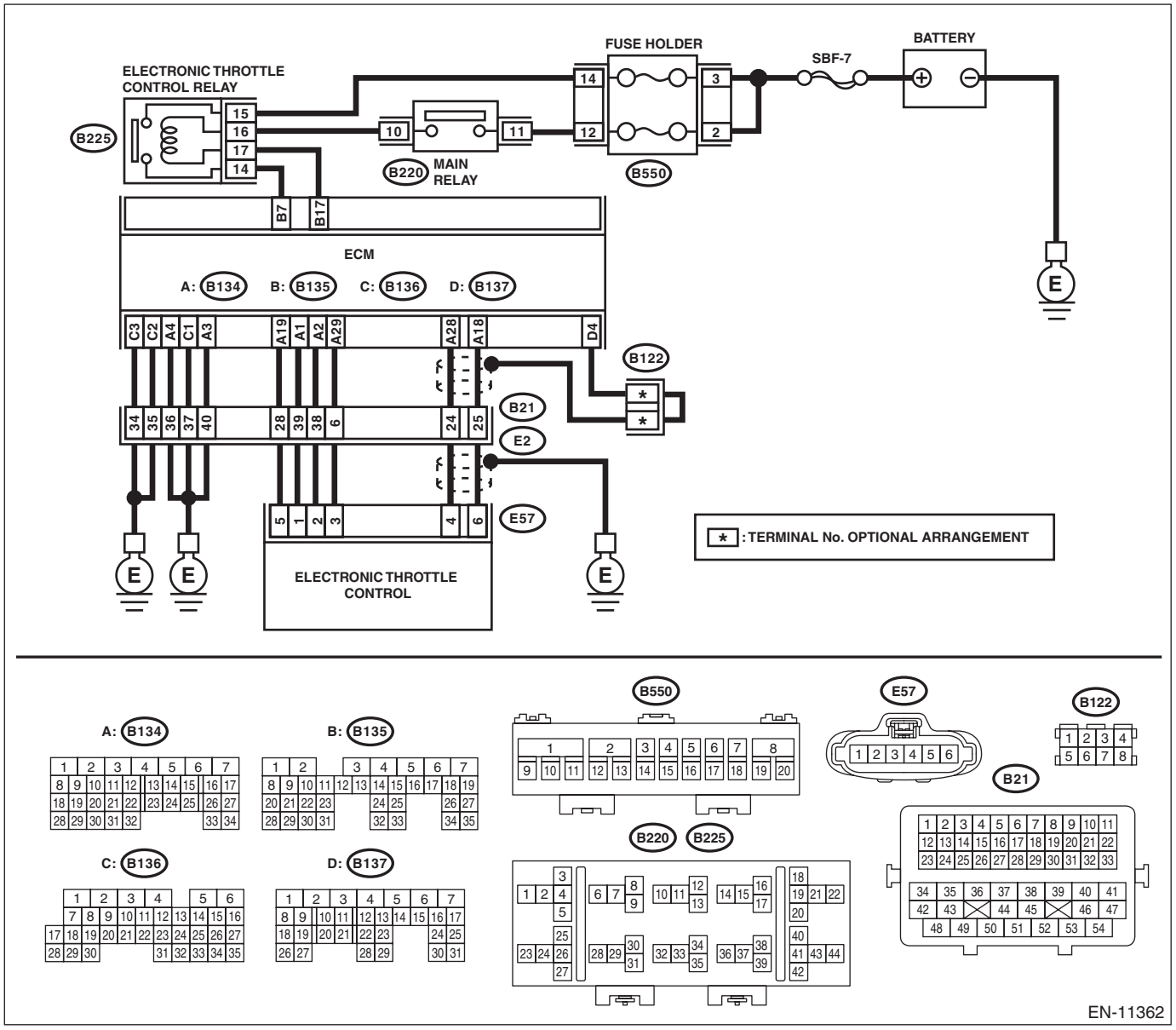
- Improper idling
- Poor driving performance
- Engine stalls.

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK ELECTRONIC THROTTLE CONTROL RELAY.** 1) Turn the ignition switch to OFF. 2) Remove the electronic throttle control relay. 3) Connect the battery to terminals No. 16 and No. 17 of electronic throttle control relay. 4) Measure the resistance between electronic throttle control relay terminals. ***Terminals*** ***No. 14 — No. 15:***	Is the resistance less than 1 Ω?	Go to step **2**.	Replace the electronic throttle control relay. <Ref. to FU(H4DO(w/o HEV))-106, Electronic Throttle Control Relay.>
2	**CHECK POWER SUPPLY OF ELECTRONIC THROTTLE CONTROL RELAY.** Measure the voltage between electronic throttle control relay connector and chassis ground. ***Connector & terminal*** ***(B225) No. 15 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **3**.	Repair the open or ground short circuit of power supply circuit.
3	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.** 1) Disconnect the connector from ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control relay connector and chassis ground. ***Connector & terminal*** ***(B225) No. 17 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM connector and electronic throttle control relay connector.	Go to step **4**.
4	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between electronic throttle control relay connector and chassis ground. ***Connector & terminal*** ***(B225) No. 14 — Chassis ground:*** ***(B225) No. 17 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the short circuit to ground in harness between ECM connector and electronic throttle control relay connector.
5	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.** Measure the resistance between ECM connector and electronic throttle control relay connector. ***Connector & terminal*** ***(B135) No. 17 — (B225) No. 17:*** ***(B135) No. 7 — (B225) No. 14:***	Is the resistance less than 1 Ω?	Repair the poor contact of ECM connector.	Repair the open circuit in harness between ECM connector and electronic throttle control relay connector.

ER:DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH

DTC DETECTING CONDITION:

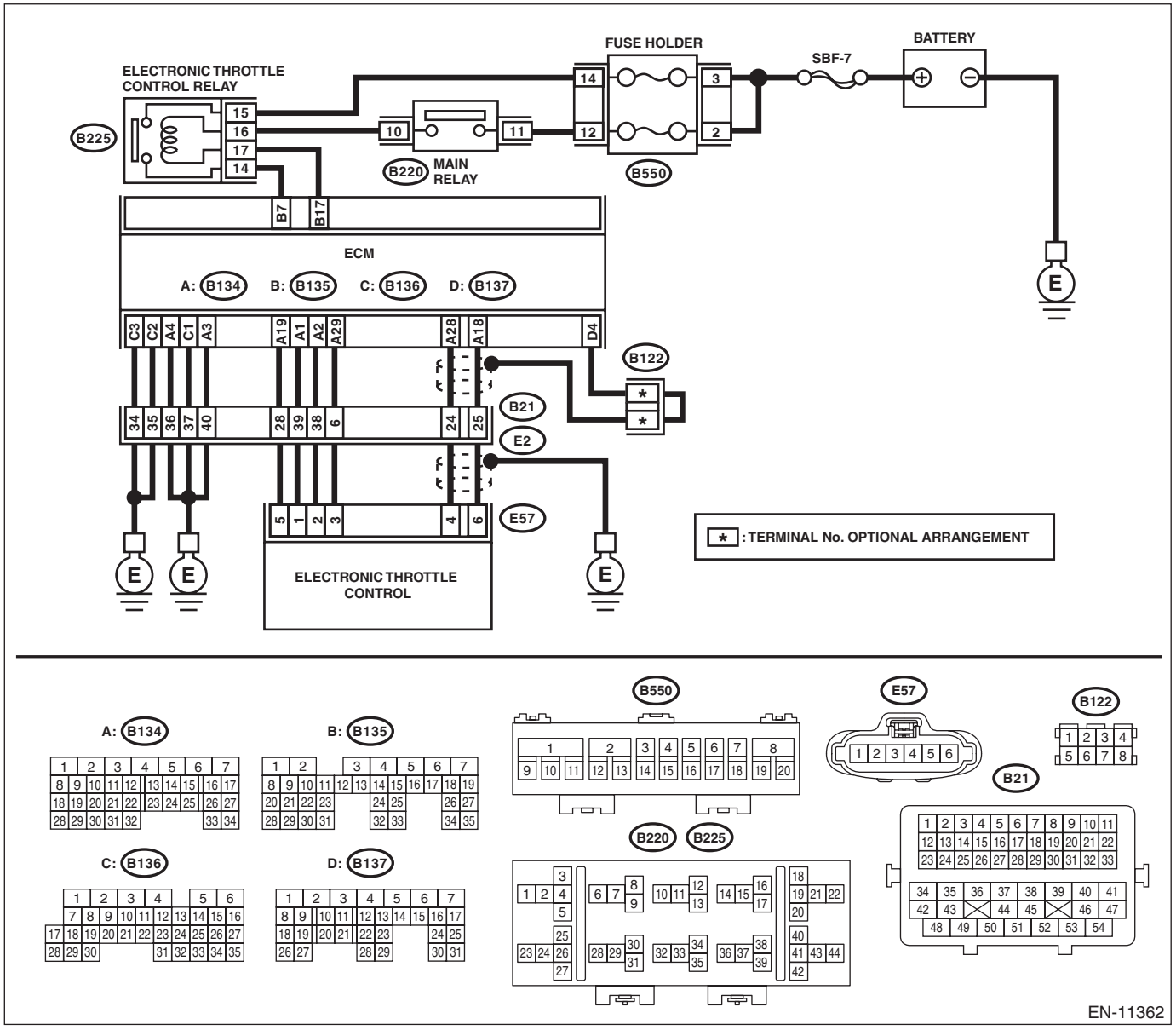
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-178, DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK ELECTRONIC THROTTLE CONTROL RELAY.** 1) Turn the ignition switch to OFF. 2) Remove the electronic throttle control relay. 3) Measure the resistance between electronic throttle control relay terminals. ***Terminals*** ***No. 14 — No. 15:***	Is the resistance 1 MΩ or more?	Go to step **2**.	Replace the electronic throttle control relay. <Ref. to FU(H4DO(w/o HEV))-106, Electronic Throttle Control Relay.>
2	**CHECK SHORT CIRCUIT OF ELECTRONIC THROTTLE CONTROL RELAY POWER SUPPLY.** 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control relay connector and chassis ground. ***Connector & terminal*** ***(B225) No. 14 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM connector and electronic throttle control relay connector.	Go to step **3**.
3	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 17 — Chassis ground:***	Is the resistance 1 MΩ or more?	Repair the poor contact of ECM connector.	Repair the short circuit to ground in harness between ECM connector and electronic throttle control relay connector.

ES:DTC P2109 THROTTLE/PEDAL POSITION SENSOR “A” MINIMUM STOP PERFORMANCE

NOTE:
For the diagnostic procedure, refer to DTC P2101. <Ref. to EN(H4DO w/o HEV)(diag)-320, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

ET:DTC P2119 THROTTLE ACTUATOR CONTROL THROTTLE BODY RANGE/PERFORMANCE

NOTE:
For the diagnostic procedure, refer to DTC P2101. <Ref. to EN(H4DO w/o HEV)(diag)-320, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

EU:DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT LOW INPUT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-182, DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

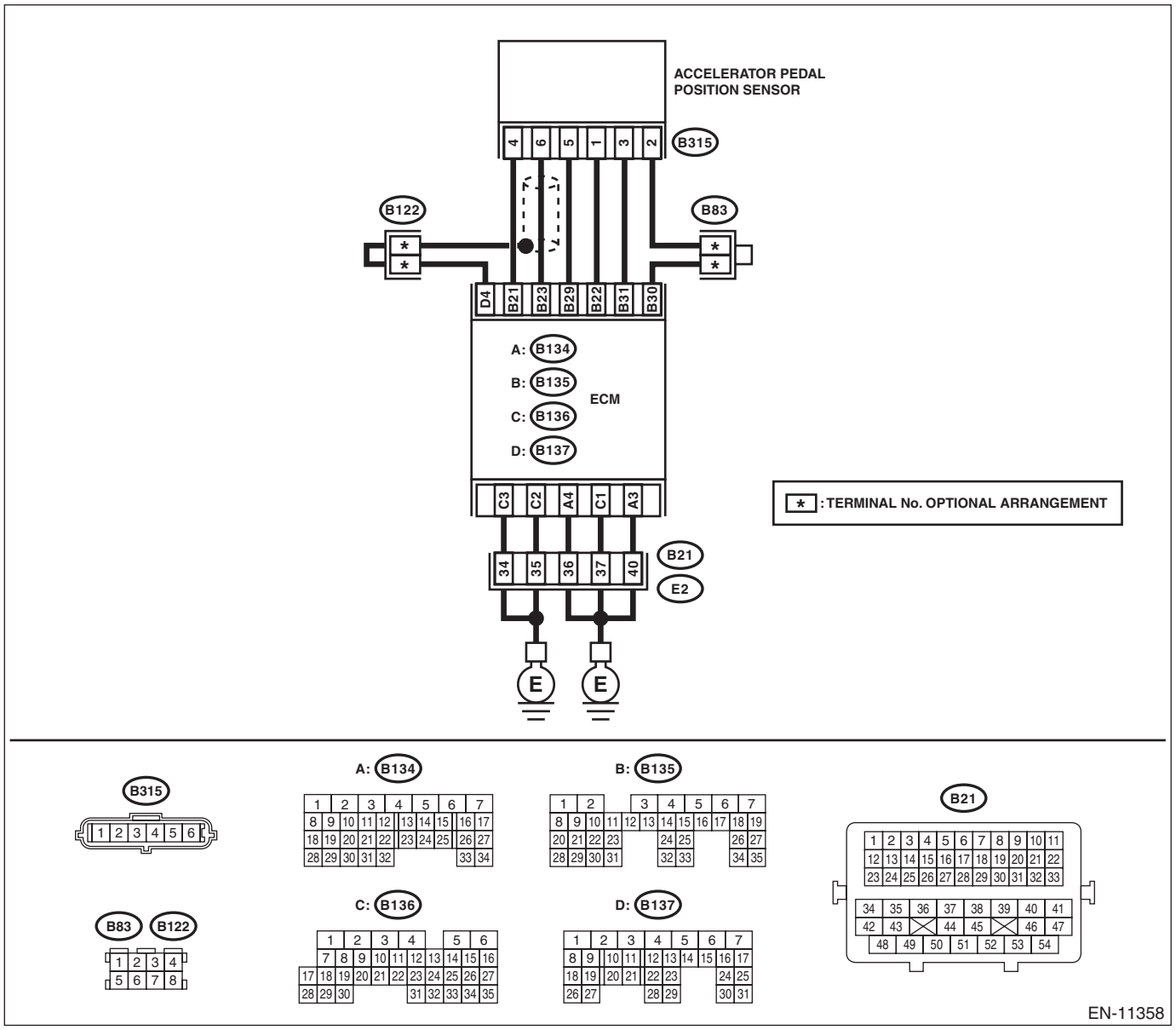
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and accelerator pedal position sensor. 3) Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 21 — Chassis ground:*** ***(B135) No. 23 — Chassis ground:*** ***(B135) No. 23 — (B137) No. 4:***	Is the resistance 1 MΩ or more?	Go to step **2**.	Repair the short circuit to ground in harness between ECM connector and accelerator pedal position sensor connector.
2	**CHECK SHORT CIRCUIT INSIDE THE ECM.** 1) Connect the connector to ECM. 2) Measure the resistance between accelerator pedal position sensor connector and chassis ground. ***Connector & terminal*** ***(B315) No. 6 — Chassis ground:***	Is the resistance 1 MΩ or more?	Replace the accelerator pedal. <Ref. to SP(H4DO(w/o HEV))-4, Accelerator Pedal.>	Repair the short circuit to ground in harness between ECM connector and accelerator pedal position sensor connector. Replace the ECM if defective. <Ref. to FU(H4DO(w/o HEV))-100, Engine Control Module (ECM).>

EV:DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT HIGH INPUT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-183, DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

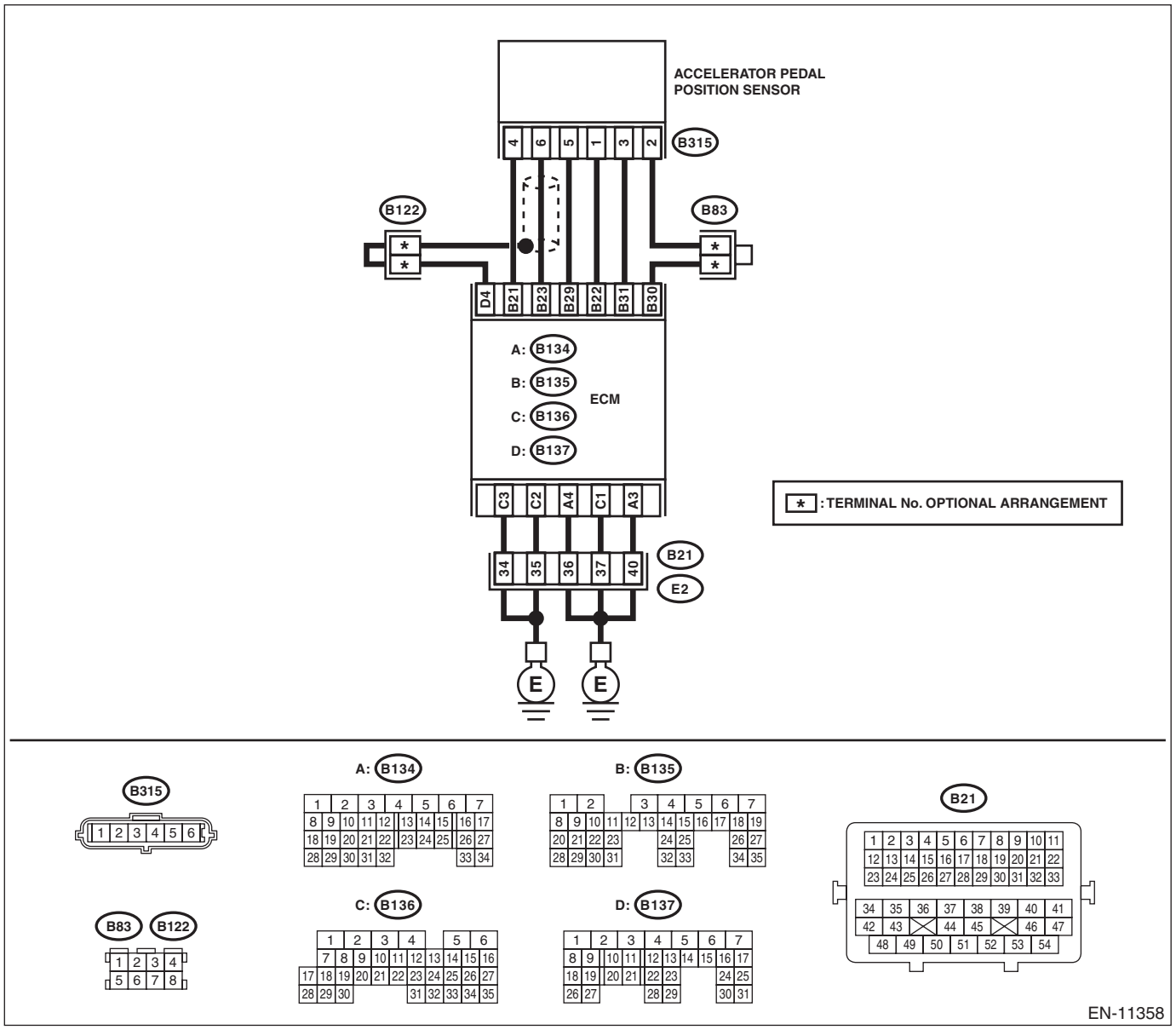
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and accelerator pedal position sensor. 3) Measure the resistance of harness between ECM connector and accelerator pedal position sensor connector. ***Connector & terminal*** ***(B135) No. 23 — (B315) No. 6:*** ***(B135) No. 29 — (B315) No. 5:***	Is the resistance less than 1 Ω?	Go to step **2**.	Repair the open circuit of harness between ECM connector and accelerator pedal position sensor connector.
2	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.** 1) Connect the connector to ECM. 2) Measure the resistance between accelerator pedal position sensor connector and chassis ground. ***Connector & terminal*** ***(B315) No. 5 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM connector and engine ground • Poor contact of ECM connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between accelerator pedal position sensor connector and chassis ground. ***Connector & terminal*** ***(B315) No. 6 (+) — Chassis ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power supply in harness between ECM connector and accelerator pedal position sensor connector.	Go to step **4**.
4	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connectors. ***Connector & terminal*** ***(B135) No. 21 — (B135) No. 23:***	Is the resistance 1 MΩ or more?	Repair the poor contact of accelerator pedal position sensor connector. Replace the accelerator pedal if defective. <Ref. to SP(H4DO(w/o HEV))-4, Accelerator Pedal.>	Repair the short circuit to power supply in harness between ECM connector and accelerator pedal position sensor connector.

EW:DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT LOW INPUT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-184, DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

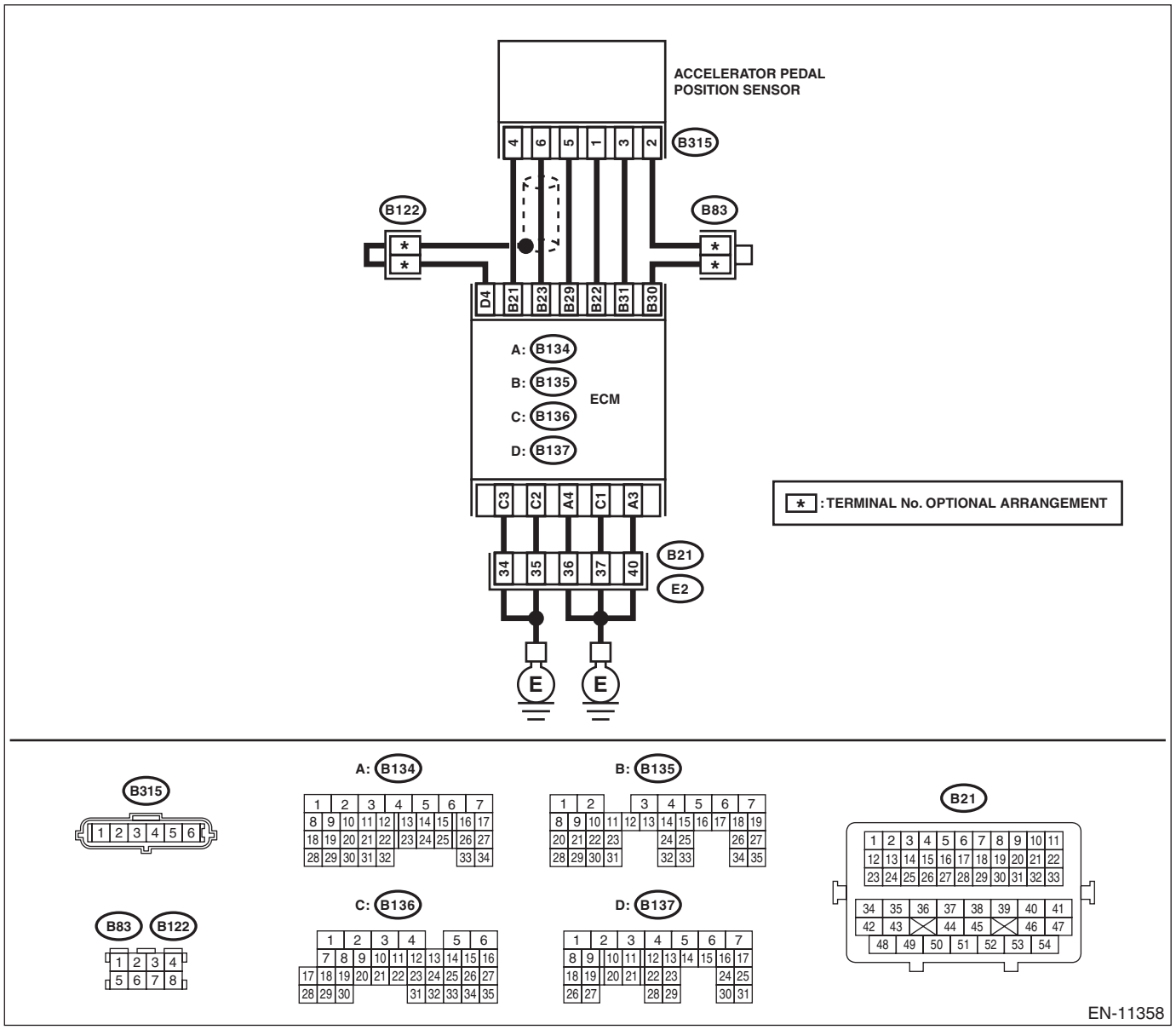
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and accelerator pedal position sensor. 3) Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 22 — Chassis ground:*** ***(B135) No. 31 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **2**.	Repair the short circuit to ground in harness between ECM connector and accelerator pedal position sensor connector.
2	**CHECK SHORT CIRCUIT INSIDE THE ECM.** 1) Connect the connector to ECM. 2) Measure the resistance between accelerator pedal position sensor connector and chassis ground. ***Connector & terminal*** ***(B315) No. 3 — Chassis ground:***	Is the resistance 1 MΩ or more?	Replace the accelerator pedal. <Ref. to SP(H4DO(w/o HEV))-4, Accelerator Pedal.>	Repair the short circuit to ground in harness between ECM connector and accelerator pedal position sensor connector. Replace the ECM if defective. <Ref. to FU(H4DO(w/o HEV))-100, Engine Control Module (ECM).>

EX:DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT HIGH INPUT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-185, DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

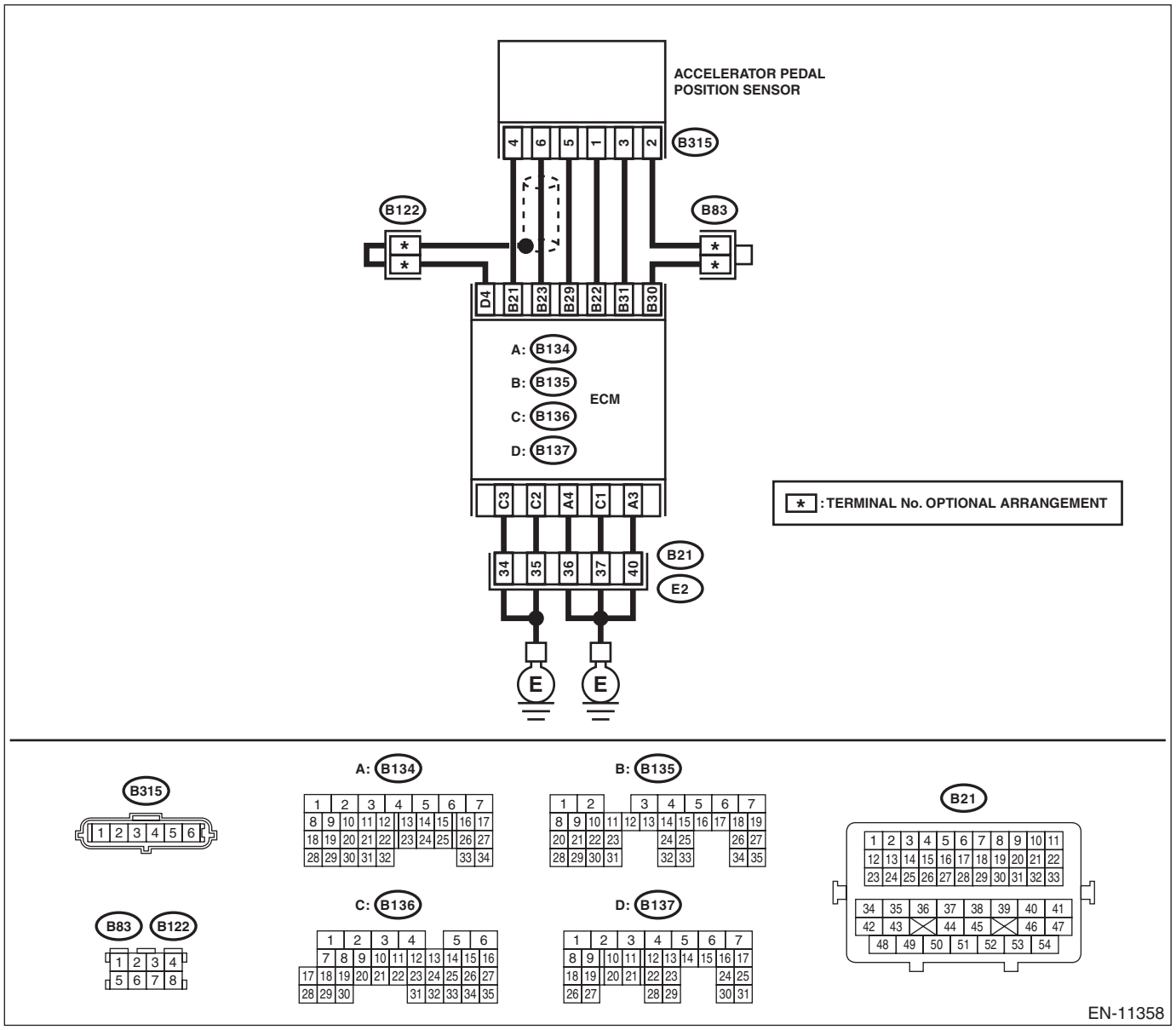
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and accelerator pedal position sensor. 3) Measure the resistance of harness between ECM connector and accelerator pedal position sensor connector. ***Connector & terminal*** ***(B135) No. 31 — (B315) No. 3:*** ***(B135) No. 30 — (B315) No. 2:***	Is the resistance less than 1 Ω?	Go to step **2**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM connector and accelerator pedal position sensor connector • Poor contact of joint connector
2	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.** 1) Connect the connector to ECM. 2) Measure the resistance between accelerator pedal position sensor connector and chassis ground. ***Connector & terminal*** ***(B315) No. 2 — Chassis ground:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM connector and engine ground • Poor contact of ECM connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between accelerator pedal position sensor connector and chassis ground. ***Connector & terminal*** ***(B315) No. 3 (+) — Chassis ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power supply in harness between ECM connector and accelerator pedal position sensor connector.	Go to step **4**.
4	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connectors. ***Connector & terminal*** ***(B135) No. 22 — (B135) No. 31:***	Is the resistance 1 MΩ or more?	Repair the poor contact of accelerator pedal position sensor connector. Replace the accelerator pedal if defective. <Ref. to SP(H4DO(w/o HEV))-4, Accelerator Pedal.>	Repair the short circuit to power supply in harness between ECM connector and accelerator pedal position sensor connector.

EY:DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A”/“B” VOLTAGE CORRELATION

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-186, DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A”/“B” VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

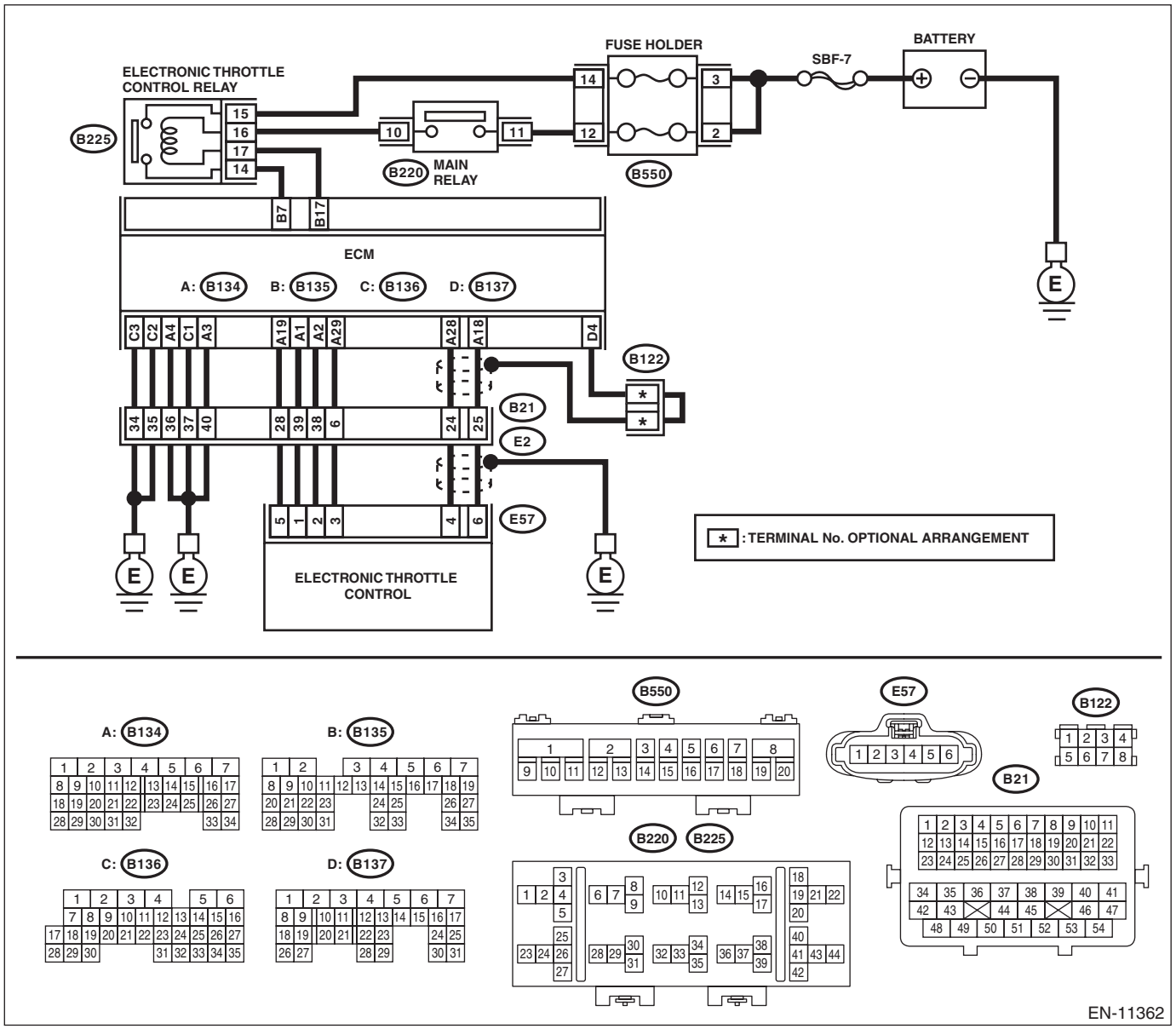
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 19 — Chassis ground:*** ***(B134) No. 18 — Chassis ground:*** ***(B134) No. 18 — (B136) No. 4:*** ***(B134) No. 28 — Chassis ground:*** ***(B134) No. 28 — (B136) No. 4:***	Is the resistance 1 MΩ or more?	Go to step **2**.	Repair the ground short circuit of harness between ECM connector and electronic throttle control connector.
2	**CHECK SHORT CIRCUIT INSIDE THE ECM.** 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 6 — Engine ground:*** ***(E57) No. 4 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **3**.	Repair the ground short circuit of harness between ECM connector and electronic throttle control connector. Replace the ECM if defective. <Ref. to FU(H4DO(w/o HEV))-100, Engine Control Module (ECM).>
3	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM connector and electronic throttle control connector. ***Connector & terminal*** ***(B134) No. 18 — (E57) No. 6:*** ***(B134) No. 28 — (E57) No. 4:*** ***(B134) No. 29 — (E57) No. 3:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and electronic throttle control connector • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 3 — Engine ground:***	Is the resistance less than 5 Ω?	Go to step **5**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM connector and engine ground • Poor contact of ECM connector • Poor contact of coupling connector

	Step	Check	Yes	No
5	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 6 (+) — Engine ground (–):*** ***(E57) No. 4 (+) — Engine ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between ECM connector and electronic throttle control connector.	Go to step **6**.
6	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connectors. ***Connector & terminal*** ***(B134) No. 19 — (B134) No. 18:*** ***(B134) No. 19 — (B134) No. 28:***	Is the resistance 1 MΩ or more?	Repair the poor contact of electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4DO(w/o HEV))-14, Throttle Body.>	Repair the short circuit to power in the harness between ECM connector and electronic throttle control connector.

EZ:DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-188, DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

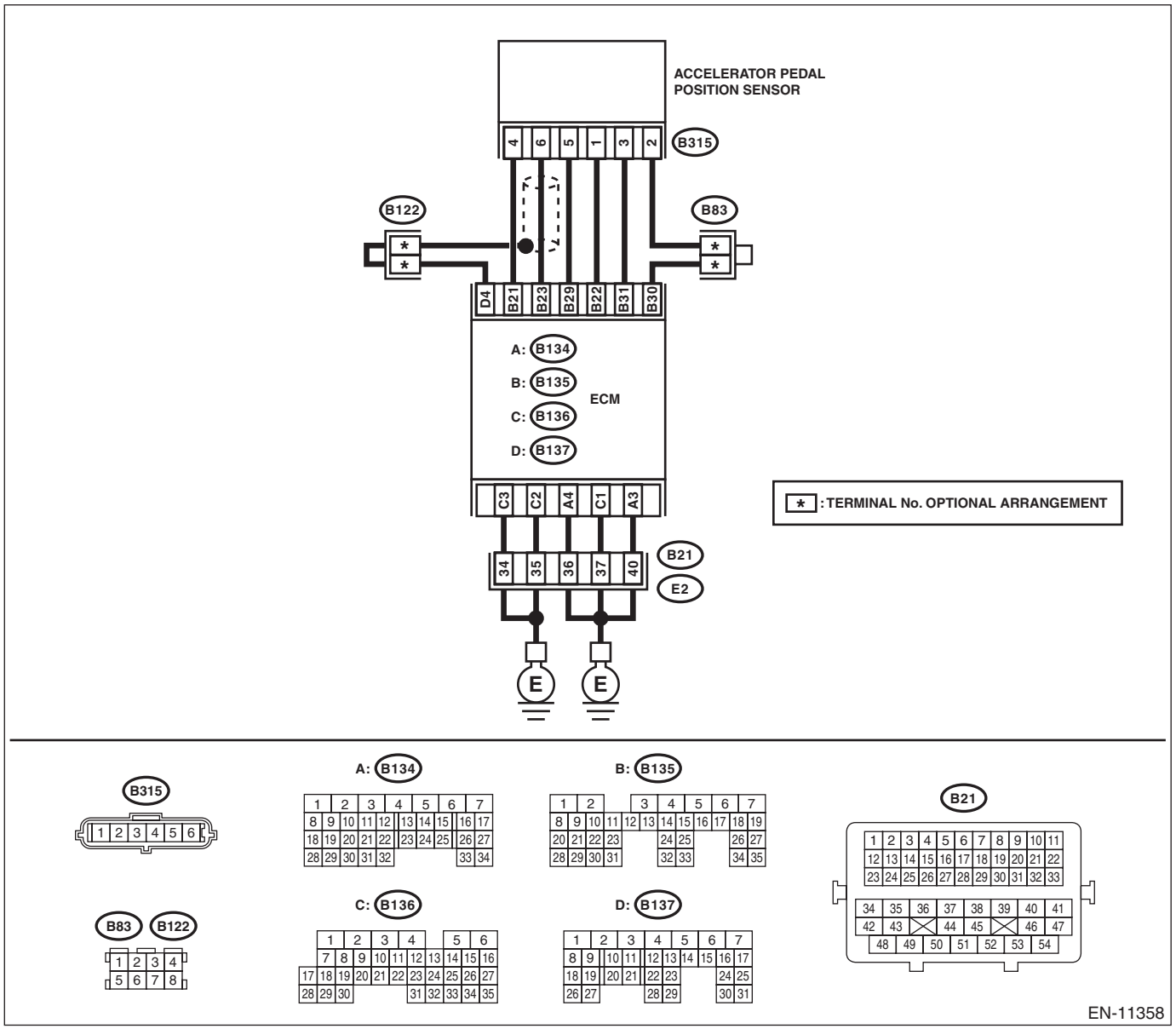
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK ACCELERATOR PEDAL POSITION SENSOR OUTPUT.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***Main accelerator pedal position sensor signal*** ***(B135) No. 23 (+) — Chassis ground (–):*** ***Sub accelerator pedal position sensor signal*** ***(B135) No. 31 (+) — Chassis ground (–):***	Is the difference in measured values for the main accelerator pedal position sensor signal and the sub accelerator pedal position sensor signal 0 V?	Go to step **3**.	Go to step **2**.
2	**CHECK ACCELERATOR PEDAL POSITION SENSOR OUTPUT.** 1) Measure the voltage between accelerator pedal position sensor connector and chassis ground. ***Connector & terminal*** ***(B315) No. 6 (+) — Chassis ground (–):*** ***(B315) No. 3 (+) — Chassis ground (–):***	Is the difference in measured values for the main accelerator pedal position sensor signal and the sub accelerator pedal position sensor signal 0 V?	Replace the accelerator pedal. <Ref. to SP(H4DO(w/o HEV))-4, Accelerator Pedal.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM connector and accelerator pedal position sensor connector • Short circuit to ground in harness between ECM connector and accelerator pedal position sensor connector
3	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.** Measure the resistance of harness between accelerator pedal position sensor connector and chassis ground. ***Connector & terminal*** ***(B315) No. 5 — Chassis ground:*** ***(B315) No. 2 — Chassis ground:***	Is the resistance less than 5 Ω?	Repair the poor contact of ECM connector.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM connector and accelerator pedal position sensor connector • Open circuit of harness between ECM connector and engine ground • Poor contact of ECM connector • Poor contact of joint connector

FA:DTC P2195 O2 SENSOR SIGNAL BIASED/STUCK LEAN (BANK 1 SENSOR 1)

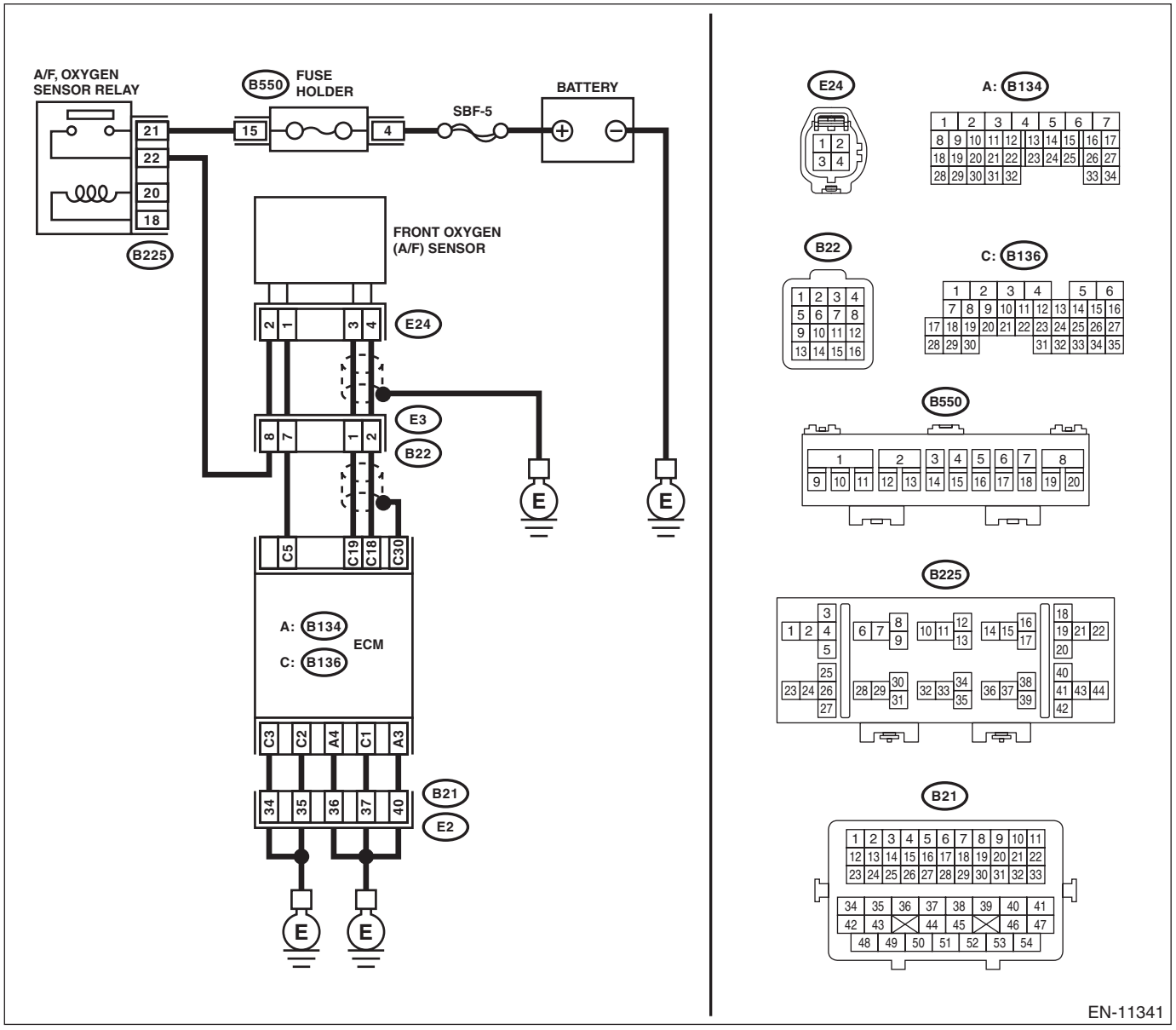
DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-190, DTC P2195 O2 SENSOR SIGNAL BIASED/STUCK LEAN (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



Step		Check	Yes	No
1	**CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **2**.

	Step	Check	Yes	No
2	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and front oxygen (A/F) sensor. 3) Measure the resistance of harness between ECM connector and front oxygen (A/F) sensor connector. ***Connector & terminal*** ***(B136) No. 19 — (E24) No. 3:*** ***(B136) No. 18 — (E24) No. 4:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and front oxygen (A/F) sensor connector • Poor contact of coupling connector
3	**CHECK FOR POOR CONTACT.** Check for poor contact of the front oxygen (A/F) sensor connector.	Is there poor contact of front oxygen (A/F) sensor connector?	Repair the poor contact of front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DO(w/o HEV))-92, Front Oxygen (A/F) Sensor.>

FB:DTC P2196 O2 SENSOR SIGNAL BIASED/STUCK RICH (BANK 1 SENSOR 1)

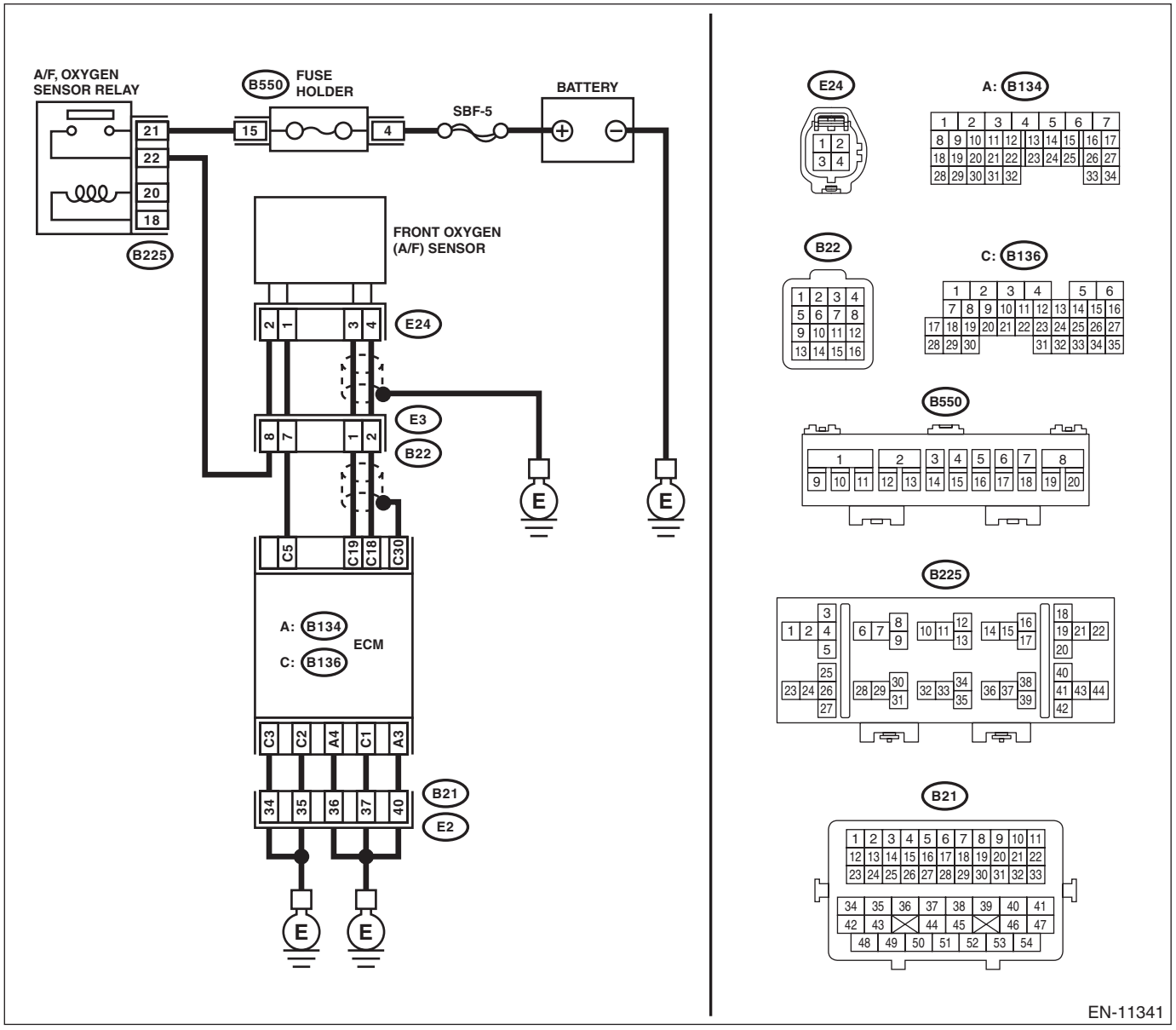
DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-192, DTC P2196 O2 SENSOR SIGNAL BIASED/STUCK RICH (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



Step		Check	Yes	No
1	**CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **2**.

	Step	Check	Yes	No
2	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 19 — Chassis ground:*** ***(B136) No. 18 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **3**.	Repair the short circuit to ground in harness between ECM connector and front oxygen (A/F) sensor connector.
3	**CHECK OUTPUT SIGNAL FOR ECM.** 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 19 (+) — Chassis ground (–):***	Is the voltage 4.5 V or more?	Go to step **5**.	Go to step **4**.
4	**CHECK OUTPUT SIGNAL FOR ECM.** Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 18 (+) — Chassis ground (–):***	Is the voltage 4.95 V or more?	Go to step **5**.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DO(w/o HEV))-92, Front Oxygen (A/F) Sensor.>
5	**CHECK OUTPUT SIGNAL FOR ECM.** Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 19 (+) — Chassis ground (–):*** ***(B136) No. 18 (+) — Chassis ground (–):***	Is the voltage 8 V or more?	Repair the short circuit to power in the harness between ECM connector and front oxygen (A/F) sensor connector. After repair, replace the ECM. <Ref. to FU(H4DO(w/o HEV))-100, Engine Control Module (ECM).>	Repair the poor contact of ECM connector.

FC:DTC P219A BANK 1 AIR-FUEL RATIO IMBALANCE

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-194, DTC P219A BANK 1 AIR-FUEL RATIO IMBALANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

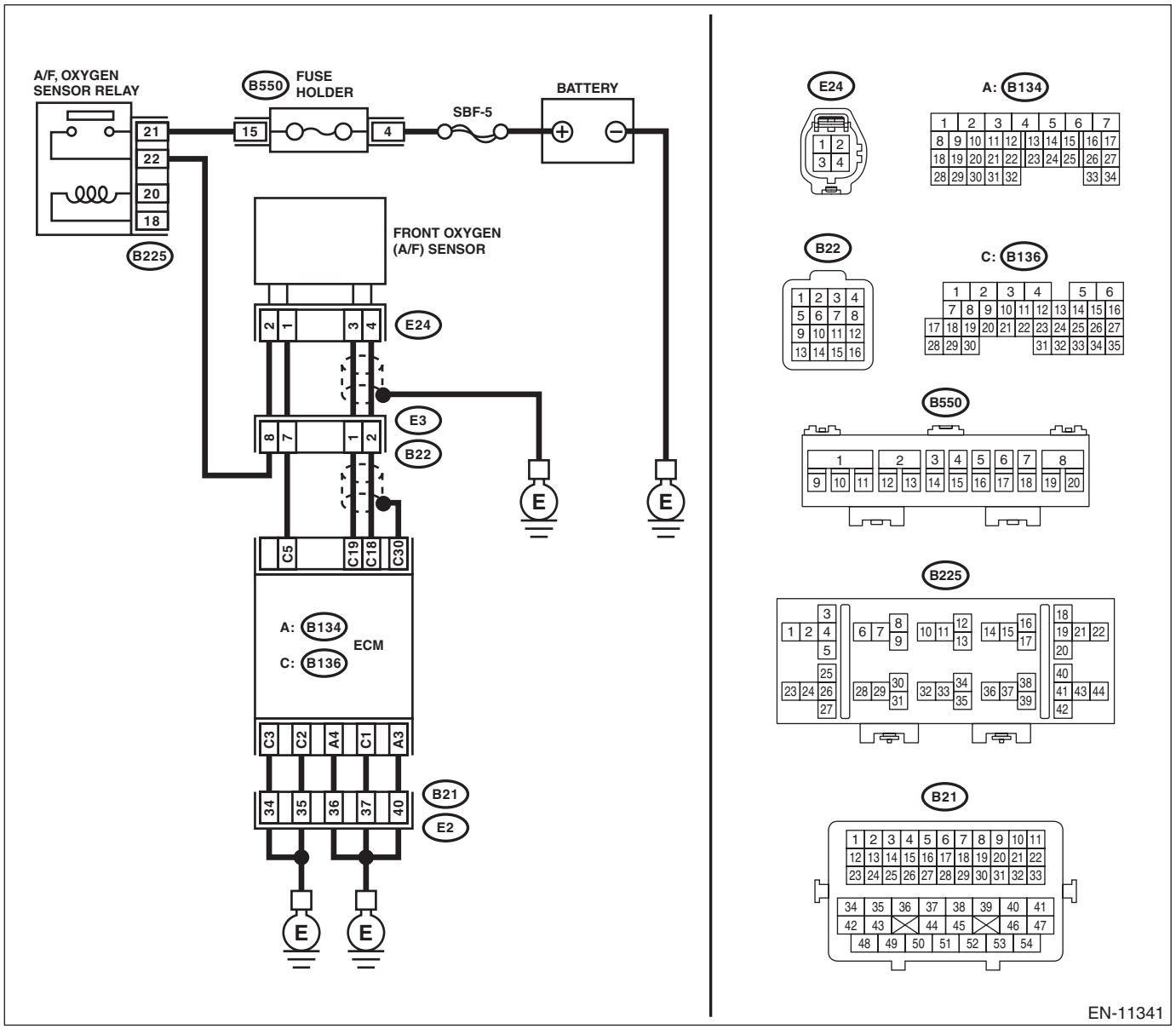
- Engine stalls.
- Improper idling

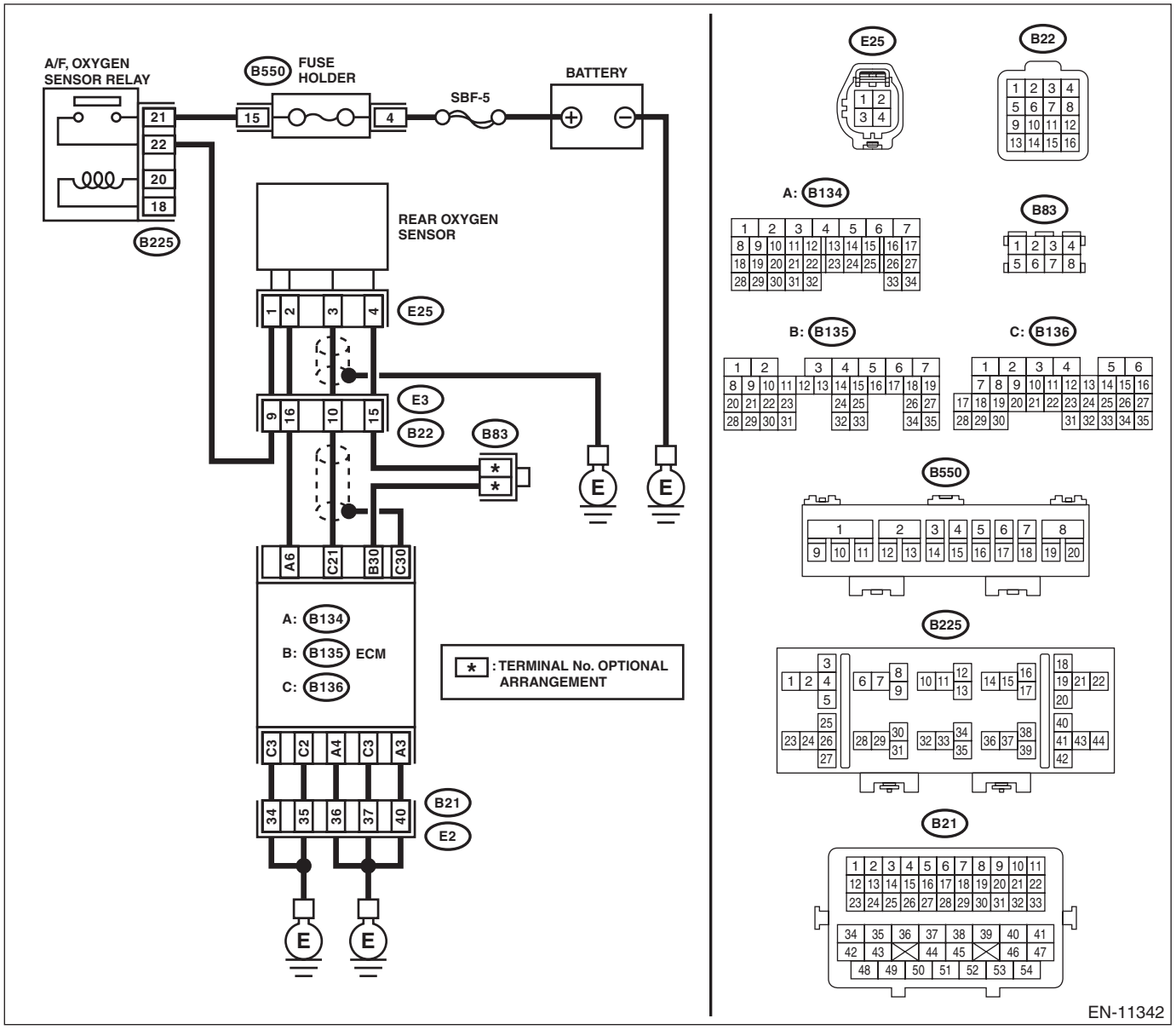
CAUTION:

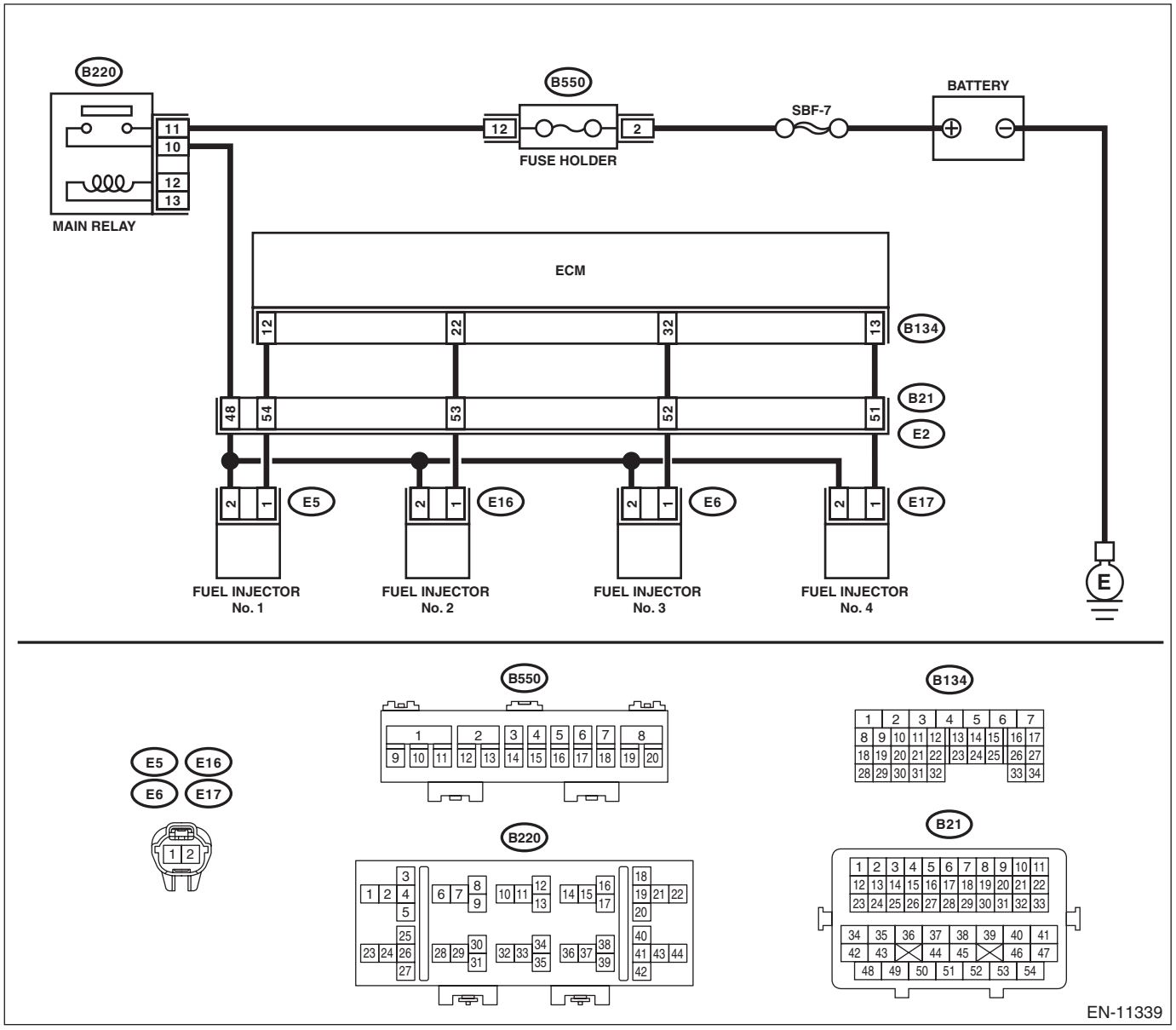
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>




A/F, OXYGEN SENSOR RELAY
B550 FUSE HOLDER
BATTERY
SBF-5
21
22
20
18
15
4
B225
REAR OXYGEN SENSOR
1 2 3 4
E25
9 16 10 15
E3
B22
B83
A6 C21 B30 C30
A: B134
B: B135 ECM
C: B136
C3 C2 A4 C3 A3
34 35 36 37 40
B21
E2
E
E
E
E
* : TERMINAL No. OPTIONAL ARRANGEMENT
E25
B22
A: B134
B83
B: B135
C: B136
B550
B225
B21
EN-11342



Step		Check	Yes	No
1	**CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **2**.
2	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and front oxygen (A/F) sensor. 3) Measure the resistance of harness between ECM connector and front oxygen (A/F) sensor connector. ***Connector & terminal*** ***(B136) No. 19 — (E24) No. 3:*** ***(B136) No. 18 — (E24) No. 4:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and front oxygen (A/F) sensor connector • Poor contact of coupling connector

	Step	Check	Yes	No
3	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 19 — Chassis ground:*** ***(B136) No. 18 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **4**.	Repair the short circuit to ground in harness between ECM connector and front oxygen (A/F) sensor connector.
4	**CHECK OUTPUT SIGNAL FOR ECM.** 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. ***Connector & terminal*** ***(E24) No. 3 (+) — Chassis ground (–):***	Is the voltage 4.5 V or more?	Go to step **6**.	Go to step **5**.
5	**CHECK OUTPUT SIGNAL FOR ECM.** Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. ***Connector & terminal*** ***(E24) No. 4 (+) — Chassis ground (–):***	Is the voltage 4.95 V or more?	Go to step **6**.	Go to step **7**.
6	**CHECK OUTPUT SIGNAL FOR ECM.** Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. ***Connector & terminal*** ***(E24) No. 3 (+) — Chassis ground (–):*** ***(E24) No. 4 (+) — Chassis ground (–):***	Is the voltage 8 V or more?	Repair the short circuit to power in the harness between ECM connector and front oxygen (A/F) sensor connector. After repair, replace the ECM. <Ref. to FU(H4DO(w/o HEV))-100, Engine Control Module (ECM).>	Repair the poor contact of ECM connector.
7	**CHECK EXHAUST SYSTEM.**	Are there holes or loose bolts on exhaust system?	Repair the exhaust system.	Go to step **8**.
8	**CHECK AIR INTAKE SYSTEM.**	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair the air intake system.	Go to step **9**.
9	**CHECK FUEL PRESSURE.** **WARNING:** **Place "NO OPEN FLAMES" signs near the working area.** **CAUTION:** **Be careful not to spill fuel.** 1) Connect the front oxygen (A/F) sensor connector. 2) Measure the fuel pressure. <Ref. to ME(H4DO(w/o HEV))-35, INSPECTION, Fuel Pressure.> **CAUTION:** **Release fuel pressure before removing the fuel pressure gauge.**	Is the measured value 340 — 400 kPa (3.5 — 4.1 kg/cm^2, 49 — 58 psi)?	Go to step **10**.	Check the fuel pump and fuel delivery line. <Ref. to FU(H4DO(w/o HEV))-142, INSPECTION, Fuel Pump.> <Ref. to FU(H4DO(w/o HEV))-170, INSPECTION, Fuel Delivery and Evaporation Lines.>

	Step	Check	Yes	No
10	**CHECK ENGINE COOLANT TEMPERATURE SENSOR.** 1) Start the engine and warm up completely. 2) Read the value of «Coolant Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Coolant Temp.» 75°C (167°F) or more?	Go to step **11**.	Replace the engine coolant temperature sensor. <Ref. to FU(H4DO(w/o HEV))-51, Engine Coolant Temperature Sensor.>
11	**CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.** 1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F). 2) For AT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Read the value of «Mass Air Flow» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Mass Air Flow» 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)?	Go to step **12**.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DO(w/o HEV))-73, Mass Air Flow and Intake Air Temperature Sensor.>

	Step	Check	Yes	No
12	**CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.** 1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F). 2) For AT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Open the front hood. 6) Measure the ambient temperature. 7) Read the value of «Intake Air Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Subtract ambient temperature from «Intake Air Temp.». Is the obtained value –10 — 50°C (–18 — 90°F)?	Go to step **13**.	Check the mass air flow and intake air temperature sensor. <Ref. to FU(H4DO(w/o HEV))-73, Mass Air Flow and Intake Air Temperature Sensor.>
13	**CHECK REAR OXYGEN SENSOR DATA.** 1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), and keep the engine speed at 3,000 rpm. (2 minutes maximum) 2) Read the value of «Rear O2 Sensor» using the Subaru Select Monitor or a general scan tool. NOTE: • Depress the clutch pedal (MT model) • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Rear O2 Sensor» 0.490 V or more?	Go to step **14**.	Go to step **15**.
14	**CHECK REAR OXYGEN SENSOR DATA.** 1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), and rapidly reduce the engine speed from 3,000 rpm. 2) Read the value of «Rear O2 Sensor» using the Subaru Select Monitor or a general scan tool. NOTE: • Depress the clutch pedal (MT model) • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Rear O2 Sensor» 0.250 V or less?	Go to step **16**.	Go to step **15**.

Step		Check	Yes	No
15	**CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **17**.
16	**CHECK FRONT OXYGEN (A/F) SENSOR USING REAR OXYGEN SENSOR SIGNAL.** 1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), then keep the engine idling for 5 minutes or more. 2) Read the value of «Rear O2 Sensor» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DO w/o HEV)(diag)-37, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value in «Rear O2 Sensor» kept at 0.250 V or less for 5 minutes or more?	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DO(w/o HEV))-92, Front Oxygen (A/F) Sensor.>	Go to step **17**.
17	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM connector and rear oxygen sensor connector. ***Connector & terminal*** ***(B136) No. 21 — (E25) No. 3:*** ***(B135) No. 30 — (E25) No. 4:***	Is the resistance less than 1 Ω?	Go to step **18**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and rear oxygen sensor connector • Poor contact of coupling connector
18	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between rear oxygen sensor connector and chassis ground. ***Connector & terminal*** ***(E25) No. 3 (+) — Chassis ground (–):***	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H4DO(w/o HEV))-92, Front Oxygen (A/F) Sensor.>	Go to step **19**.
19	**CHECK OUTPUT SIGNAL OF ECM.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground on faulty cylinders. ***Connector & terminal*** ***#1 (B134) No. 12 (+) — Chassis ground (–):*** ***#2 (B134) No. 22 (+) — Chassis ground (–):*** ***#3 (B134) No. 32 (+) — Chassis ground (–):*** ***#4 (B134) No. 13 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **24**.	Go to step **20**.

	Step	Check	Yes	No
20	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector on faulty cylinders. 3) Measure the resistance between fuel injector connector and engine ground on faulty cylinders. ***Connector & terminal*** ***#1 (E5) No. 1 — Engine ground:*** ***#2 (E16) No. 1 — Engine ground:*** ***#3 (E6) No. 1 — Engine ground:*** ***#4 (E17) No. 1 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **21**.	Repair the short circuit to ground in harness between ECM connector and fuel injector connector.
21	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** Measure the resistance of harness between ECM and fuel injector connector on faulty cylinders. ***Connector & terminal*** ***#1 (B134) No. 12 — (E5) No. 1:*** ***#2 (B134) No. 22 — (E16) No. 1:*** ***#3 (B134) No. 32 — (E6) No. 1:*** ***#4 (B134) No. 13 — (E17) No. 1:***	Is the resistance less than 1 Ω?	Go to step **22**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and fuel injector connector • Poor contact of coupling connector
22	**CHECK FUEL INJECTOR.** Measure the resistance between fuel injector terminals on faulty cylinder. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 5 — 20 Ω?	Go to step **23**.	Replace the faulty fuel injector. <Ref. to FU(H4DO(w/o HEV))-79, Fuel Injector.>
23	**CHECK POWER SUPPLY LINE.** 1) Turn the ignition switch to ON. 2) Measure the voltage between fuel injector connector of faulty cylinders and engine ground. ***Connector & terminal*** ***#1 (E5) No. 2 (+) — Engine ground (–):*** ***#2 (E16) No. 2 (+) — Engine ground (–):*** ***#3 (E6) No. 2 (+) — Engine ground (–):*** ***#4 (E17) No. 2 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Repair the poor contact of all connectors in fuel injector circuit.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between the main relay and fuel injector connector on faulty cylinders • Poor contact of coupling connector • Poor contact of main relay connector
24	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector on faulty cylinders. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground on faulty cylinders. ***Connector & terminal*** ***#1 (B134) No. 12 (+) — Chassis ground (–):*** ***#2 (B134) No. 22 (+) — Chassis ground (–):*** ***#3 (B134) No. 32 (+) — Chassis ground (–):*** ***#4 (B134) No. 13 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in harness between ECM connector and fuel injector connectors.	Go to step **25**.

	Step	Check	Yes	No
25	**CHECK FUEL INJECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between fuel injector terminals on faulty cylinder. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 5 — 20 Ω?	Go to step **26**.	Replace the faulty fuel injector. <Ref. to FU(H4DO(w/o HEV))-79, Fuel Injector.>
26	**CHECK INSTALLATION CONDITION OF CAMSHAFT POSITION SENSOR/CRANKSHAFT POSITION SENSOR.**	Is the camshaft position sensor or crankshaft position sensor loosely installed?	Tighten the camshaft position sensor or crankshaft position sensor. <Ref. to FU(H4DO(w/o HEV))-61, INSTALLATION, Camshaft Position Sensor.> <Ref. to FU(H4DO(w/o HEV))-56, INSTALLATION, Crankshaft Position Sensor.>	Go to step **27**.
27	**CHECK CRANKSHAFT POSITION SENSOR PLATE.**	Is the crankshaft position sensor plate rusted or does it have broken teeth?	Replace the crankshaft position sensor plate. <Ref. to ME(H4DO(w/o HEV))-304, Cylinder Block.>	Go to step **28**.
28	**CHECK INSTALLATION CONDITION OF TIMING CHAIN.** Turn the crankshaft using ST, and align the alignment mark on crank sprocket with alignment mark on cylinder block. ST 18252AA000 CRANKSHAFT SOCKET	Is the timing chain dislocated from its proper position?	Correct the installation condition of timing chain. <Ref. to ME(H4DO(w/o HEV))-169, Timing Chain Assembly.>	Go to step **29**.
29	**CHECK FUEL LEVEL.**	Is the fuel meter indication higher than the “Lower” level?	Go to step **30**.	Refill the fuel so that the fuel meter indication is higher than the “Lower” level, and proceed to the next step. Go to step **30**.
30	**CHECK STATUS OF MALFUNCTION INDICATOR LIGHT.** 1) Clear the memory using the Subaru Select Monitor or general scan tool. <Ref. to EN(H4DO w/o HEV)(diag)-65, Clear Memory Mode.> 2) Start the engine, and drive the vehicle 10 minutes or more.	Does the malfunction indicator light illuminate or blink?	Go to step **32**.	Go to step **31**.

	Step	Check	Yes	No
31	**CHECK CAUSE OF MISFIRE.**	Was the cause of misfire identified when the engine is running?	Finish diagnostics operation, if the engine has no abnormality.	Repair the poor contact of connector. NOTE: In this case, repair the following item: • Poor contact of ignition coil connector • Poor contact of fuel injector connector on faulty cylinders • Poor contact of ECM connector • Poor contact of coupling connector
32	**CHECK AIR INTAKE SYSTEM.**	Is there any fault in air intake system?	Repair the air intake system. NOTE: Check the following items. • Are there air leaks or air suction caused by loose or dislocated nuts and bolts? • Are there cracks or any disconnection of hoses?	Go to step **33**.
33	**CHECK MISFIRE SYMPTOM.** 1) Turn the ignition switch to ON. 2) Check for DTC. <Ref. to EN(H4DO w/o HEV)(diag)-49, Read Diagnostic Trouble Code (DTC).>	Does the Subaru Select Monitor or general scan tool indicate only one DTC?	Go to step **36**.	Go to step **34**.
34	**CHECK DTC.**	Is DTC P0301 and P0303 displayed on the Subaru Select Monitor or general scan tool?	Go to step **37**.	Go to step **35**.
35	**CHECK DTC.**	Is DTC P0302 and P0304 displayed on the Subaru Select Monitor or general scan tool?	Go to step **38**.	Go to step **39**.
36	**ONLY ONE CYLINDER.**	Is there any fault in the cylinder?	Repair or replace faulty parts. NOTE: Check the following items. • Spark plug • Ignition coil • Fuel injector • Compression ratio	Go to DTC P0171. <Ref. to EN(H4DO w/o HEV)(diag)-178, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Step		Check	Yes	No
37	GROUP OF #1 AND #3 CYLINDERS.	Are there any faults in #1 and #3 cylinders?	Repair or replace faulty parts. NOTE: Check the following items. • Spark plug • Ignition coil • Fuel injector • Compression ratio • Skipping timing belt teeth	Go to DTC P0171. <Ref. to EN(H4DO w/o HEV)(diag)-178, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
38	GROUP OF #2 AND #4 CYLINDERS.	Are there any faults in #2 and #4 cylinders?	Repair or replace faulty parts. NOTE: Check the following items. • Spark plug • Ignition coil • Fuel injector • Compression ratio • Skipping timing belt teeth	Go to DTC P0171. <Ref. to EN(H4DO w/o HEV)(diag)-178, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
39	CYLINDER AT RANDOM.	Is the engine idle rough?	Go to DTC P0171. <Ref. to EN(H4DO w/o HEV)(diag)-178, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Repair or replace faulty parts. NOTE: Check the following items. • Spark plug • Ignition coil • Fuel injector • Compression ratio

FD:DTC P2270 O2 SENSOR SIGNAL BIASED/STUCK LEAN (BANK 1 SENSOR 2)

DTC DETECTING CONDITION:

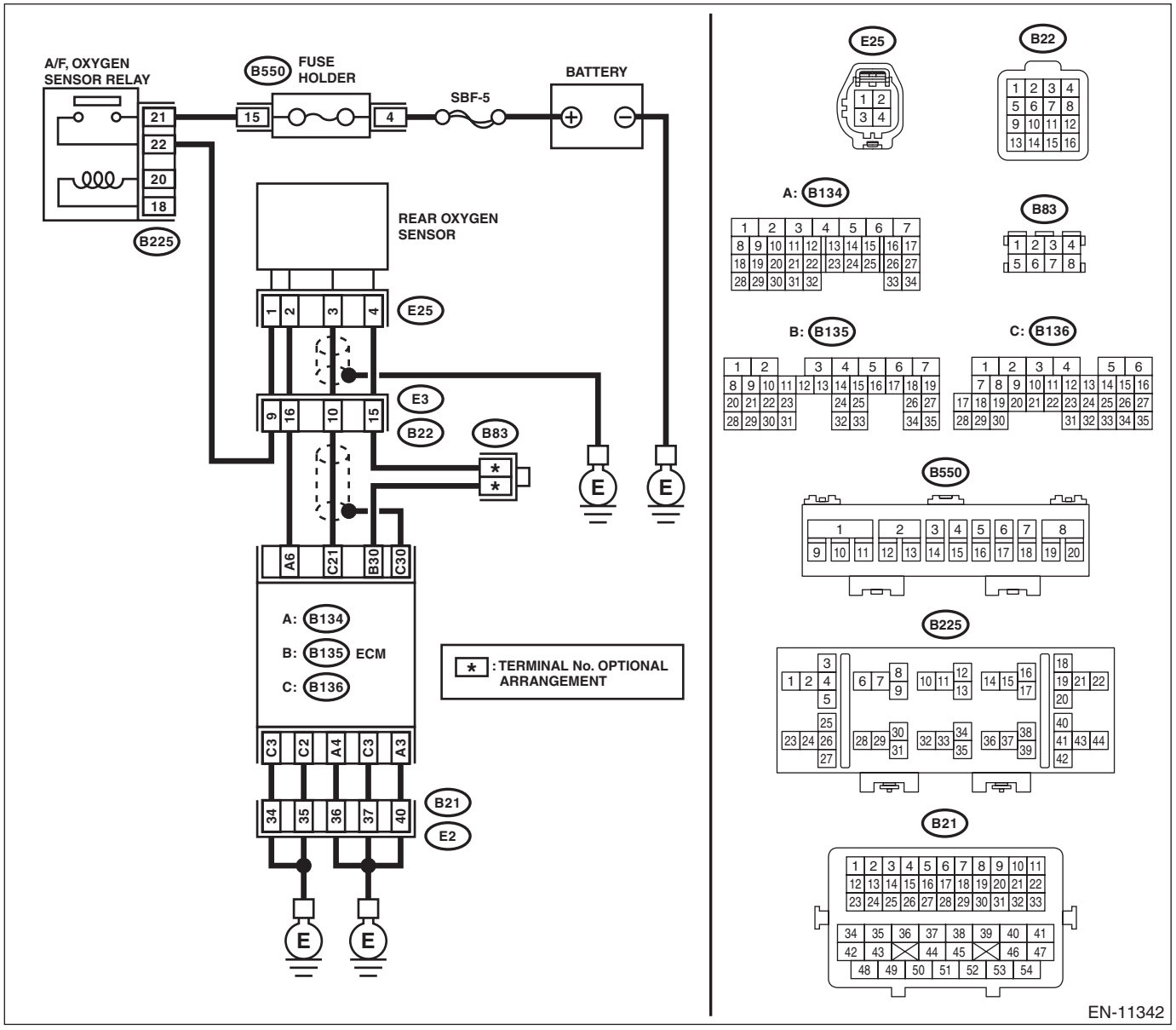
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-199, DTC P2270 O2 SENSOR SIGNAL BIASED/STUCK LEAN (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



Step		Check	Yes	No
1	**CHECK REAR OXYGEN SENSOR CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **2**.

	Step	Check	Yes	No
2	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM connector and rear oxygen sensor connector. ***Connector & terminal*** ***(E135) No. 30 — (E25) No. 4:*** ***(E136) No. 21 — (E25) No. 3:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the open circuit of harness between ECM connector and rear oxygen sensor connector.
3	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between rear oxygen sensor connector and engine ground. ***Connector & terminal*** ***(E25) No. 3 (+) — Engine ground (–):***	Is the voltage 0.15 V or more?	Repair the short circuit to power in the harness between ECM connector and rear oxygen sensor connector.	Go to step **4**.
4	**CHECK EXHAUST SYSTEM.** Check exhaust system parts. NOTE: Check the following items. • Looseness and improper fitting of exhaust system parts • Damage (crack, hole etc.) of parts • Damage (crack, hole etc.) between front oxygen (A/F) sensor and rear oxygen sensor	Is there any fault in exhaust system?	Repair or replace faulty parts.	Replace the rear oxygen sensor. <Ref. to FU(H4DO(w/o HEV))-96, Rear Oxygen Sensor.>

FE:DTC P2271 O2 SENSOR SIGNAL BIASED/STUCK RICH (BANK 1 SENSOR 2)

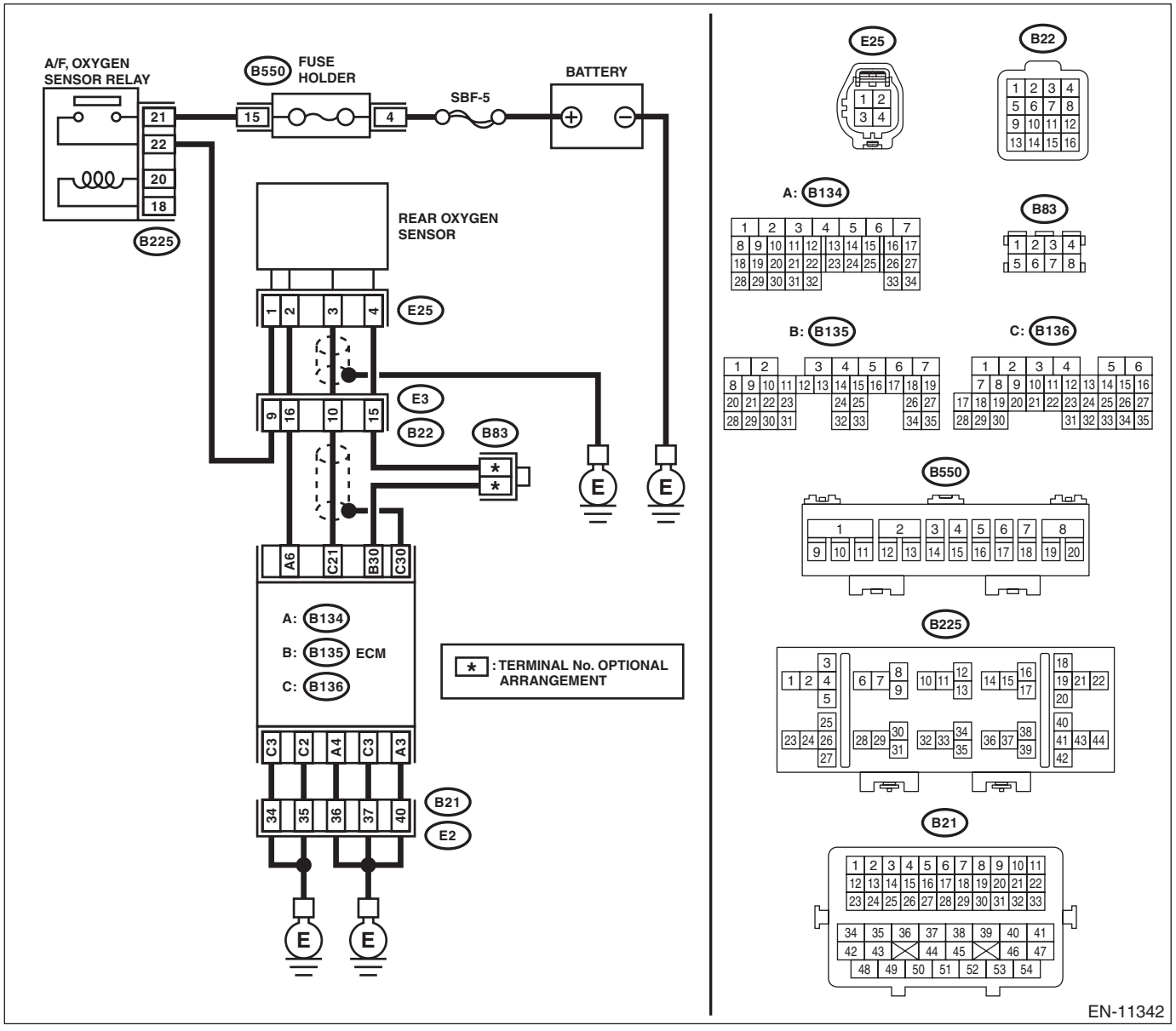
DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-201, DTC P2271 O2 SENSOR SIGNAL BIASED/STUCK RICH (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



Step		Check	Yes	No
1	**CHECK REAR OXYGEN SENSOR CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **2**.

	Step	Check	Yes	No
2	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM connector and rear oxygen sensor connector. ***Connector & terminal*** ***(E135) No. 30 — (E25) No. 4:*** ***(E136) No. 21 — (E25) No. 3:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the open circuit of harness between ECM connector and rear oxygen sensor connector.
3	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** Measure the resistance between the ECM connector and engine ground. ***Connector & terminal*** ***(E135) No. 30 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **4**.	Repair the short circuit to ground in harness between ECM connector and rear oxygen sensor connector.
4	**CHECK EXHAUST SYSTEM.** Check exhaust system parts. NOTE: Check the following items. • Looseness and improper fitting of exhaust system parts • Damage (crack, hole etc.) of parts • Damage (crack, hole etc.) between front oxygen (A/F) sensor and rear oxygen sensor	Is there any fault in exhaust system?	Repair or replace faulty parts.	Replace the rear oxygen sensor. <Ref. to FU(H4DO(w/o HEV))-96, Rear Oxygen Sensor.>

FF: DTC P2401 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP CONTROL CIRCUIT LOW

DTC DETECTING CONDITION:

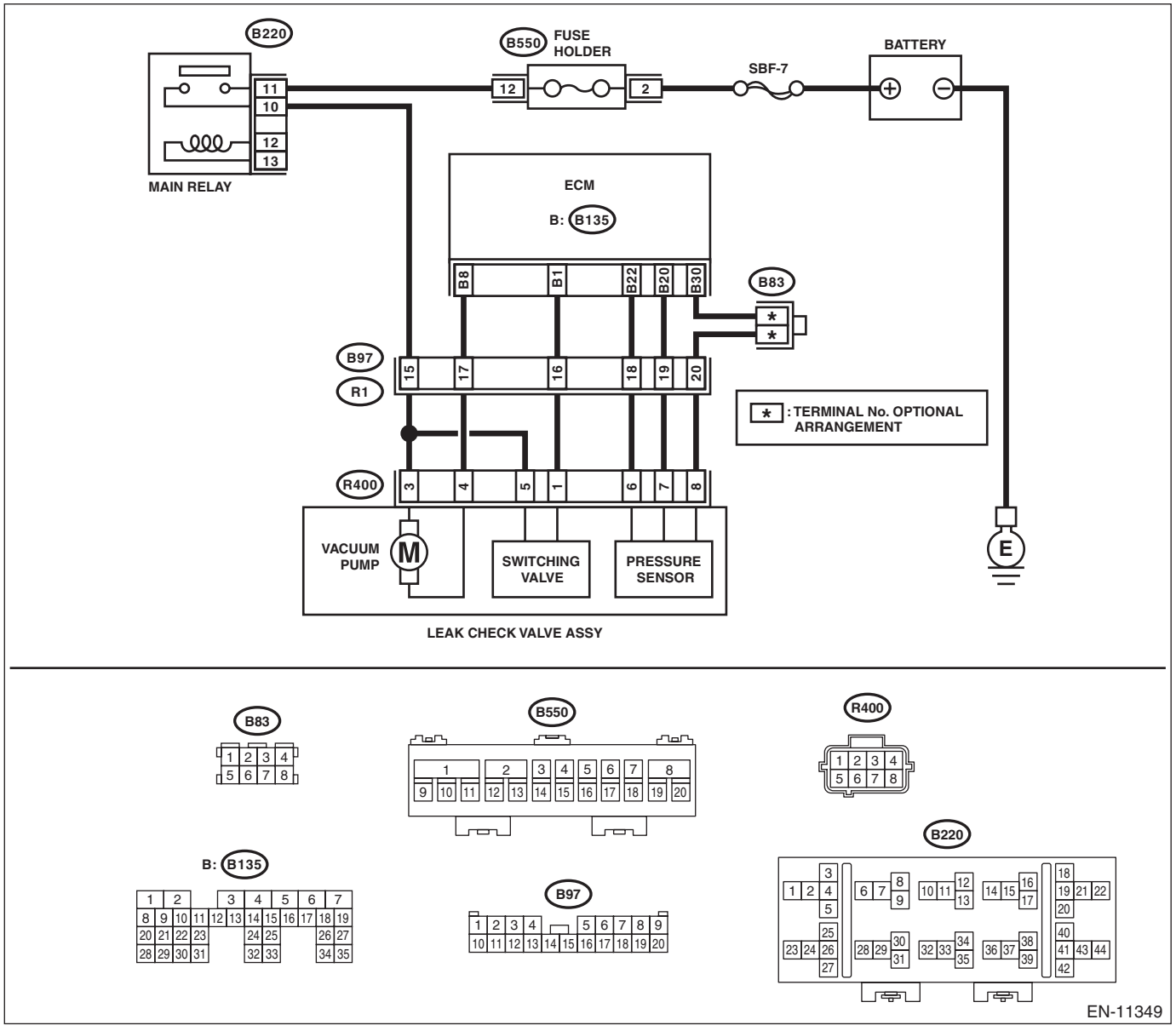
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-202, DTC P2401 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP CONTROL CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 18 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **2**.	Go to step **3**.
2	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM connector.	Is there poor contact of ECM connector?	Repair the poor contact of ECM connector.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary open or short circuit of harness or temporary poor contact of connector may be the cause.
3	**CHECK POWER SUPPLY TO LEAK CHECK VALVE ASSEMBLY.** Measure the voltage between the leak check valve assembly connector and engine ground. ***Connector & terminal*** ***(R400) No. 3 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **4**.	Repair the power supply circuit.
4	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and the leak check valve assembly. 3) Measure the resistance between leak check valve assembly and chassis ground. ***Connector & terminal*** ***(R400) No. 4 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the short circuit to ground in harness between ECM connector and leak check valve assembly connector.
5	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** Measure the resistance of harness between ECM connector and the leak check valve assembly connector. ***Connector & terminal*** ***(B135) No. 18 — (R400) No. 4:***	Is the resistance less than 1 Ω?	Go to step **6**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and the leak check valve assembly connector • Poor contact of coupling connector

Step		Check	Yes	No
6	**CHECK LEAK CHECK VALVE ASSEMBLY.** Check the vacuum pump of the leak check valve assembly. <Ref. to EC(H4DO(w/o HEV))-60, CHECK VACUUM PUMP, INSPECTION, Leak Check Valve Assembly.>	Is the vacuum pump of the leak check valve assembly OK?	Repair the poor contact in the leak check valve assembly connector.	Replace the leak check valve assembly. <Ref. to EC(H4DO(w/o HEV))-43, Leak Check Valve Assembly.>

FG:DTC P2402 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP CONTROL CIRCUIT HIGH

DTC DETECTING CONDITION:

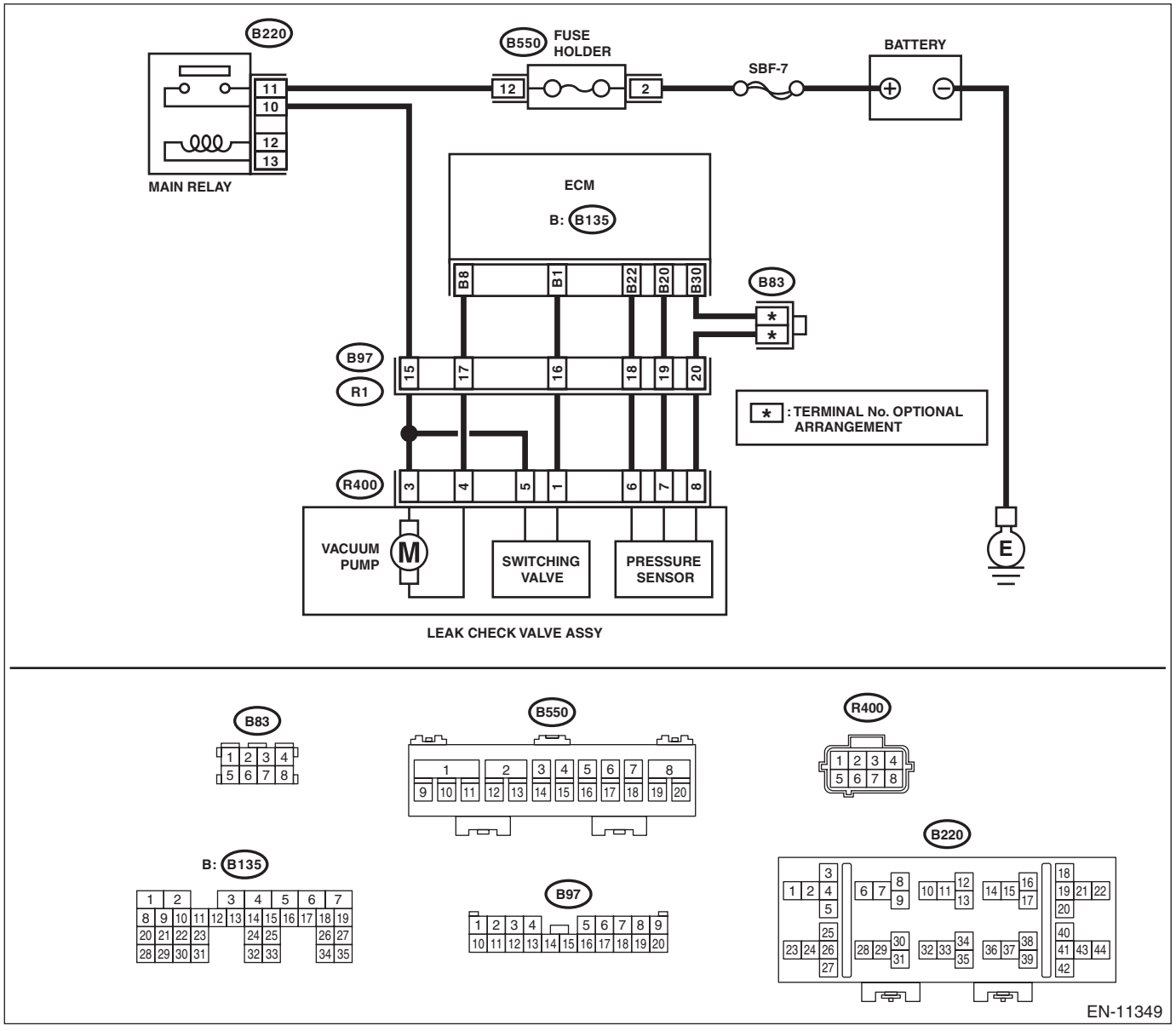
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-203, DTC P2402 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP CONTROL CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the leak check valve assembly. 3) Turn the ignition switch to ON. 4) Measure the voltage between leak check valve assembly and chassis ground. ***Connector & terminal*** ***(R400) No. 4 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in harness between ECM connector and leak check valve assembly connector.	Go to step **2**.
2	**CHECK LEAK CHECK VALVE ASSEMBLY.** 1) Turn the ignition switch to OFF. 2) Check the vacuum pump of the leak check valve assembly. <Ref. to EC(H4DO(w/o HEV))-60, CHECK VACUUM PUMP, INSPECTION, Leak Check Valve Assembly.>	Is the vacuum pump of the leak check valve assembly OK?	Repair the poor contact in the leak check valve assembly connector.	Replace the leak check valve assembly. <Ref. to EC(H4DO(w/o HEV))-43, Leak Check Valve Assembly.>

FH:DTC P2404 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP SENSE CIRCUIT RANGE/PERFORMANCE

DTC DETECTING CONDITION:

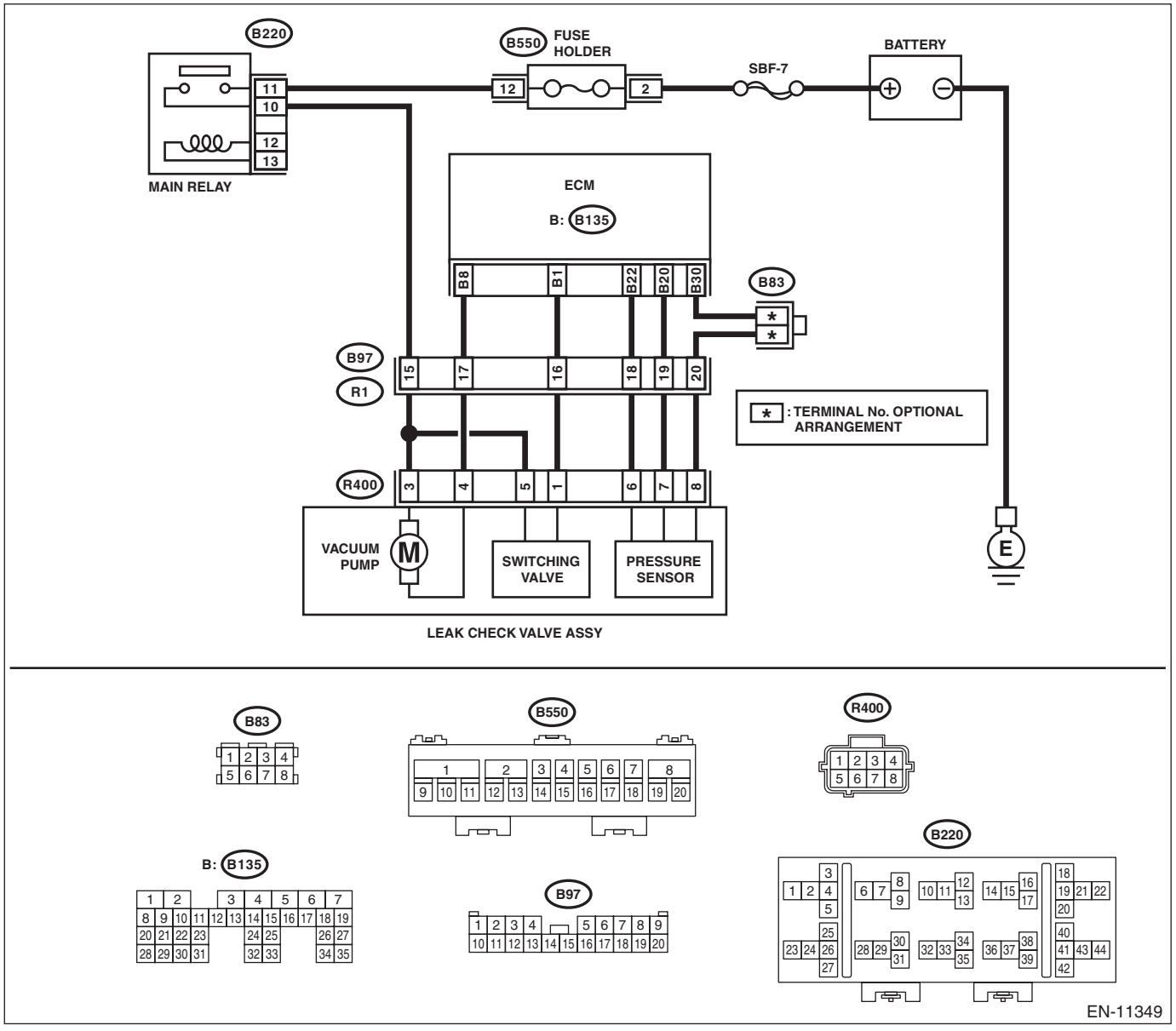
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-204, DTC P2404 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP SENSE CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK ELCM PUMP.** Operate the ELCM pump using the Subaru Select Monitor. NOTE: For detailed procedures, refer to "System Operation Check Mode". <Ref. to EN(H4DO w/o HEV)(diag)-66, System Operation Check Mode.>	Does the ELCM pump operate?	Go to step **6**.	Go to step **3**.
3	**CHECK POWER SUPPLY OF LEAK CHECK VALVE ASSEMBLY.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the leak check valve assembly. 3) Turn the ignition switch to ON. 4) Measure the voltage between the leak check valve assembly connector and chassis ground. ***Connector & terminal*** ***(R400) No. 3 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between the main relay and the leak check valve assembly connector • Poor contact of main relay connector • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM connector and the leak check valve assembly connector. ***Connector & terminal*** ***(B135) No. 18 — (R400) No. 4:***	Is the resistance less than 1 Ω?	Go to step **5**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and the leak check valve assembly connector • Poor contact of coupling connector
5	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** 1) Measure the resistance of harness between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 18 — Chassis ground:***	Is the resistance 1 MΩ or more?	Replace the leak check valve assembly. <Ref. to EC(H4DO(w/o HEV))-43, Leak Check Valve Assembly.>	Repair the short circuit to ground in harness between ECM connector and leak check valve assembly connector.

	Step	Check	Yes	No
6	**CHECK ELCM SWITCHING VALVE.** Operate the ELCM switching valve using the Subaru Select Monitor. NOTE: For detailed procedures, refer to "System Operation Check Mode". <Ref. to EN(H4DO w/o HEV)(diag)-66, System Operation Check Mode.>	Does the ELCM switching valve operate?	Go to step **10**.	Go to step **7**.
7	**CHECK POWER SUPPLY OF LEAK CHECK VALVE ASSEMBLY.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the leak check valve assembly. 3) Turn the ignition switch to ON. 4) Measure the voltage between the leak check valve assembly connector and chassis ground. ***Connector & terminal*** ***(R400) No. 5 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **8**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between the main relay and the leak check valve assembly connector • Poor contact of main relay connector • Poor contact of coupling connector
8	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM connector and the leak check valve assembly connector. ***Connector & terminal*** ***(B135) No. 1 — (R400) No. 1:***	Is the resistance less than 1 Ω?	Go to step **9**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and the leak check valve assembly connector • Poor contact of coupling connector
9	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** 1) Measure the resistance of harness between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 1 — Chassis ground:***	Is the resistance 1 MΩ or more?	Replace the leak check valve assembly. <Ref. to EC(H4DO(w/o HEV))-43, Leak Check Valve Assembly.>	Repair the short circuit to ground in harness between ECM connector and leak check valve assembly connector.

Step		Check	Yes	No
10	**CHECK EVAPORATIVE EMISSION CONTROL SYSTEM.** Perform drive cycle I. <Ref. to EN(H4DO w/o HEV)(diag)-61, DRIVE CYCLE I, PROCEDURE, Drive Cycle.>	Is DTC P2404 displayed on the display?	Replace the leak check valve assembly. <Ref. to EC(H4DO(w/o HEV))-43, Leak Check Valve Assembly.>	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.

FI: DTC P2419 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT LOW

DTC DETECTING CONDITION:

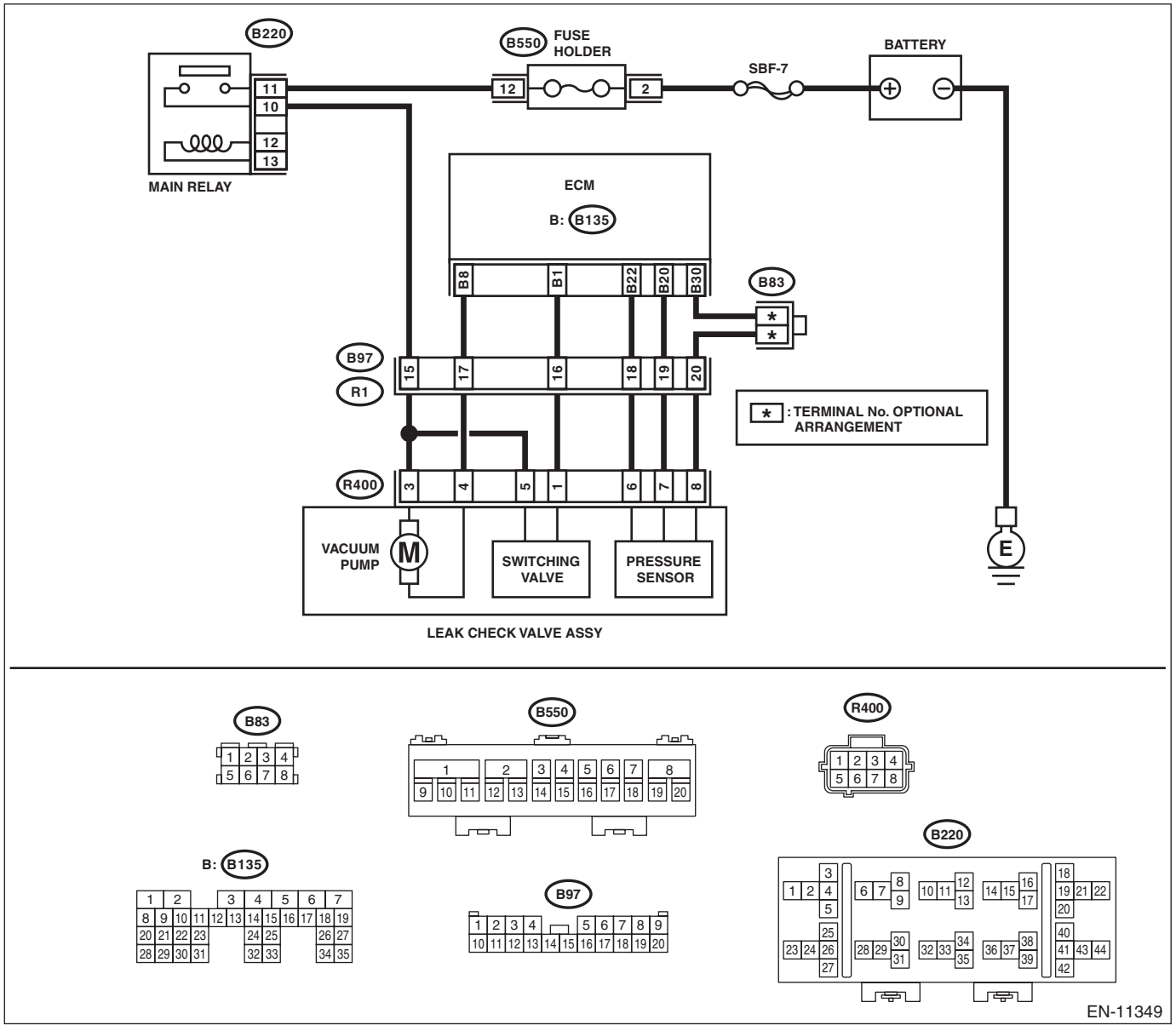
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-205, DTC P2419 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 4 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **2**.	Go to step **3**.
2	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM connector.	Is there poor contact of ECM connector?	Repair the poor contact of ECM connector.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary open or short circuit of harness or temporary poor contact of connector may be the cause.
3	**CHECK POWER SUPPLY TO LEAK CHECK VALVE ASSEMBLY.** Measure the voltage between the leak check valve assembly connector and engine ground. ***Connector & terminal*** ***(R400) No. 5 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **4**.	Repair the power supply circuit.
4	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and the leak check valve assembly. 3) Measure the resistance between leak check valve assembly and chassis ground. ***Connector & terminal*** ***(R400) No. 1 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the short circuit to ground in harness between ECM connector and leak check valve assembly connector.
5	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** Measure the resistance of harness between ECM connector and the leak check valve assembly connector. ***Connector & terminal*** ***(B135) No. 1 — (R400) No. 1:***	Is the resistance less than 1 Ω?	Go to step **6**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector and the leak check valve assembly connector • Poor contact of coupling connector

Step		Check	Yes	No
6	**CHECK LEAK CHECK VALVE ASSEMBLY.** Check the switching valve of the leak check valve assembly. <Ref. to EC(H4DO(w/o HEV))-59, CHECK SWITCHING VALVE, INSPECTION, Leak Check Valve Assembly.>	Is the switching valve of the leak check valve assembly OK?	Repair the poor contact in the leak check valve assembly connector.	Replace the leak check valve assembly. <Ref. to EC(H4DO(w/o HEV))-43, Leak Check Valve Assembly.>

FJ: DTC P2420 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT HIGH

DTC DETECTING CONDITION:

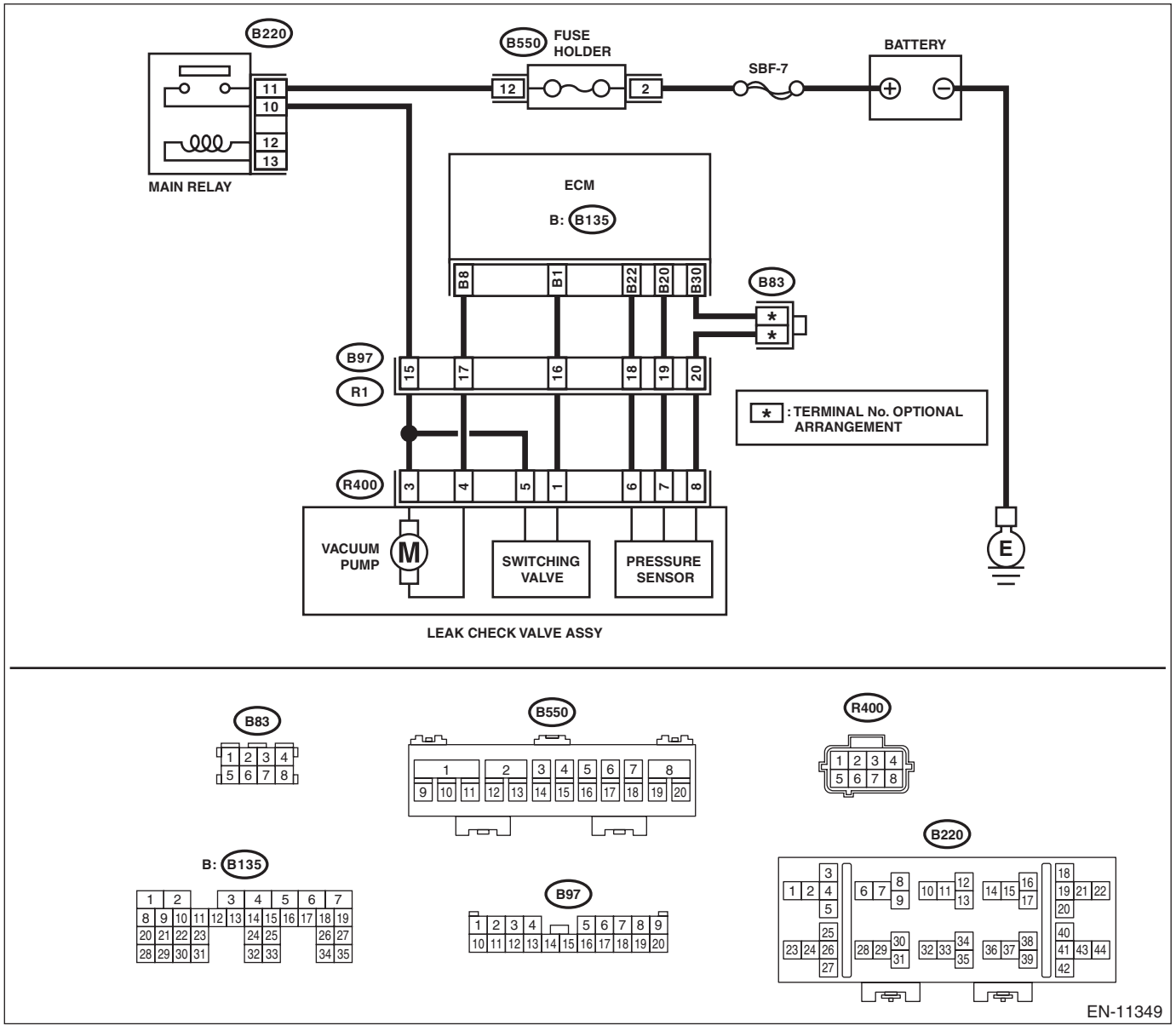
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-206, DTC P2420 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the leak check valve assembly. 3) Turn the ignition switch to ON. 4) Measure the voltage between leak check valve assembly and chassis ground. ***Connector & terminal*** ***(R400) No. 1 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in harness between ECM connector and leak check valve assembly connector.	Go to step **2**.
2	**CHECK LEAK CHECK VALVE ASSEMBLY.** 1) Turn the ignition switch to OFF. 2) Check the switching valve of the leak check valve assembly. <Ref. to EC(H4DO(w/o HEV))-59, CHECK SWITCHING VALVE, INSPECTION, Leak Check Valve Assembly.>	Is the switching valve of the leak check valve assembly OK?	Repair the poor contact in the leak check valve assembly connector.	Replace the leak check valve assembly. <Ref. to EC(H4DO(w/o HEV))-43, Leak Check Valve Assembly.>

FK:DTC P2530 IGNITION SWITCH RUN POSITION CIRCUIT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-207, DTC P2530 IGNITION SWITCH RUN POSITION CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

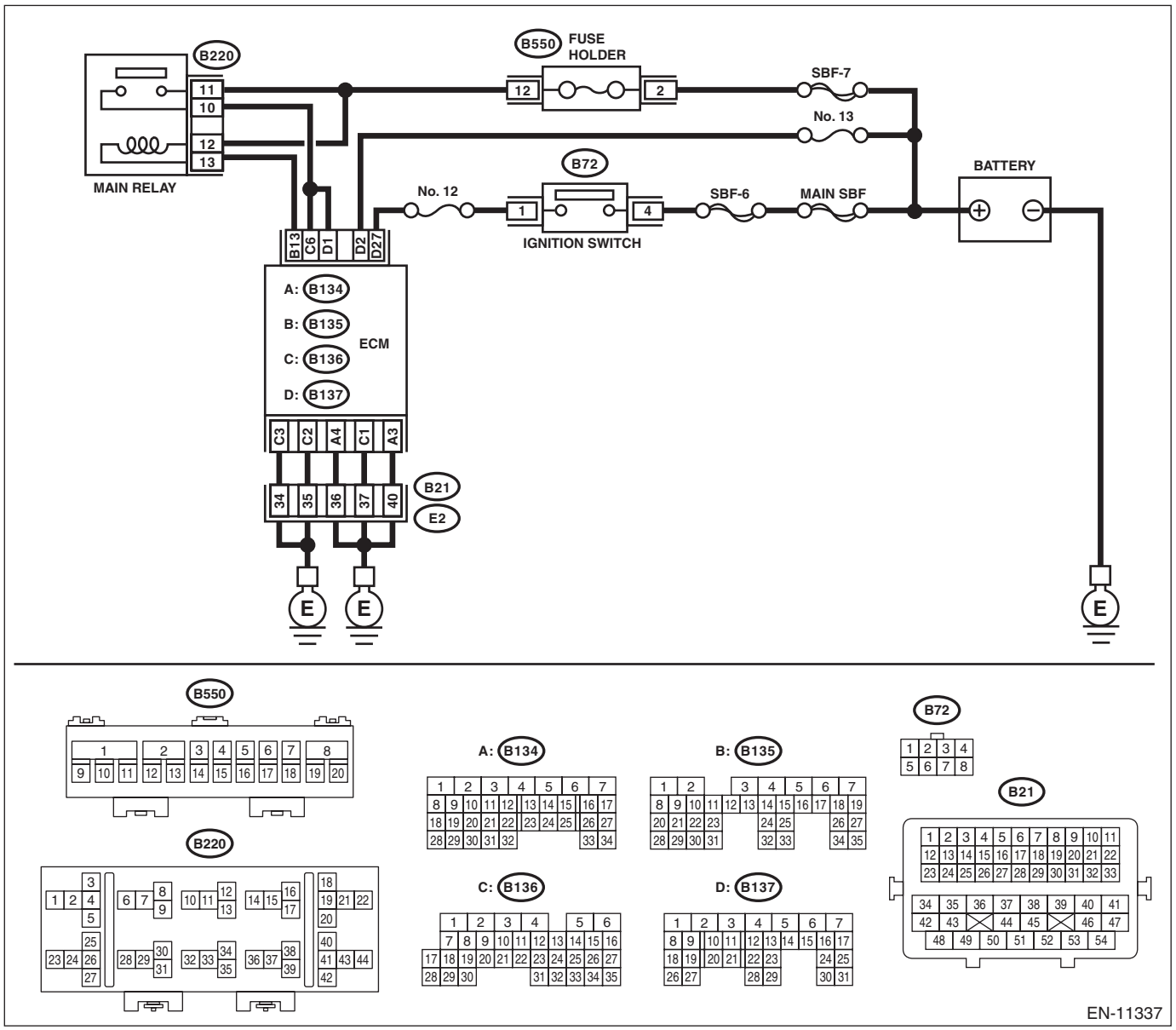
Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system <Ref. to WI(w/o HEV)-98, Engine Electrical System.>



Step		Check	Yes	No
1	**CHECK ECM CONNECTOR.** Check the connecting condition of ECM connector.	Is the ECM connector correctly connected?	Go to step **2**.	Connect the ECM connector correctly.

Step		Check	Yes	No
2	**CHECK INPUT VOLTAGE OF ECM.** 1) Turn the ignition switch to ON. 2) Connect the check board. ST 18460AA050 CHECK BOARD 3) Measure the voltage between ECM connector and engine ground while wiggling the harness between ECM connector and F/B connector. ***Connector & terminal*** ***(B137) No. 2 (+) — Engine ground (–):***	Is the voltage 8 V or more all the time?	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, the following items may be the cause of fault. • Open circuit or short circuit to ground in harness between ECM connector and F/B connector • Poor contact of fuse (F/B No. 5) • Poor contact of IG2 relay connector • Poor contact of IG2 relay	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit or short circuit to ground in harness between ECM connector and F/B connector • Poor contact of fuse (F/B No. 5) • Poor contact of IG2 relay connector • Poor contact of IG2 relay

FL: DTC P2610 ECM/PCM INTERNAL ENGINE OFF TIMER PERFORMANCE

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DO w/o HEV)-208, DTC P2610 ECM/PCM INTERNAL ENGINE OFF TIMER PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.>.

Step		Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check DTC using “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4DO w/o HEV)(diag)-96, List of Diagnostic Trouble Code (DTC).>	Replace the ECM. <Ref. to FU(H4DO(w/o HEV))-100, Engine Control Module (ECM).> NOTE: The soak timer IC is built into the ECM.

FM:DTC U0073 CONTROL MODULE COMMUNICATION BUS OFF

NOTE:
For the diagnostic procedure, refer to LAN section. <Ref. to LAN(w/o HEV)(diag)-2, Basic Diagnostic Procedure.>

FN:DTC U0101 LOST COMMUNICATION WITH TCM

NOTE:
For the diagnostic procedure, refer to LAN section. <Ref. to LAN(w/o HEV)(diag)-2, Basic Diagnostic Procedure.>

FO:DTC U0122 LOST COMMUNICATION WITH VEHICLE DYNAMICS CONTROL MODULE

NOTE:
For the diagnostic procedure, refer to LAN section. <Ref. to LAN(w/o HEV)(diag)-2, Basic Diagnostic Procedure.>

FP:DTC U0155 LOST COMMUNICATION WITH INSTRUMENT PANEL CLUSTER (IPC) CONTROL MODULE

NOTE:
For the diagnostic procedure, refer to LAN section. <Ref. to LAN(w/o HEV)(diag)-2, Basic Diagnostic Procedure.>

FQ:DTC U0402 INVALID DATA RECEIVED FROM TCM

NOTE:
For the diagnostic procedure, refer to LAN section. <Ref. to LAN(w/o HEV)(diag)-2, Basic Diagnostic Procedure.>

FR:DTC U0416 INVALID DATA RECEIVED FROM VEHICLE DYNAMICS CONTROL MODULE

NOTE:
For the diagnostic procedure, refer to LAN section. <Ref. to LAN(w/o HEV)(diag)-2, Basic Diagnostic Procedure.>

FS:DTC U0423 INVALID DATA RECEIVED FROM INSTRUMENT PANEL CLUSTER CONTROL MODULE

NOTE:
For the diagnostic procedure, refer to LAN section. <Ref. to LAN(w/o HEV)(diag)-2, Basic Diagnostic Procedure.>

20.General Diagnostic Table

A: INSPECTION

1. ENGINE

NOTE:
Malfunction of parts other than those listed is also possible. <Ref. to ME(H4DO(w/o HEV))-421, Engine Trouble in General.>

Symptoms	Faulty parts
1. Engine stalls during idling.	1) Manifold absolute pressure sensor 2) Mass air flow and intake air temperature sensor 3) Ignition parts (*1) 4) Engine coolant temperature sensor (*2) 5) Crankshaft position sensor (*3) 6) Camshaft position sensor (*3) 7) Fuel injection parts (*4) 8) Electronic throttle control
2. Rough idling	1) Manifold absolute pressure sensor 2) Mass air flow and intake air temperature sensor 3) Engine coolant temperature sensor (*2) 4) Ignition parts (*1) 5) Air intake system (*5) 6) Fuel injection parts (*4) 7) Electronic throttle control 8) Crankshaft position sensor (*3) 9) Camshaft position sensor (*3) 10) Oxygen sensor 11) Fuel pump and fuel pump relay 12) EGR control valve
3. Engine does not return to idle.	1) Engine coolant temperature sensor 2) Electronic throttle control 3) Manifold absolute pressure sensor 4) Mass air flow and intake air temperature sensor 5) EGR control valve 6) Accelerator pedal position sensor 7) Engine oil temperature sensor
4. Poor acceleration	1) Manifold absolute pressure sensor 2) Mass air flow and intake air temperature sensor 3) Electronic throttle control 4) Fuel injection parts (*4) 5) Fuel pump and fuel pump relay 6) Engine coolant temperature sensor (*2) 7) Crankshaft position sensor (*3) 8) Camshaft position sensor (*3) 9) Engine torque control signal circuit 10) Ignition parts (*1) 11) EGR control valve 12) Accelerator pedal position sensor 13) Engine oil temperature sensor
5. Engine stalls, hesitates, or sputters at acceleration.	1) Manifold absolute pressure sensor 2) Mass air flow and intake air temperature sensor 3) Engine coolant temperature sensor (*2) 4) Crankshaft position sensor (*3) 5) Camshaft position sensor (*3) 6) Purge control solenoid valve 7) Fuel injection parts (*4) 8) Electronic throttle control 9) Fuel pump and fuel pump relay 10) EGR control valve

Symptoms	Faulty parts
6. Surging	1) Mass air flow and intake air temperature sensor 2) Manifold absolute pressure sensor 3) Engine coolant temperature sensor (*2) 4) Crankshaft position sensor (*3) 5) Camshaft position sensor (*3) 6) Fuel injection parts (*4) 7) Electronic throttle control 8) Fuel pump and fuel pump relay 9) EGR control valve
7. Spark knock	1) Mass air flow and intake air temperature sensor 2) Manifold absolute pressure sensor 3) Engine coolant temperature sensor 4) Knock sensor 5) Fuel injection parts (*4) 6) Fuel pump and fuel pump relay 7) EGR control valve
8. After burning in exhaust system	1) Mass air flow and intake air temperature sensor 2) Manifold absolute pressure sensor 3) Engine coolant temperature sensor (*2) 4) Fuel injection parts (*4) 5) Fuel pump and fuel pump relay

*1: Check ignition coil and spark plug.
*2: Indicate the symptom occurring only in cold temperatures.
*3: Ensure the secure installation.
*4: Check fuel injector and fuel filter.
*5: Inspect air leak in air intake system.

GENERAL DESCRIPTION

GD(H4DO w/o HEV)

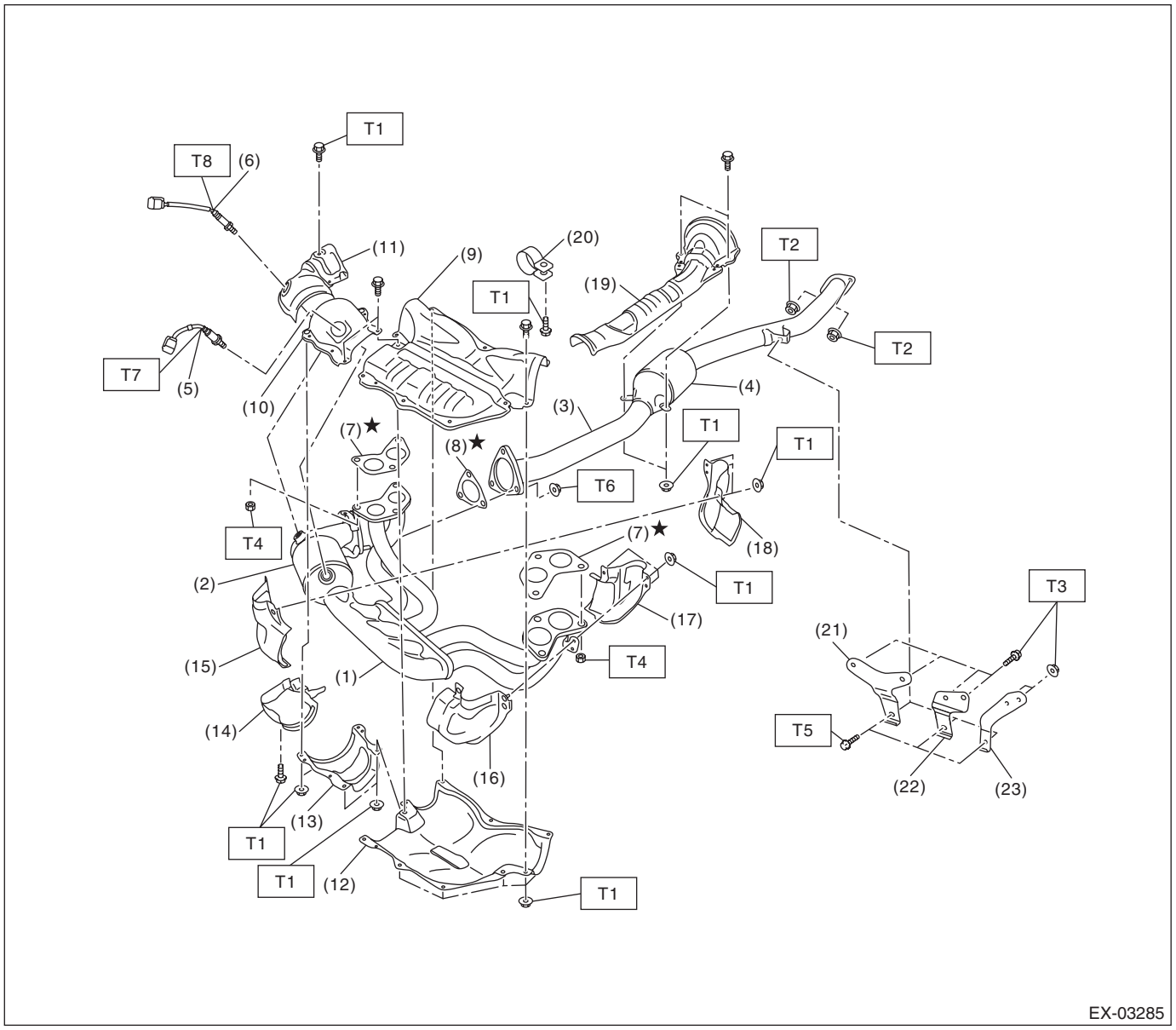
Page

1. List of Diagnostic Trouble Code (DTC) 2
2. Diagnostic Trouble Code (DTC) Detecting Criteria 11

1. General Description

A: COMPONENT

1. FRONT EXHAUST PIPE AND CENTER EXHAUST PIPE



(1)	Front exhaust pipe	(12)	Front exhaust pipe lower cover	(23)	Hanger bracket (MT model)
(2)	Front catalytic converter	(13)	Front catalytic converter lower cover LH		
(3)	Center exhaust pipe	(14)	Front catalytic converter lower cover RH		
(4)	Rear catalytic converter	(15)	Front exhaust pipe side cover RH (front)		
(5)	Front oxygen (A/F) sensor	(16)	Front exhaust pipe side cover LH (front)		
(6)	Rear oxygen sensor	(17)	Front exhaust pipe side cover LH (rear)		
(7)	Gasket	(18)	Front exhaust pipe side cover RH (rear)		
(8)	Gasket	(19)	Center exhaust pipe upper cover		
(9)	Front exhaust pipe upper cover	(20)	Band		
(10)	Front catalytic converter upper cover LH	(21)	Hanger bracket (HEV model)		
(11)	Front catalytic converter upper cover RH	(22)	Hanger bracket (gasoline engine CVT model)		

Tightening torque: N·m (kgf-m, ft-lb)

T1: 13 (1.3, 9.6)

T2: 18 (1.8, 13.3)

T3: 23 (2.3, 17.0)

T4: 30 (3.1, 22.1)

T5: 35 (3.6, 25.8)

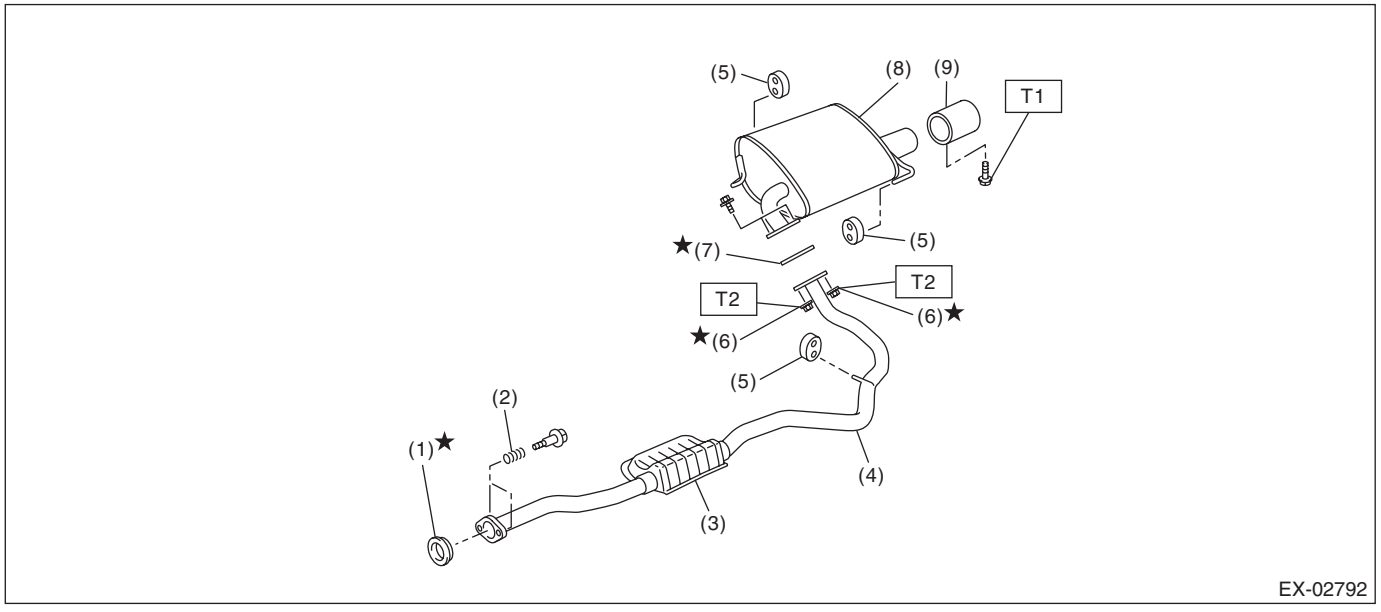
T6: 42.5 (4.3, 31.3)

T7: <Ref. to FU(H4DO(w/o HEV))-93, INSTALLATION, Front Oxygen (A/F) Sensor.> <Ref. to FU(H4DO(HEV))-80, INSTALLATION, Front Oxygen (A/F) Sensor.>

T8: <Ref. to FU(H4DO(w/o HEV))-97, INSTALLATION, Rear Oxygen Sensor.> <Ref. to FU(H4DO(HEV))-83, INSTALLATION, Rear Oxygen Sensor.>

2. REAR EXHAUST PIPE AND MUFFLER

- 4 door model



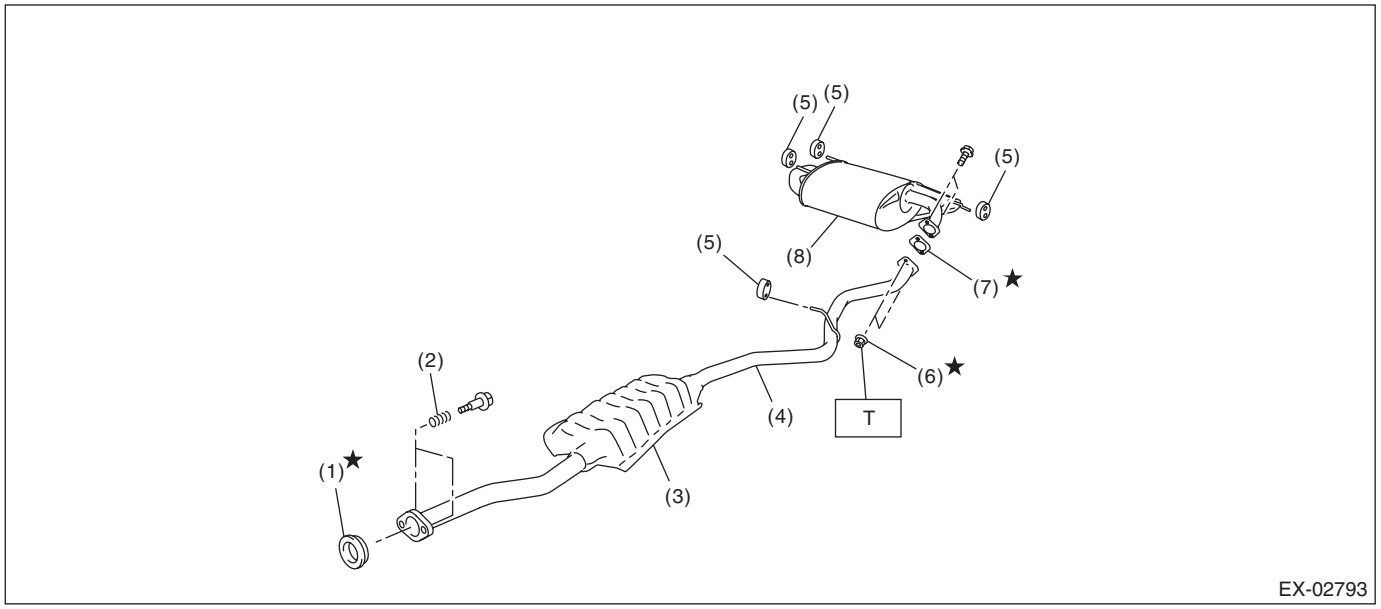
(1)	Gasket	(6)	Self-locking nut		
(2)	Spring	(7)	Gasket		
(3)	Chamber	(8)	Muffler		
(4)	Rear exhaust pipe	(9)	Muffler cutter (models with muffler cutter)		
(5)	Cushion rubber				

Tightening torque: N·m (kgf-m, ft-lb)

T1: 7.5 (0.8, 5.5)

T2: 48 (4.9, 35.4)

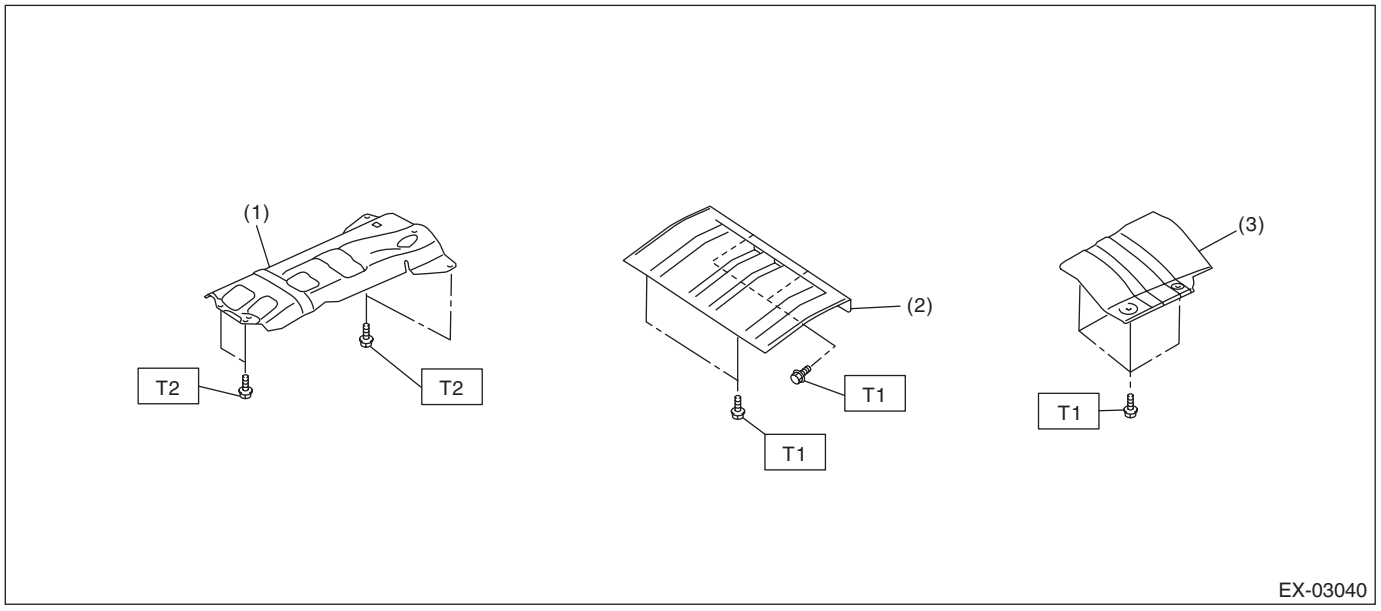
- 5 door model



(1) Gasket
(2) Spring
(3) Chamber
(4) Rear exhaust pipe
(5) Cushion rubber
(6) Self-locking nut
(7) Gasket
(8) Muffler

Tightening torque: N·m (kgf-m, ft-lb)
T: 48 (4.9, 35.4)

3. HEAT SHIELD COVER



(1) Center exhaust cover
(2) Rear exhaust cover (5 door model)
(3) Rear exhaust cover (4 door model)

Tightening torque: N·m (kgf-m, ft-lb)
T1: 10 (1.0, 7.4)
T2: 18 (1.8, 13.3)

B: CAUTION

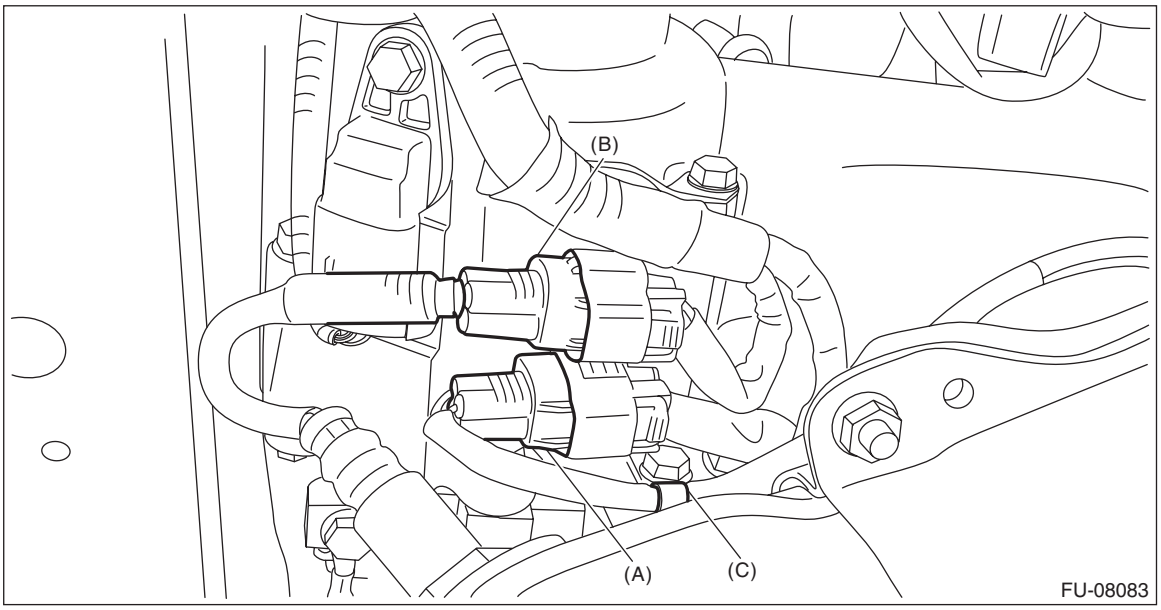
- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a work cap, and protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.
- If any grease adheres to the exhaust pipe, wipe it off. Otherwise a fire may happen.

2. Front Exhaust Pipe

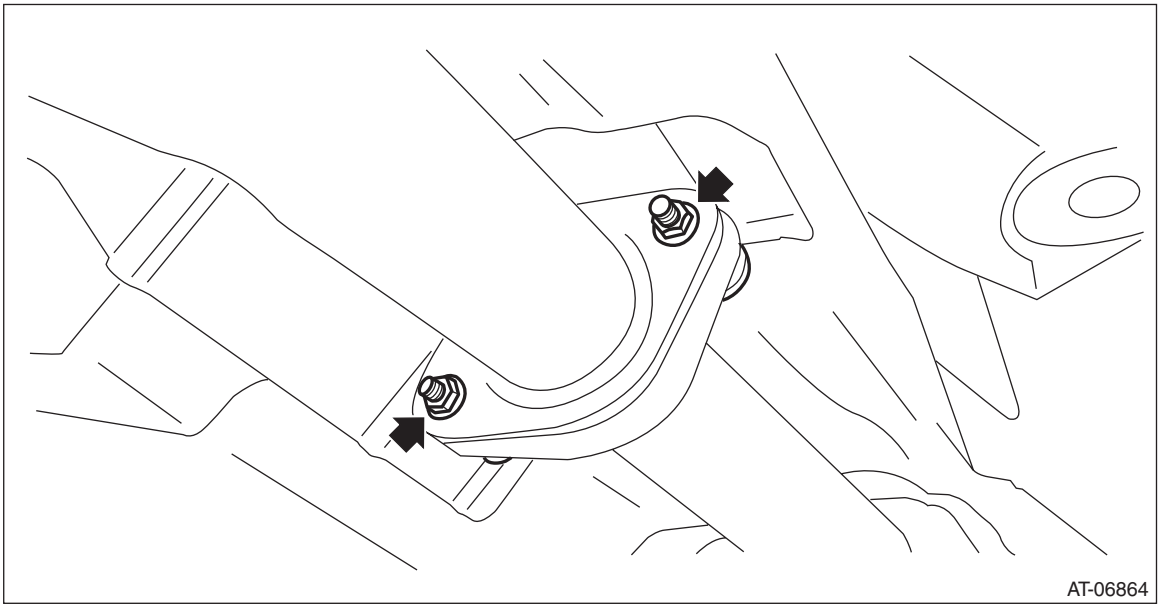
A: REMOVAL

CAUTION:
Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
1) Disconnect the ground cable from battery. <Ref. to NT-5, BATTERY, NOTE, Note.>

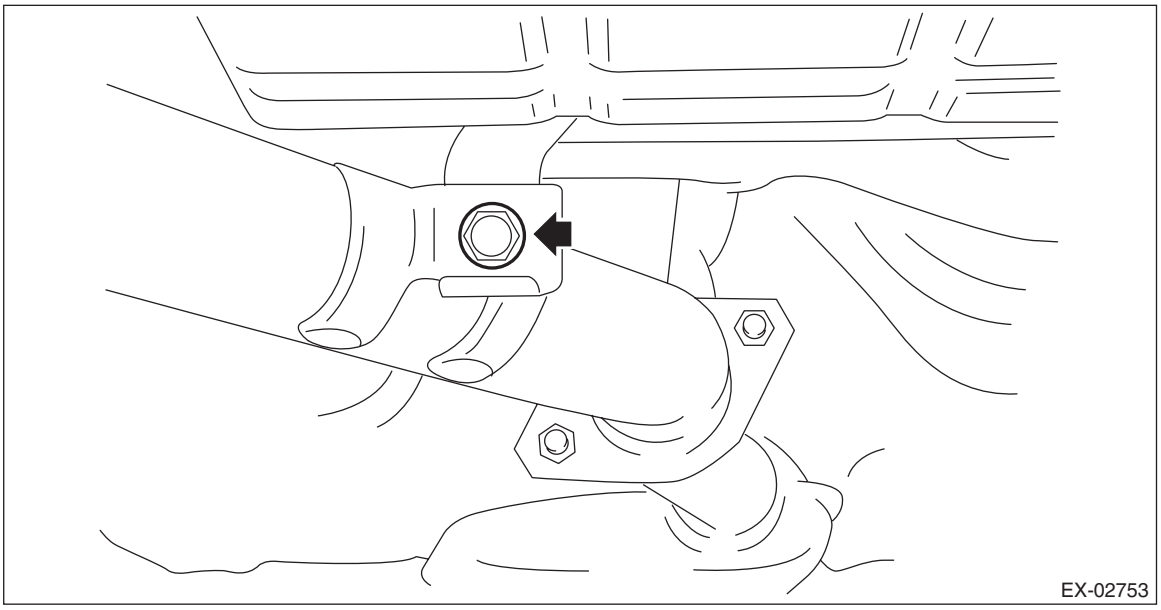
NOTE:
For the 12 volt engine restart battery of HEV model, disconnect the ground terminal from 12V engine restart battery sensor.
2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-32, REMOVAL, Front Under Cover.>
4) Disconnect the front oxygen (A/F) sensor connector (A) and rear oxygen sensor connector (B) and remove the clip (C) fastening the harness.



5) Remove the bolts, springs, and nuts securing the rear exhaust pipe to the center exhaust pipe.

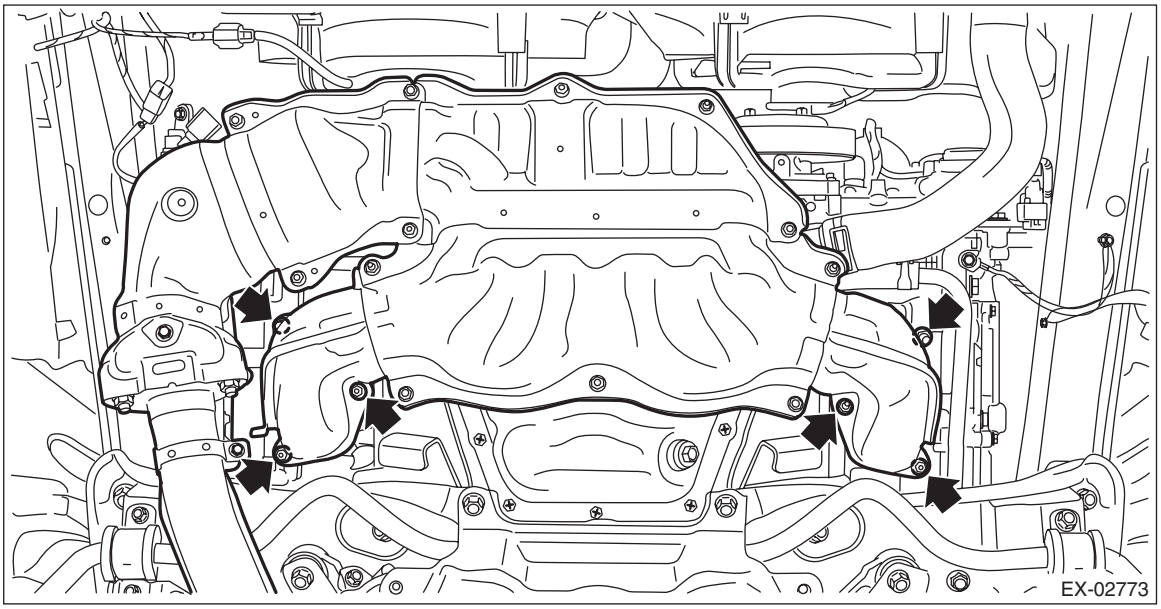


6) Remove the bolt which holds center exhaust pipe to hanger bracket.



7) Remove the front exhaust pipe and center exhaust pipe from vehicle as a unit.

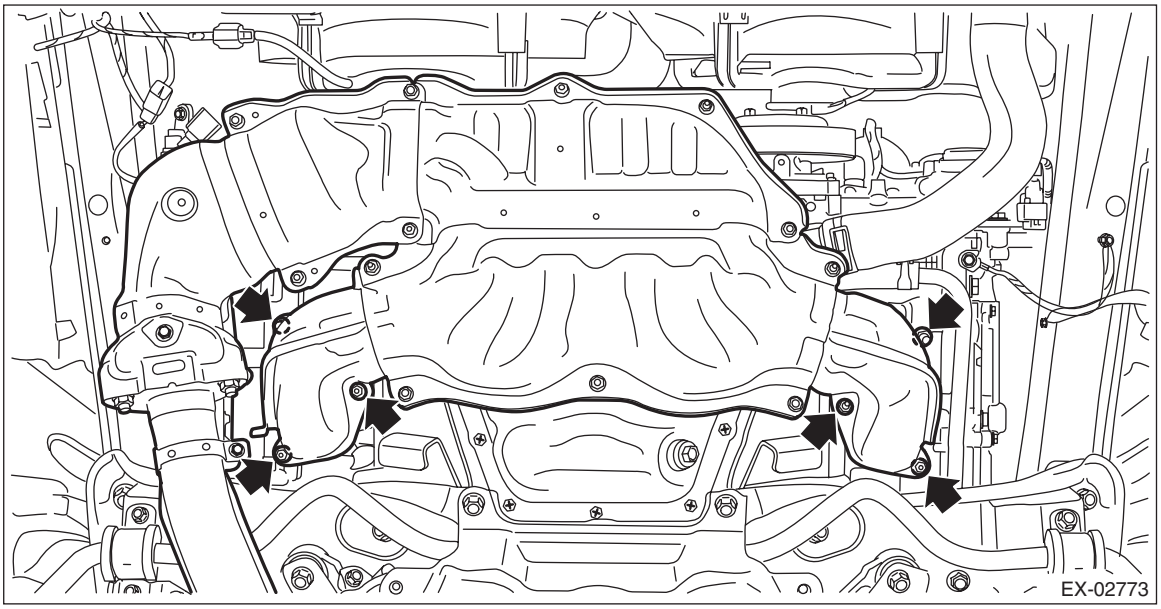
CAUTION:
• The front exhaust pipe and center exhaust pipe assembly are very heavy. Be careful not to drop the exhaust pipes when removing.
• After removing the front exhaust pipe and center exhaust pipe assembly, do not pull the rear exhaust pipe with excessive force.



B: INSTALLATION

1) Set the front exhaust pip and center exhaust pipe to the vehicle, and temporally tighten the nuts which secure the front exhaust pipe to cylinder head.

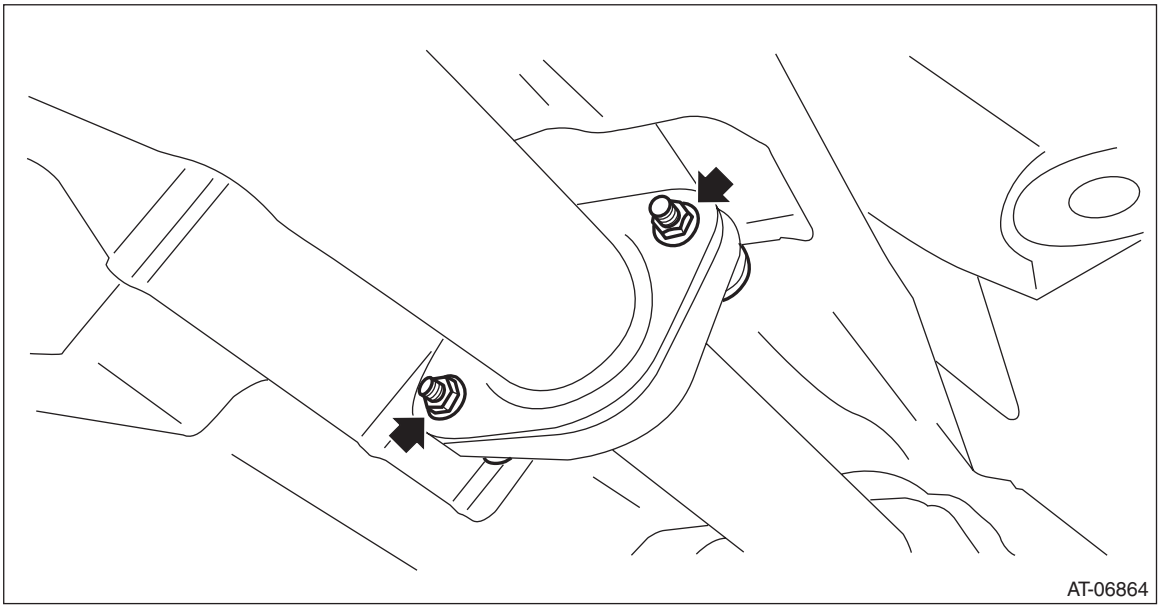
NOTE:
Use a new gasket.



2) Install the bolts, springs, and nuts which secure the rear exhaust pipe to the center exhaust pipe.

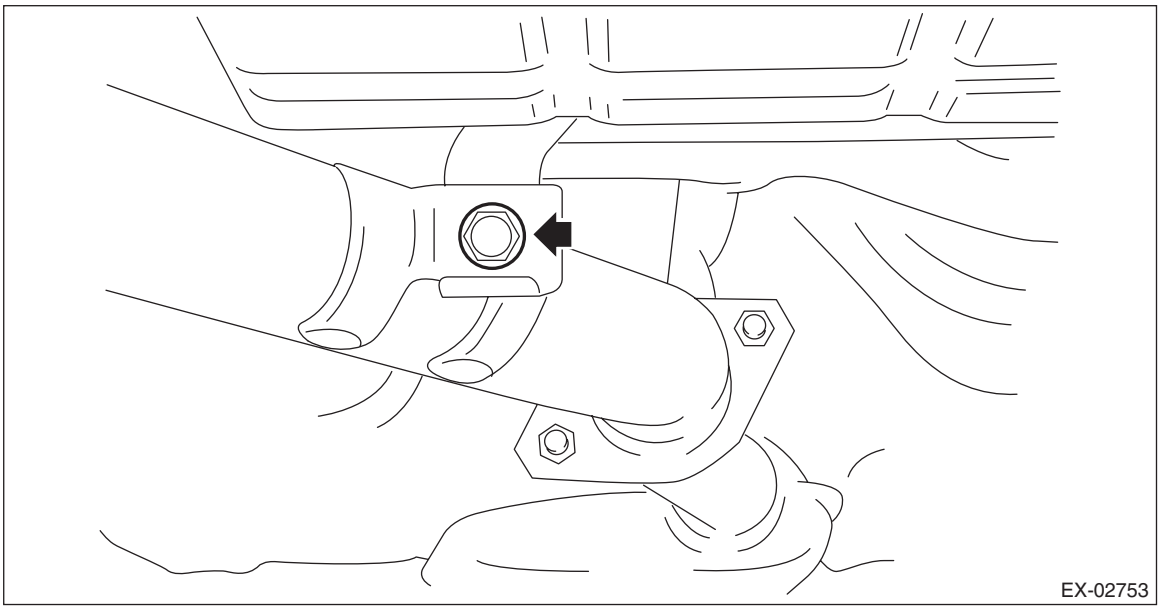
NOTE:
Use a new gasket.

Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)



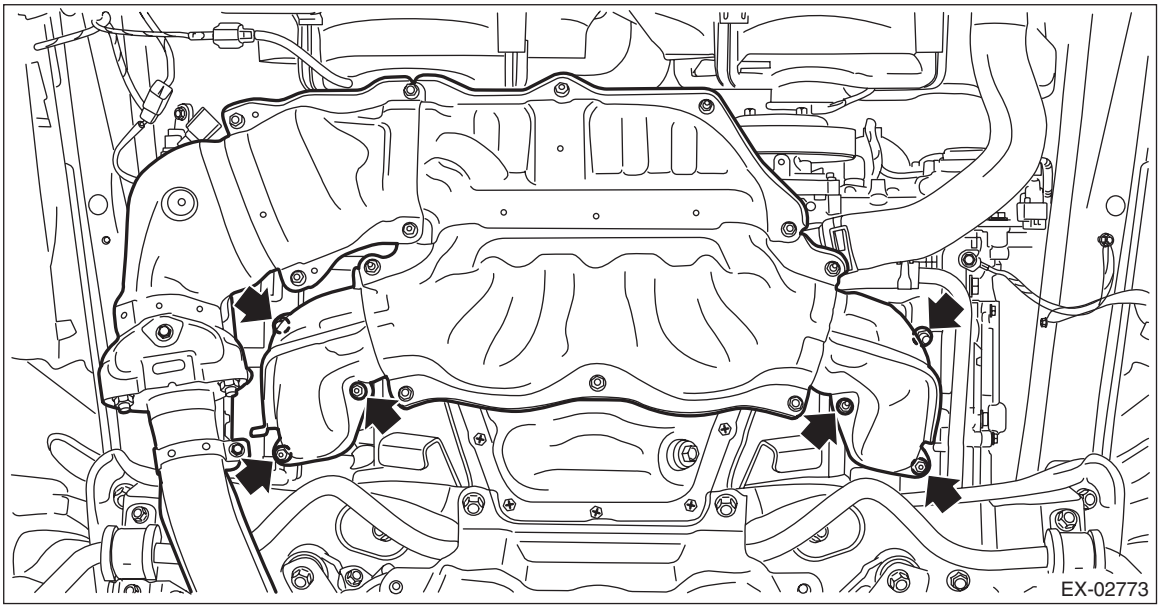
3) Tighten the bolts which secure the center exhaust pipe to the hanger bracket.

Tightening torque:
35 N·m (3.6 kgf-m, 25.8 ft-lb)

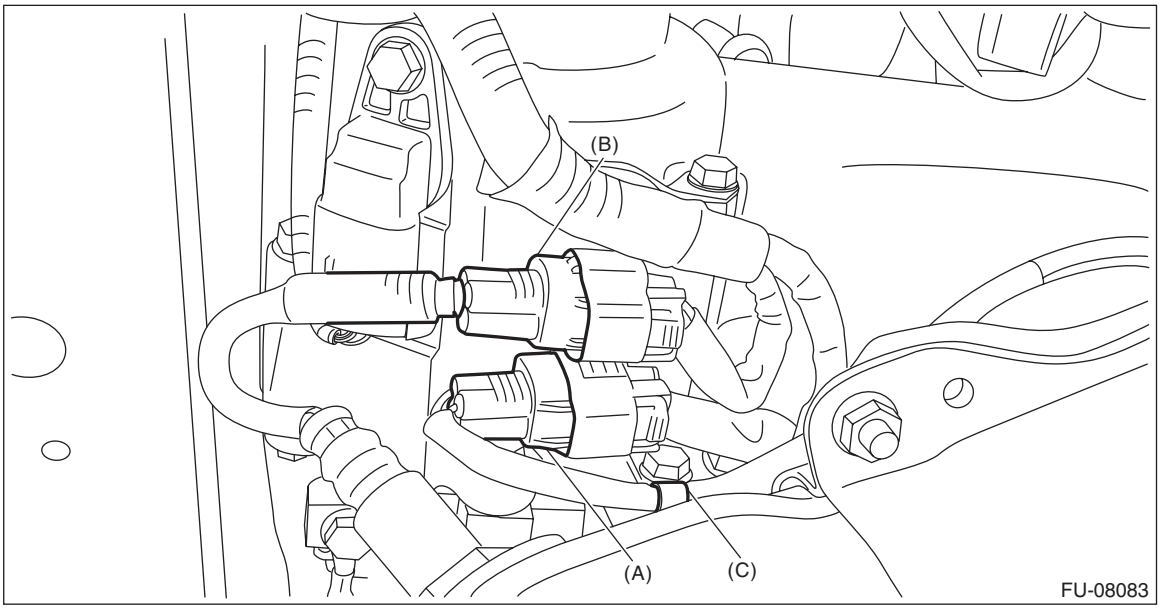


4) Tighten the nuts which hold front exhaust pipe to cylinder heads.

Tightening torque:
30 N·m (3.1 kgf-m, 22.1 ft-lb)



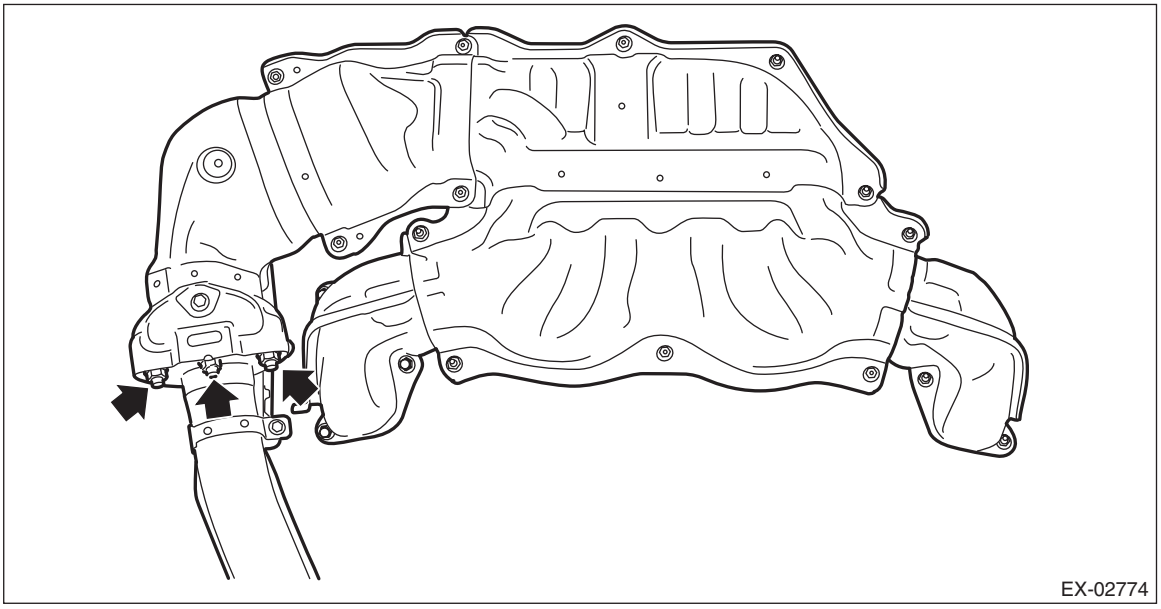
5) Connect the front oxygen (A/F) sensor connector (A) and rear oxygen sensor connector (B), and fasten the harness with the clip (C).



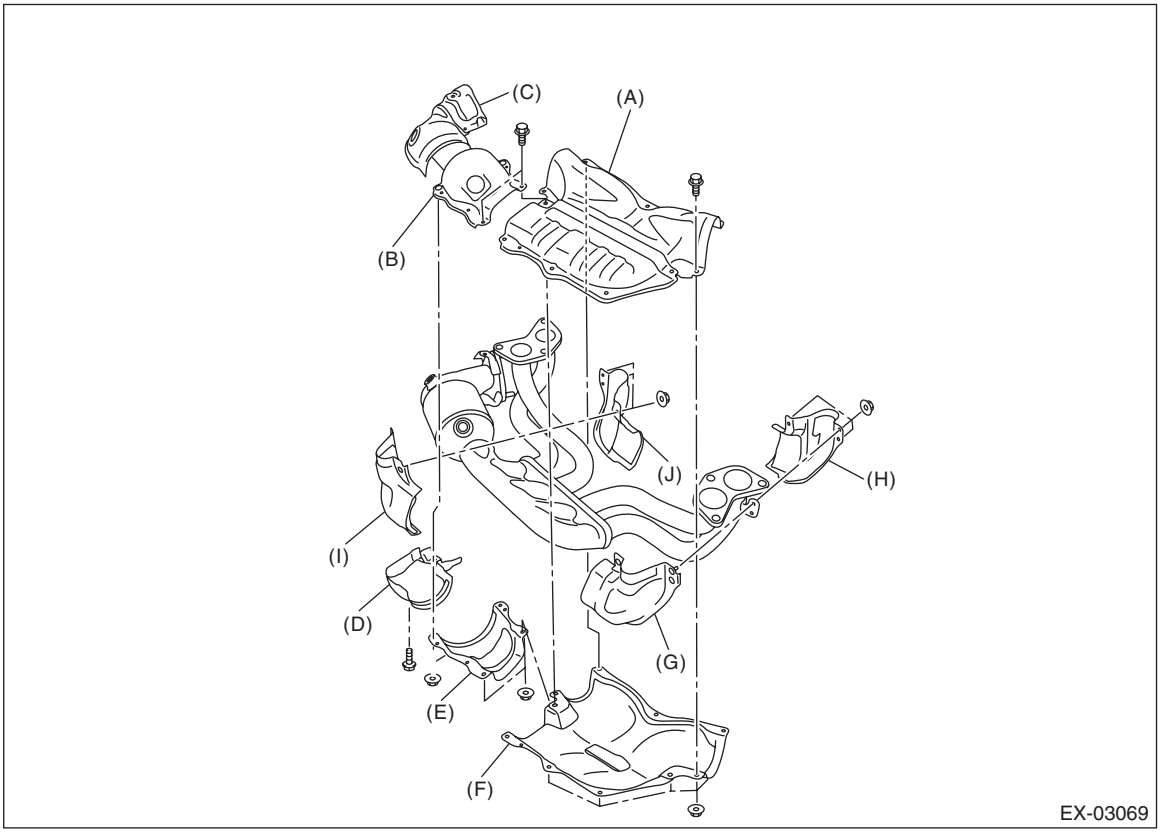
6) Install the under cover. <Ref. to EI-32, INSTALLATION, Front Under Cover.>
7) Lower the vehicle.
8) Connect the battery ground terminal. <Ref. to NT-5, BATTERY, NOTE, Note.>

C: DISASSEMBLY

1) Remove the front oxygen (A/F) sensor and rear oxygen sensor from front exhaust pipe. <Ref. to FU(H4DO(w/o HEV))-92, REMOVAL, Front Oxygen (A/F) Sensor.> <Ref. to FU(H4DO(w/o HEV))-96, REMOVAL, Rear Oxygen Sensor.> <Ref. to FU(H4DO(HEV))-78, REMOVAL, Front Oxygen (A/F) Sensor.> <Ref. to FU(H4DO(HEV))-82, REMOVAL, Rear Oxygen Sensor.>
2) Remove the center exhaust pipe from the front exhaust pipe.



3) Remove each cover from the front exhaust pipe.

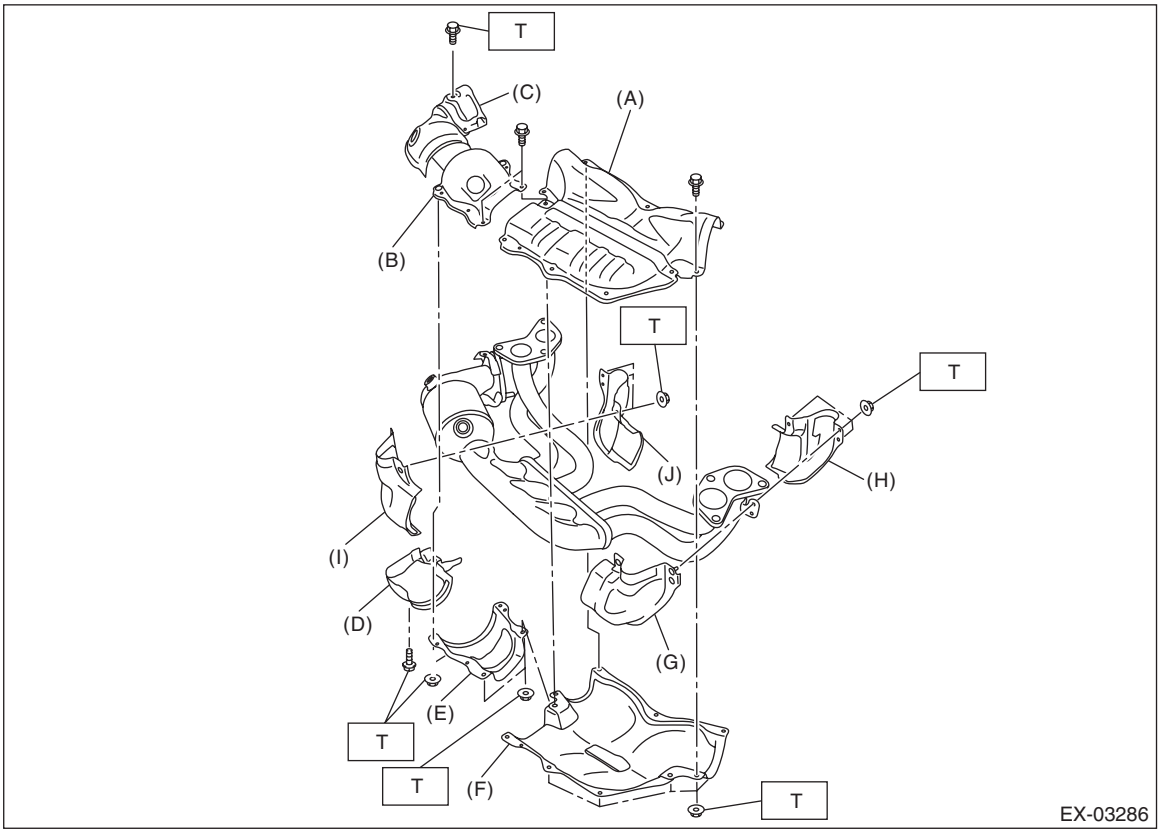


(A) Front exhaust pipe upper cover
(B) Front catalytic converter upper cover LH
(C) Front catalytic converter upper cover RH
(D) Front catalytic converter lower cover RH
(E) Front catalytic converter lower cover LH
(F) Front exhaust pipe lower cover
(G) Front exhaust pipe side cover LH (front)
(H) Front exhaust pipe side cover LH (rear)
(I) Front exhaust pipe side cover RH (front)
(J) Front exhaust pipe side cover RH (rear)

D: ASSEMBLY

1) Install each cover to the front exhaust pipe.

Tightening torque:
13 N·m (1.3 kgf-m, 9.6 ft-lb)

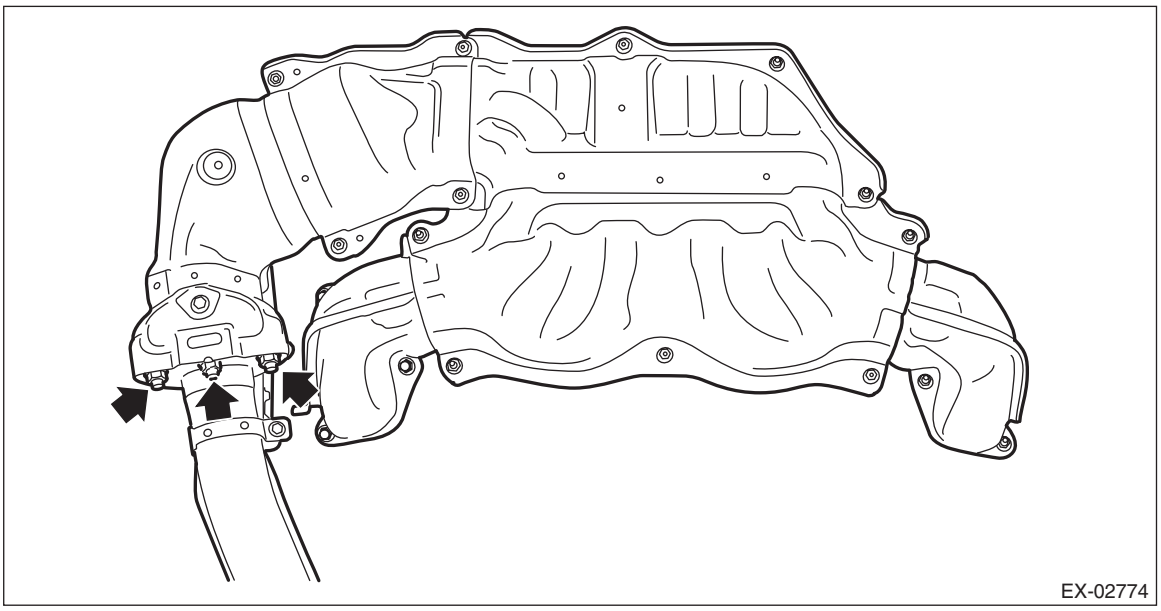


(A) Front exhaust pipe upper cover
(B) Front catalytic converter upper cover LH
(C) Front catalytic converter upper cover RH
(D) Front catalytic converter lower cover RH
(E) Front catalytic converter lower cover LH
(F) Front exhaust pipe lower cover
(G) Front exhaust pipe side cover LH (front)
(H) Front exhaust pipe side cover LH (rear)
(I) Front exhaust pipe side cover RH (front)
(J) Front exhaust pipe side cover RH (rear)

2) Install the center exhaust pipe to front exhaust pipe.

NOTE:
Use a new gasket.

Tightening torque:
42.5 N·m (4.3 kgf-m, 31.3 ft-lb)



3) Install the front oxygen (A/F) sensor and rear oxygen sensor to the front exhaust pipe. <Ref. to FU(H4DO(w/o HEV))-93, INSTALLATION, Front Oxygen (A/F) Sensor.> <Ref. to FU(H4DO(w/o HEV))-97, INSTALLATION, Rear Oxygen Sensor.> <Ref. to FU(H4DO(HEV))-80, INSTALLATION, Front Oxygen (A/F) Sensor.> <Ref. to FU(H4DO(HEV))-83, INSTALLATION, Rear Oxygen Sensor.>

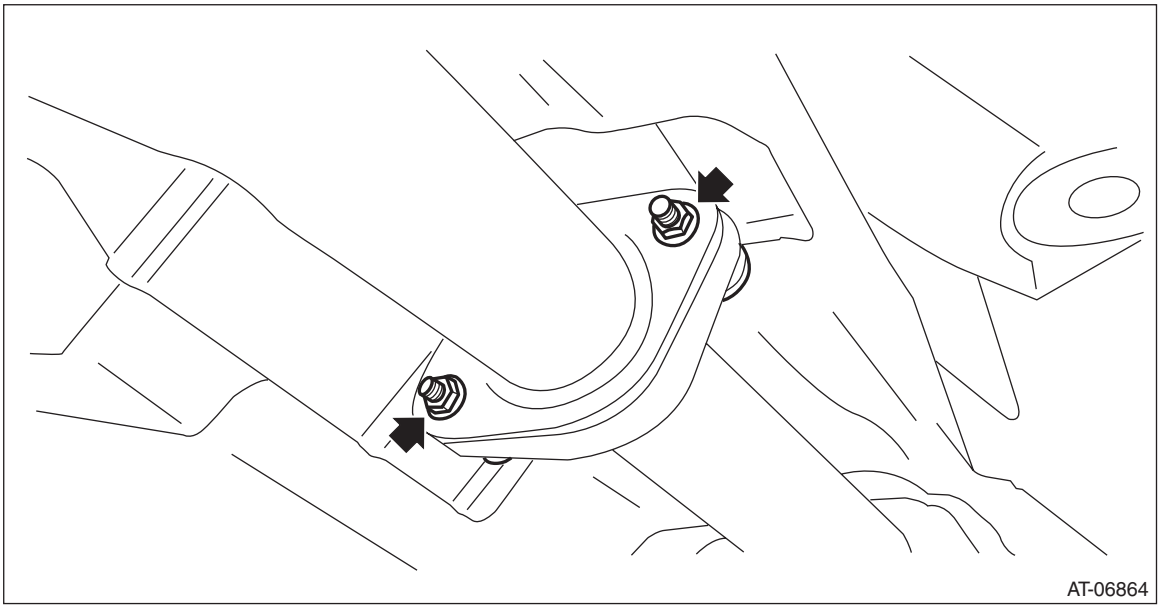
E: INSPECTION

1) Check the connections and welded parts for exhaust leaks.
2) Make sure there are no holes or rusting.

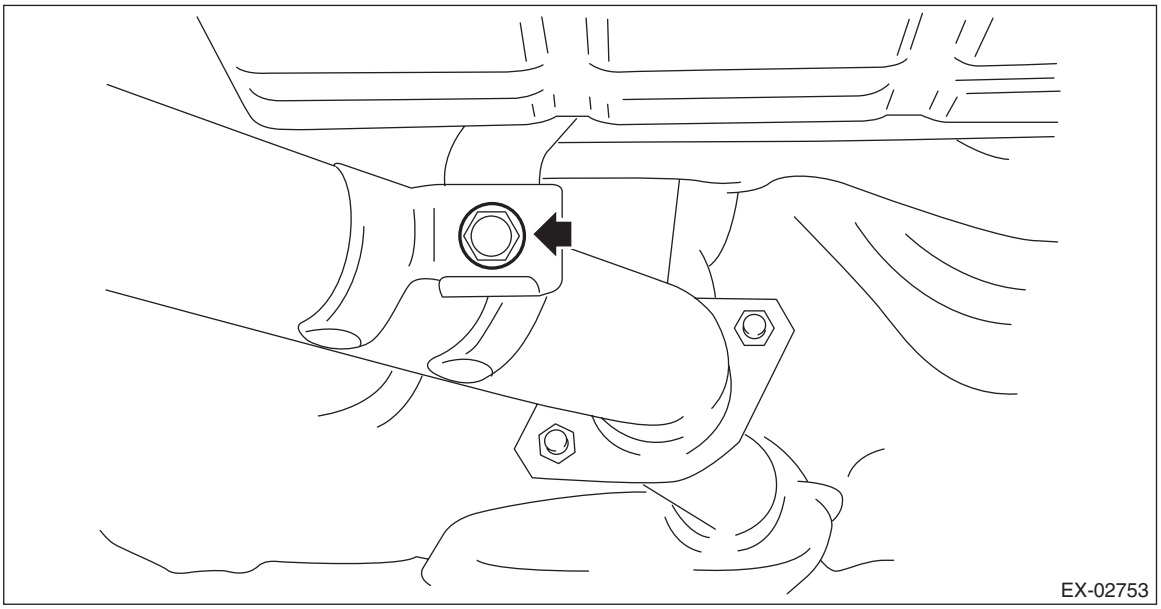
3. Center Exhaust Pipe

A: REMOVAL

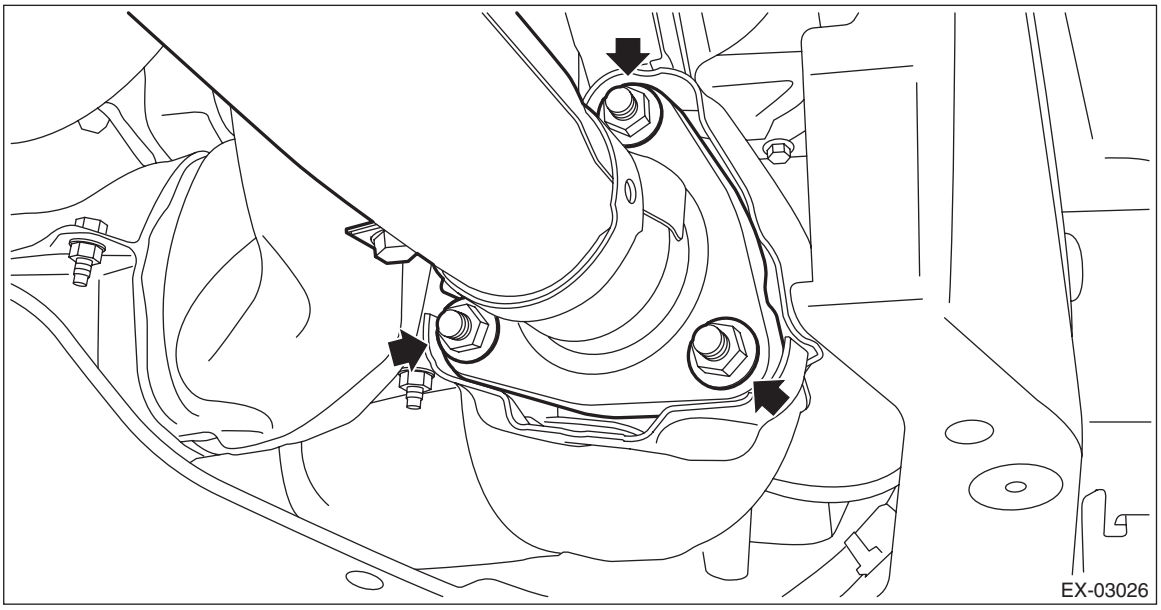
CAUTION:
Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
1) Turn the ignition switch to OFF.
2) Lift up the vehicle.
3) Remove the bolts, springs, and nuts securing the rear exhaust pipe to the center exhaust pipe.



4) Remove the bolt which holds center exhaust pipe to hanger bracket.



5) Remove the center exhaust pipe from the front exhaust pipe.



6) Remove the center exhaust pipe upper cover from the center exhaust pipe.

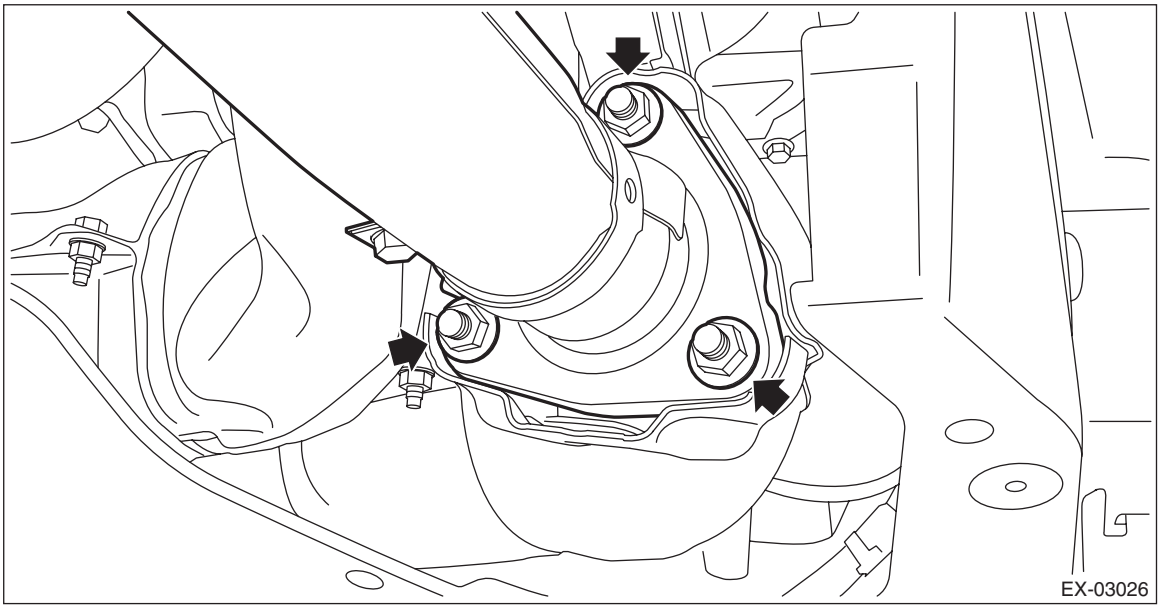
B: INSTALLATION

1) Install the center exhaust pipe upper cover to the center exhaust pipe.

Tightening torque:
13 N·m (1.3 kgf-m, 9.6 ft-lb)

2) Temporarily tighten the nuts which secure the center exhaust pipe to the front exhaust pipe.

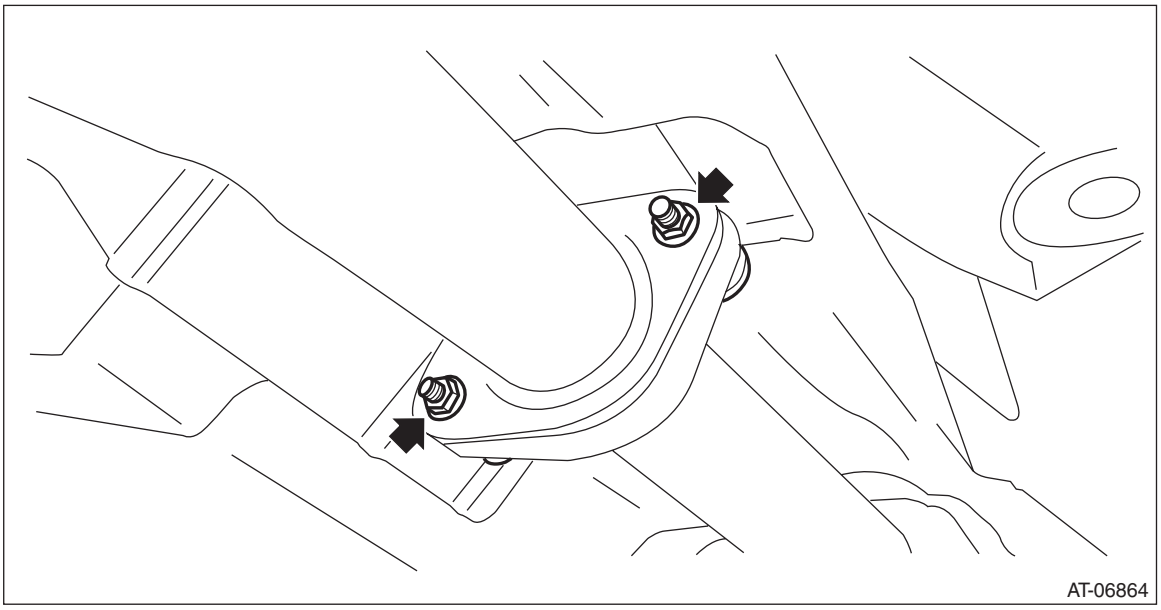
NOTE:
Use a new gasket.



3) Install the bolts, springs, and nuts which secure the rear exhaust pipe to the center exhaust pipe.

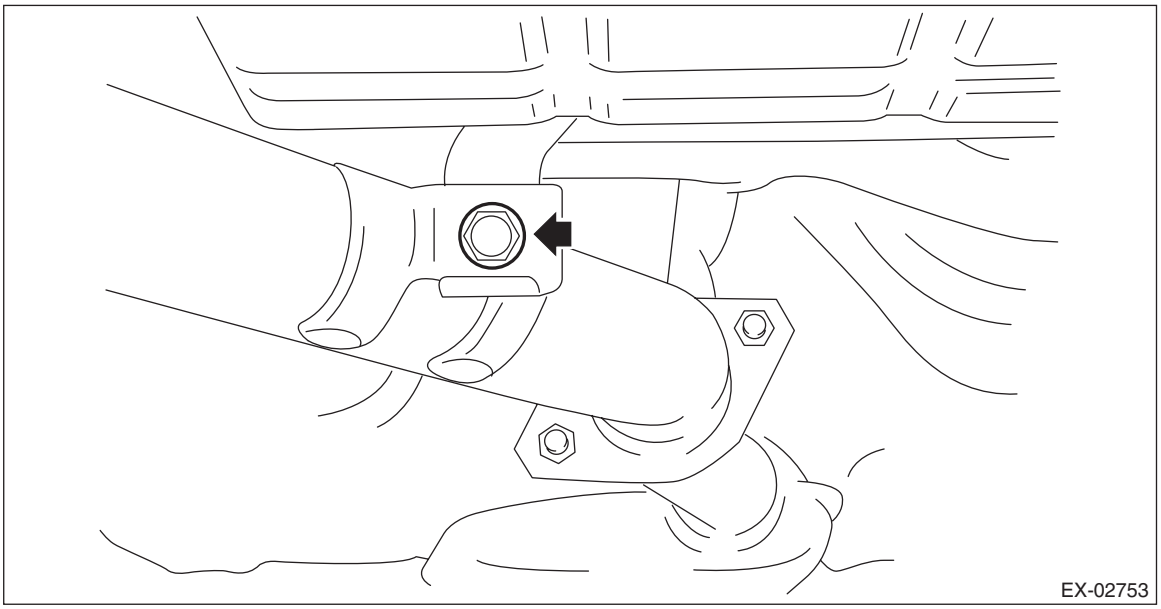
NOTE:
Use a new gasket.

Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)



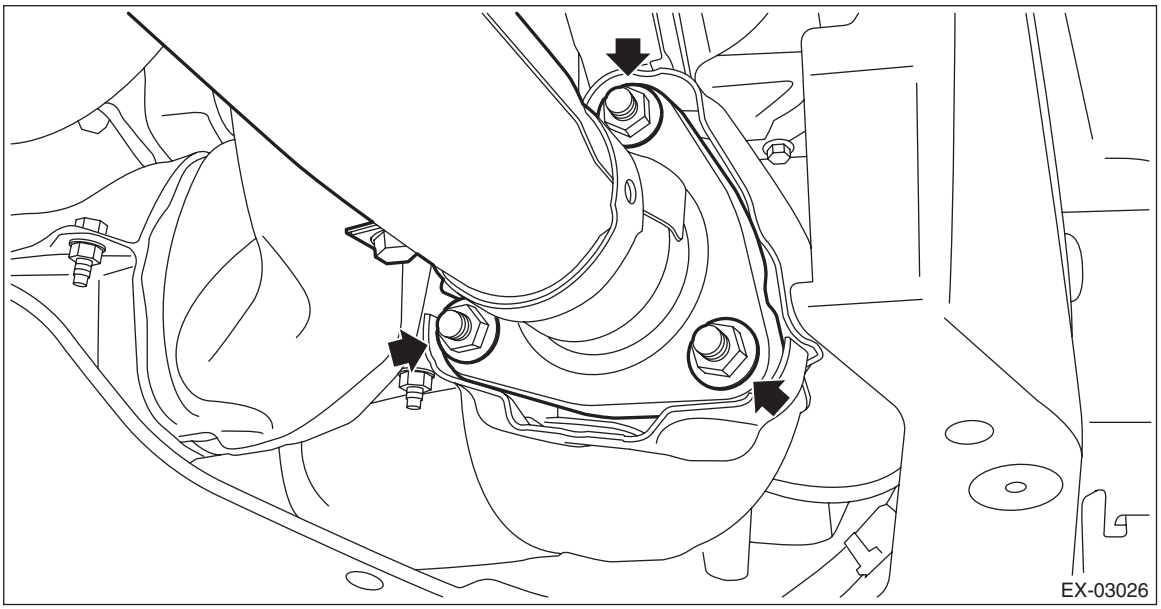
4) Tighten the bolts which secure the center exhaust pipe to the hanger bracket.

Tightening torque:
35 N·m (3.6 kgf-m, 25.8 ft-lb)



5) Tighten the nuts which secure the center exhaust pipe to the front exhaust pipe.

Tightening torque:
42.5 N·m (4.3 kgf-m, 31.3 ft-lb)



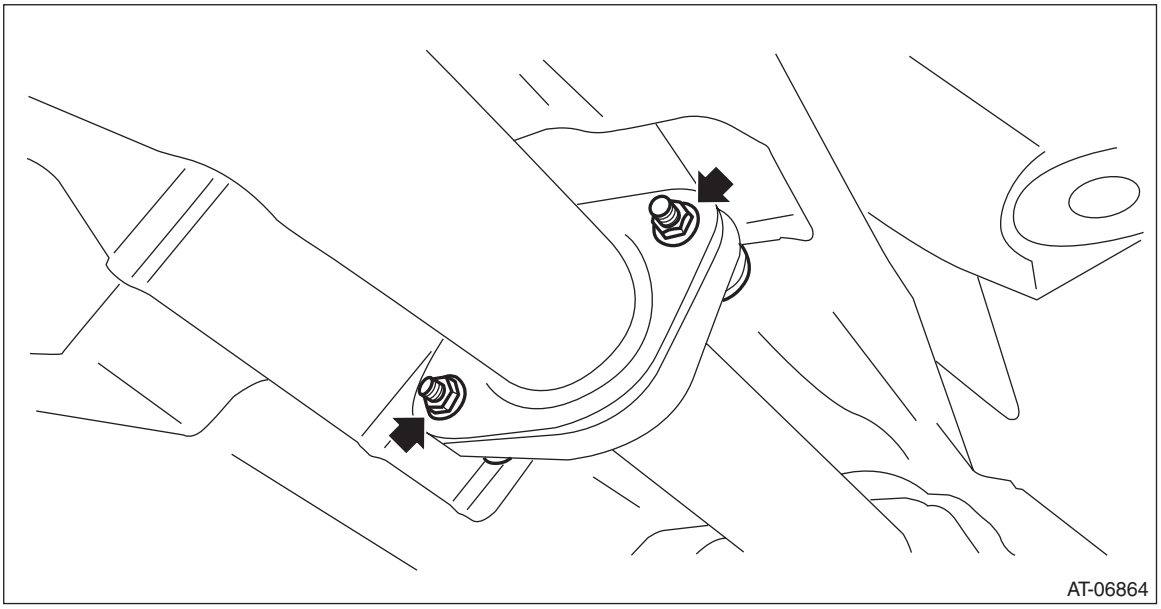
C: INSPECTION

1) Check the connections and welded parts for exhaust leaks.
2) Make sure there are no holes or rusting.

4. Rear Exhaust Pipe

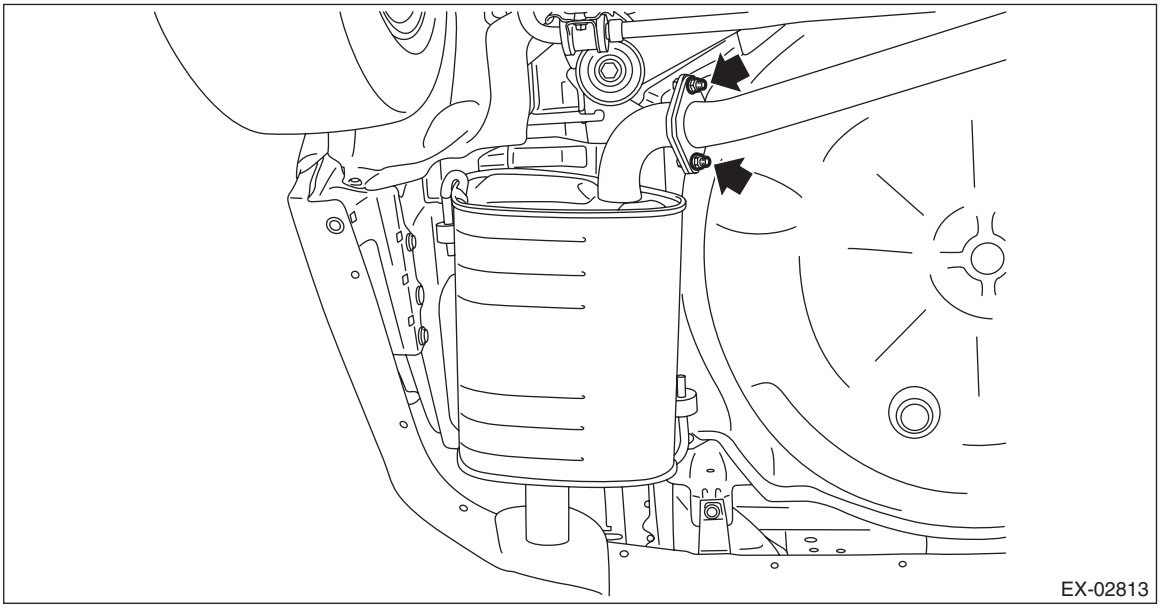
A: REMOVAL

CAUTION:
Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
1) Turn the ignition switch to OFF.
2) Lift up the vehicle.
3) Remove the bolts, springs, and nuts securing the center exhaust pipe to the rear exhaust pipe.

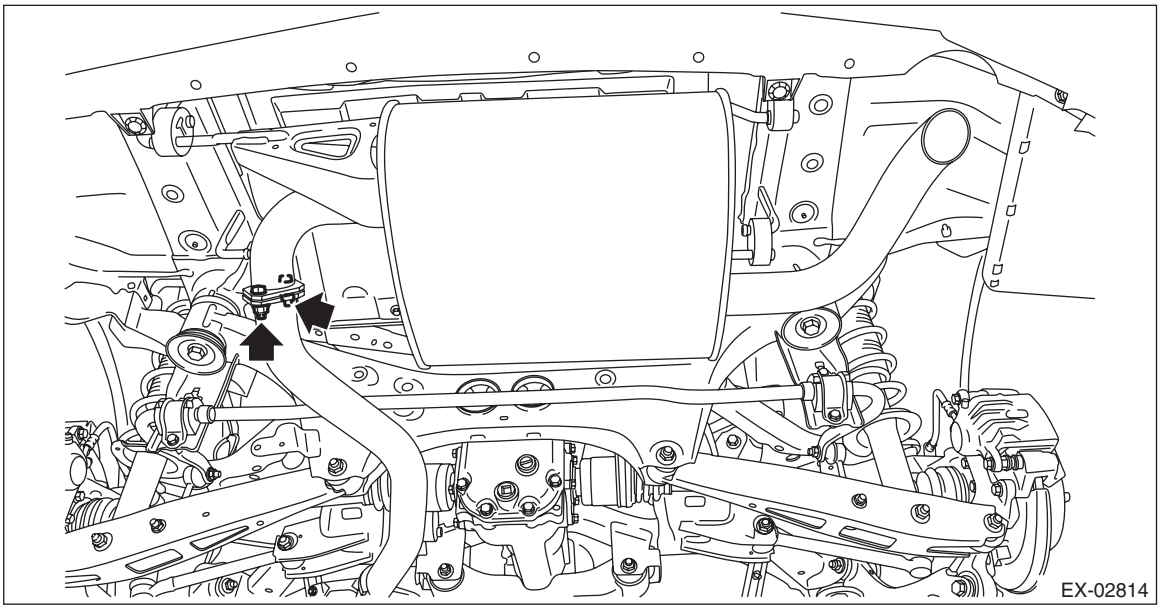


4) Remove the bolts and self-locking nuts securing the mufflers to the rear exhaust pipes.

CAUTION:
Be careful not to drop the rear exhaust pipe.
- 4 door model

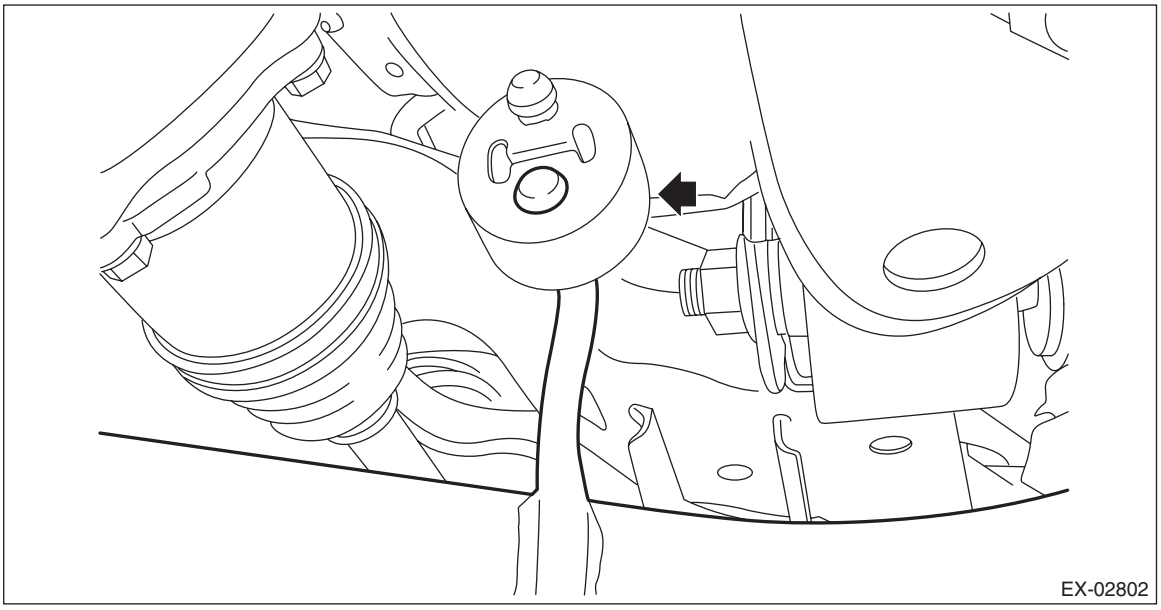


- 5 door model



5) Apply a coat of spray type lubricant to the mating area of cushion rubber.
6) Remove the rear exhaust pipe from the cushion rubber.

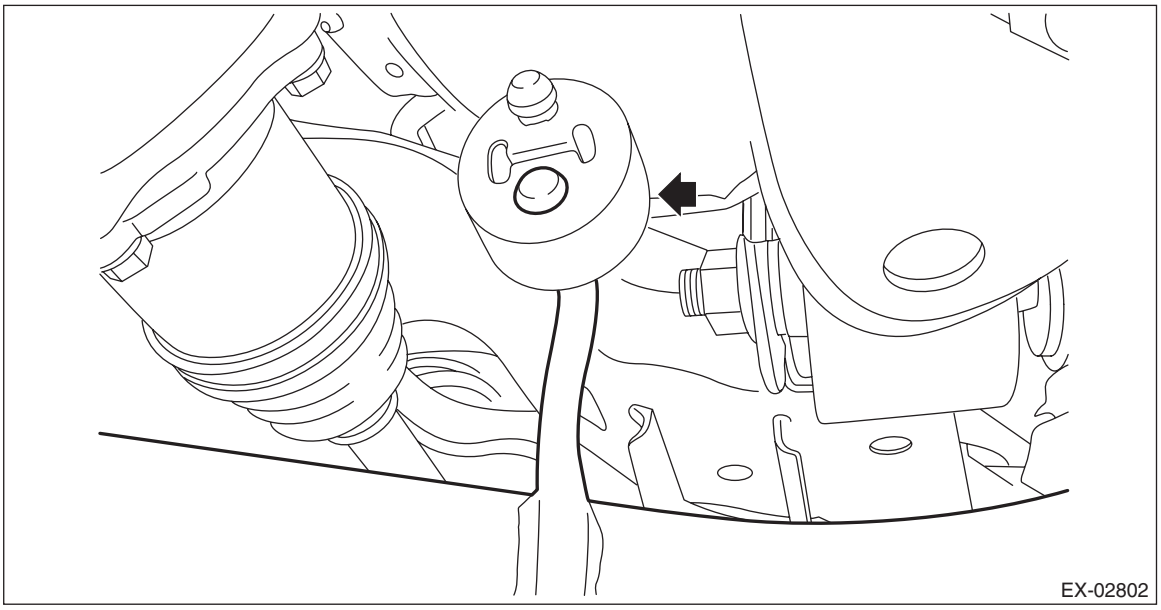
CAUTION:
Be careful not to let the muffler contact the rear bumper.



B: INSTALLATION

1) Apply a coat of spray type lubricant to the mating area of cushion rubber.
2) Install the rear exhaust pipe to cushion rubber.

NOTE:
After assembling, degrease the lubricant which was applied to the cushion rubber while removing/installing.

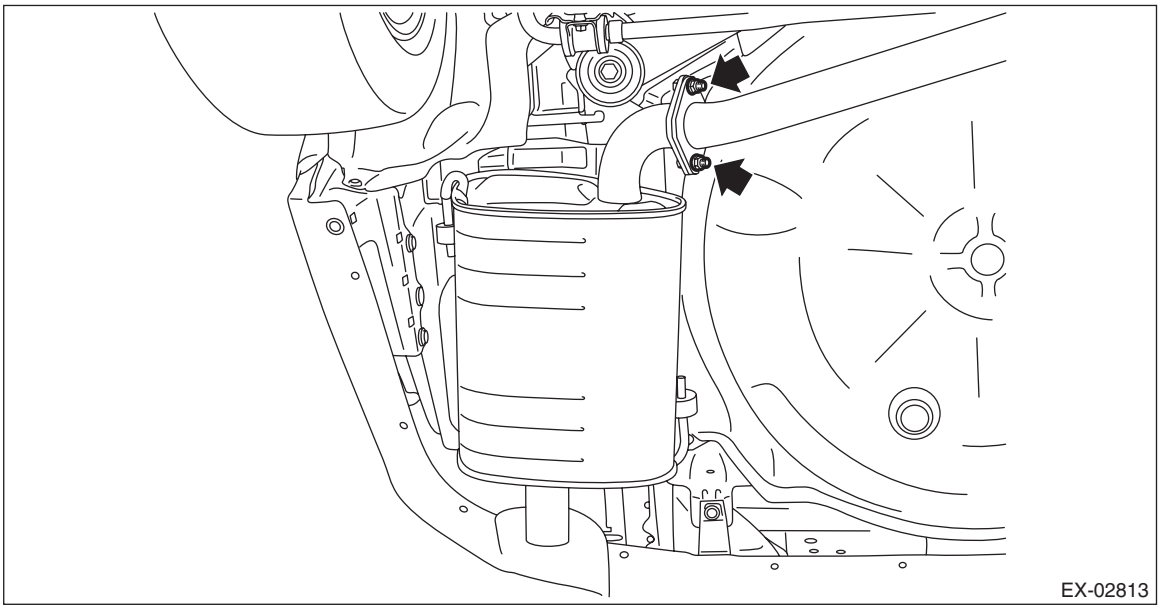


3) Install the bolts and self-locking nuts which secure the muffler to the rear exhaust pipe.

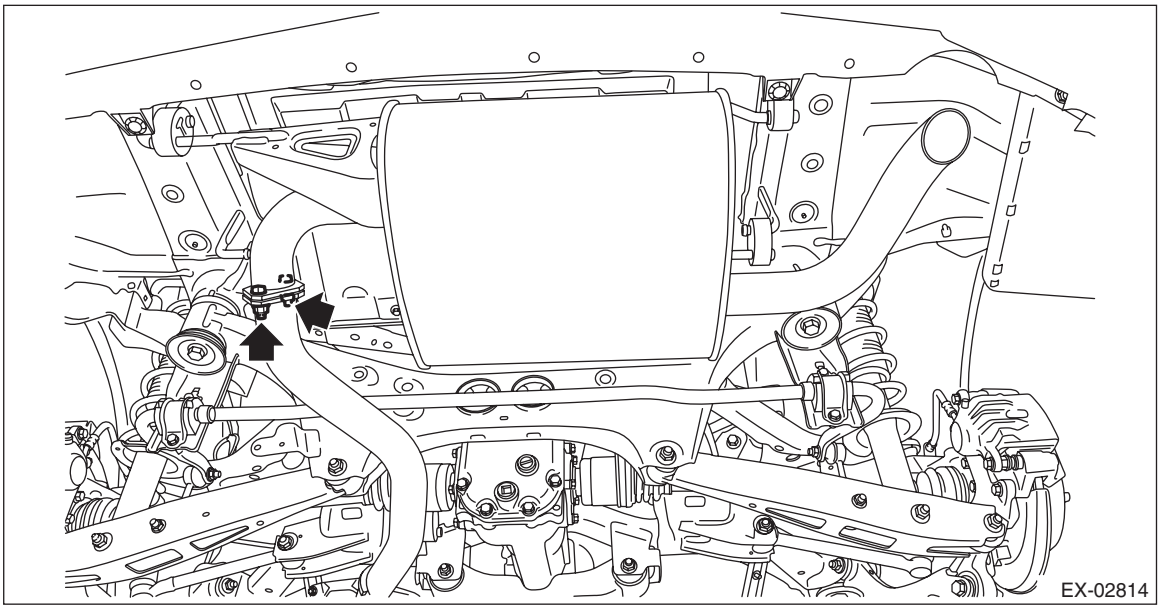
NOTE:
Use a new gasket and self-locking nut.

Tightening torque:
48 N·m (4.9 kgf-m, 35.4 ft-lb)

- 4 door model



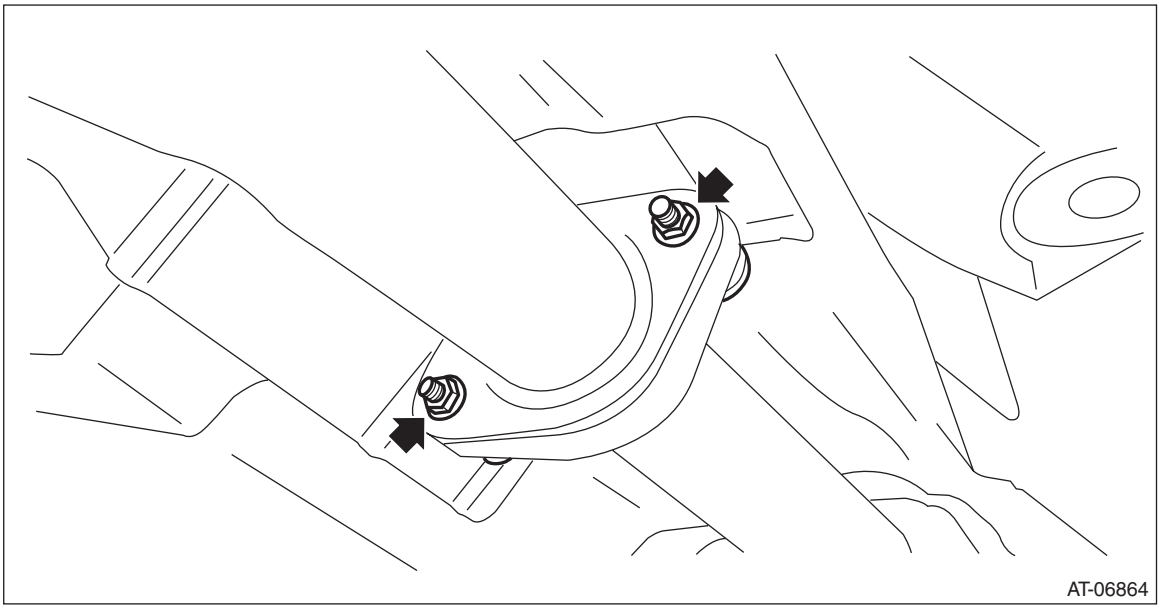
- 5 door model



4) Install the bolts, springs, and nuts which secure the center exhaust pipe to the rear exhaust pipe.

NOTE:
Use a new gasket.

Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)



5) Lower the vehicle.

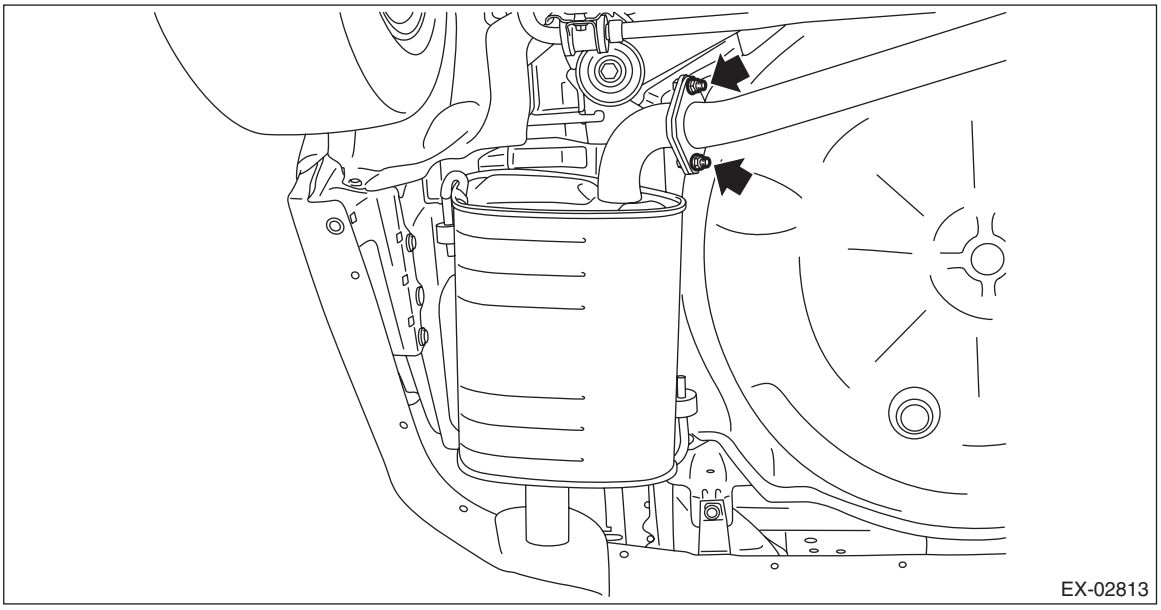
C: INSPECTION

1) Check the connections and welded parts for exhaust leaks.
2) Make sure there are no holes or rusting.
3) Check the cushion rubber for wear or crack.

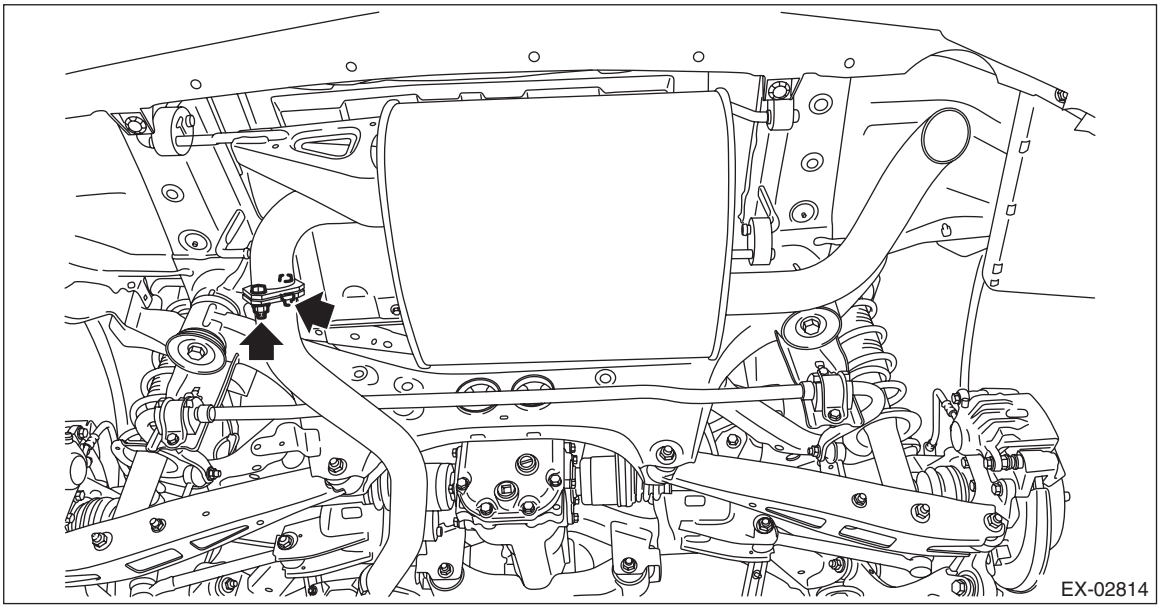
5. Muffler

A: REMOVAL

CAUTION:
Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
1) Turn the ignition switch to OFF.
2) Lift up the vehicle.
3) Remove the bolts and self-locking nuts which secure the rear exhaust pipe to the muffler.
- 4 door model



- 5 door model

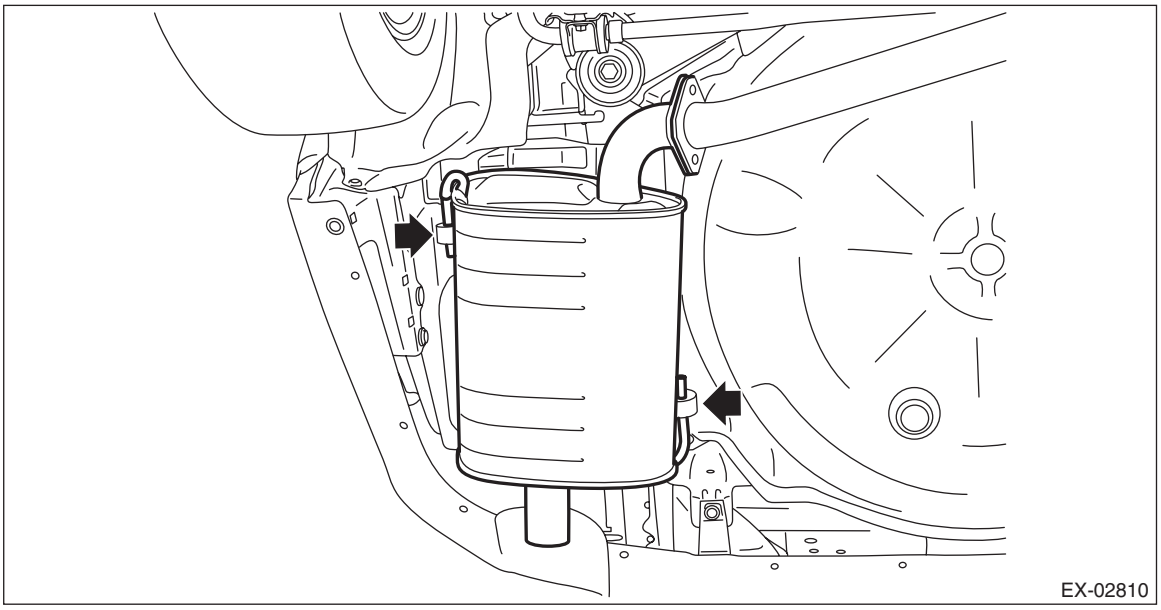


4) Apply a coat of spray type lubricant to the mating area of cushion rubber.

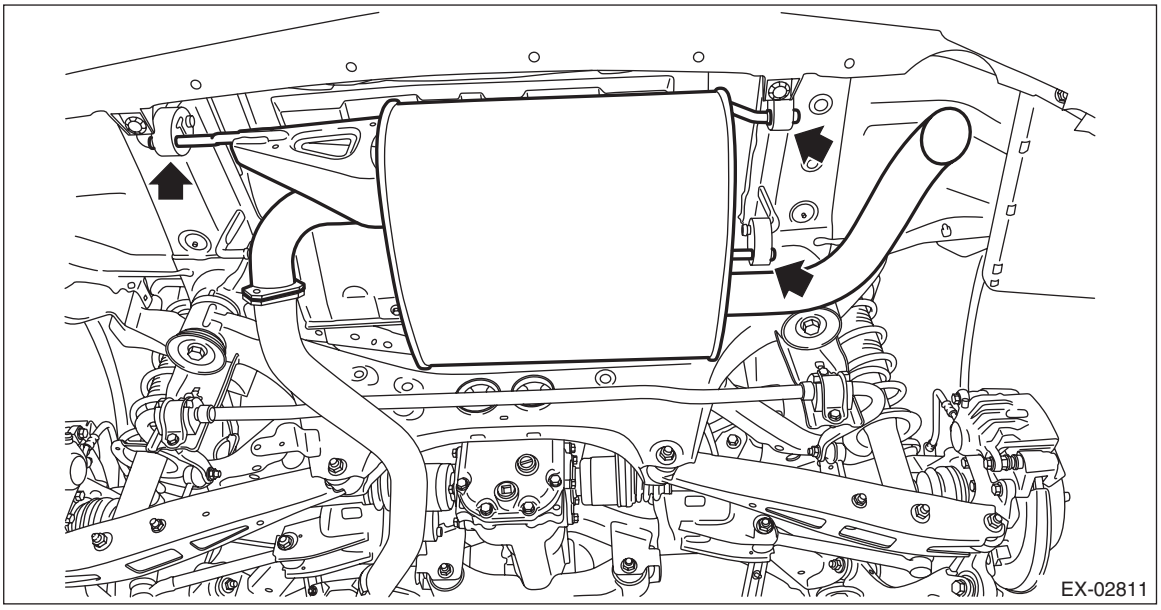
5) Remove the muffler from the cushion rubber.

CAUTION:
Be careful not to drop the muffler during removal.

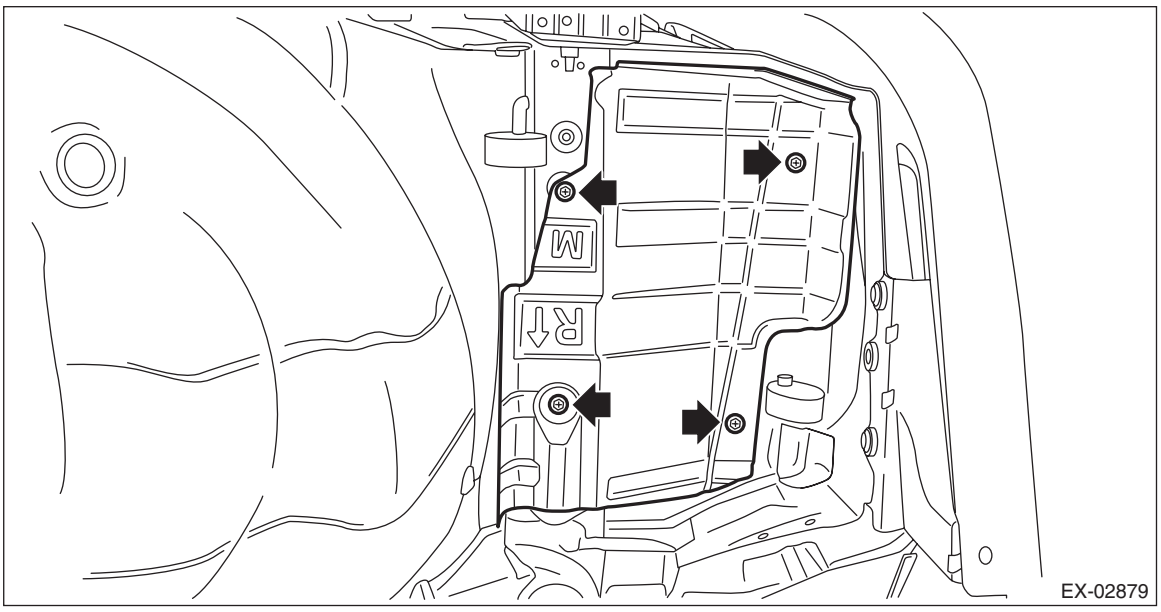
- 4 door model



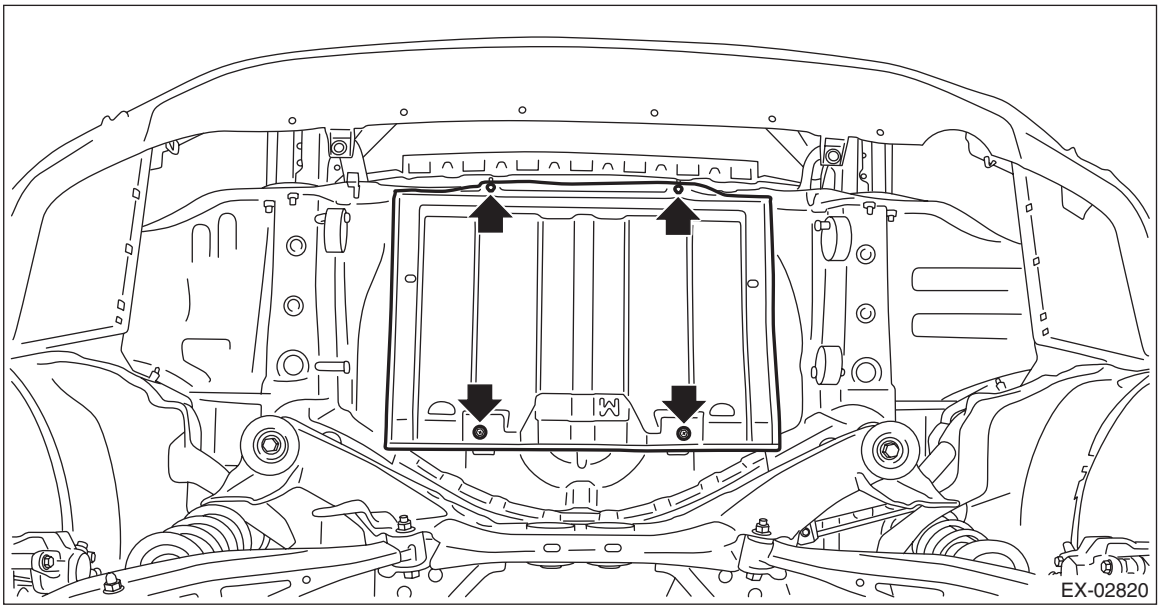
- 5 door model



6) Remove the heat shield cover from the vehicle.
- 4 door model



- 5 door model



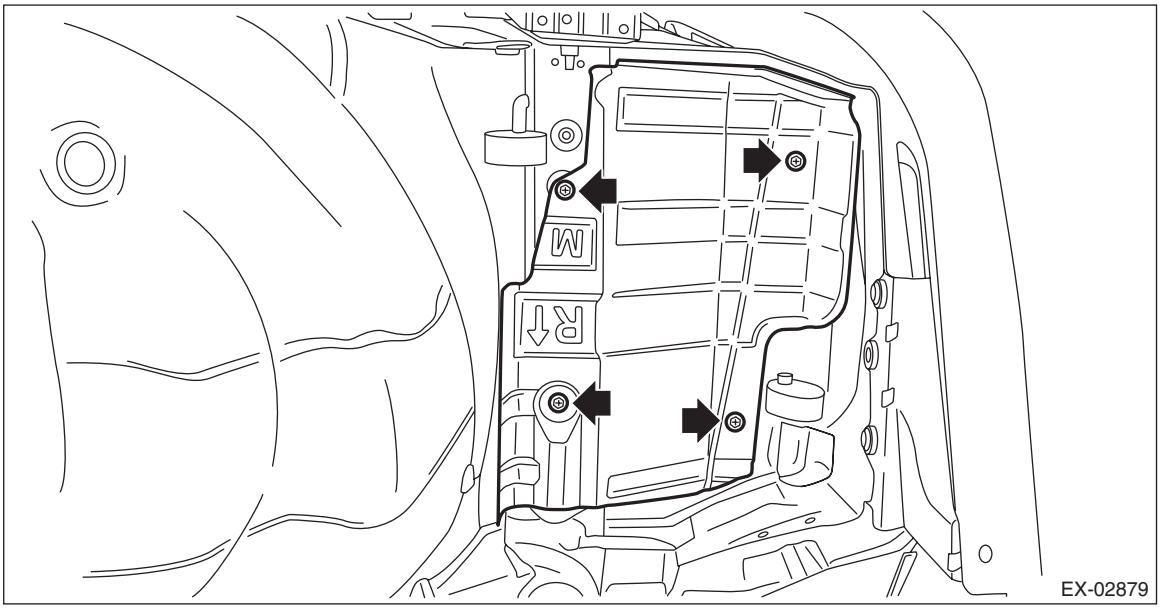
B: INSTALLATION

Install in the reverse order of removal.

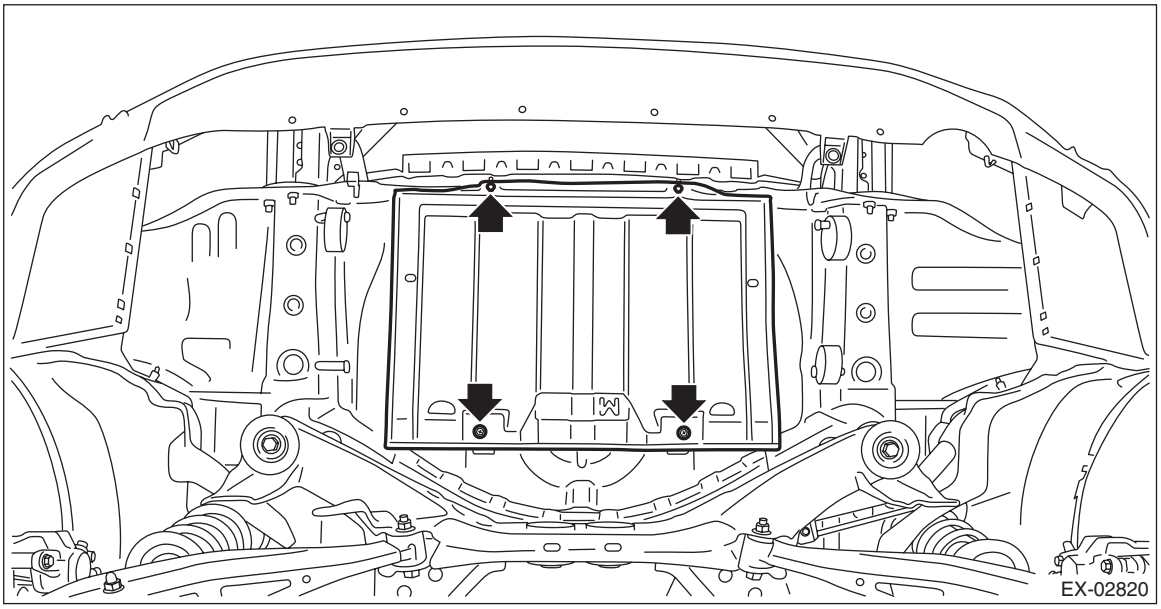
NOTE:
- Use a new gasket and self-locking nut.
- After assembling, degrease the lubricant which was applied to the cushion rubber while removing/installing.

Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)

- 4 door model

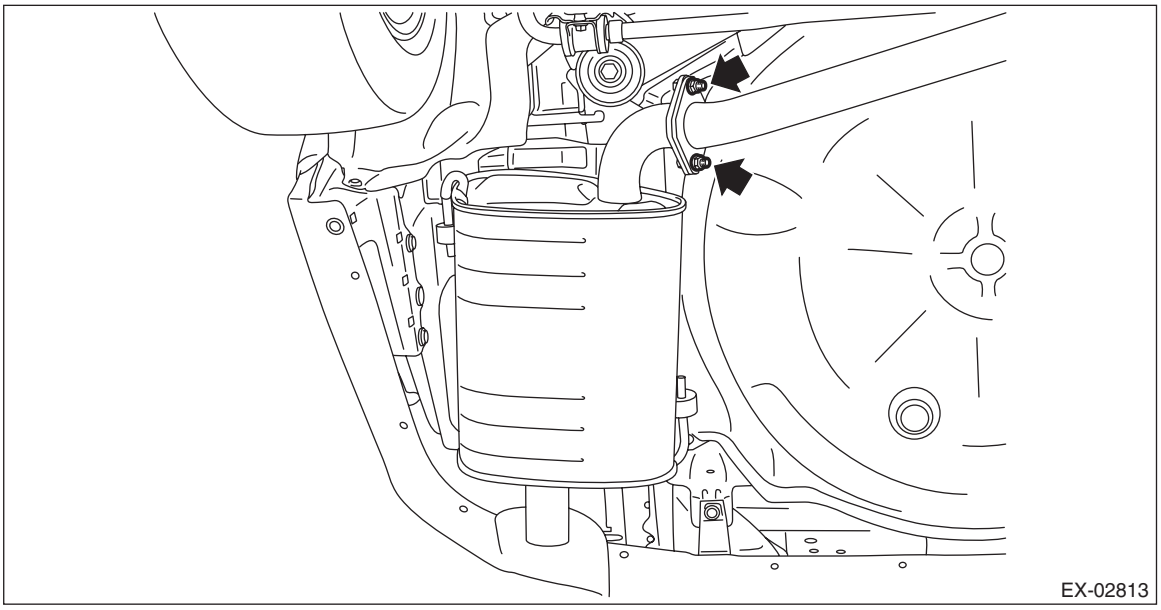


- 5 door model

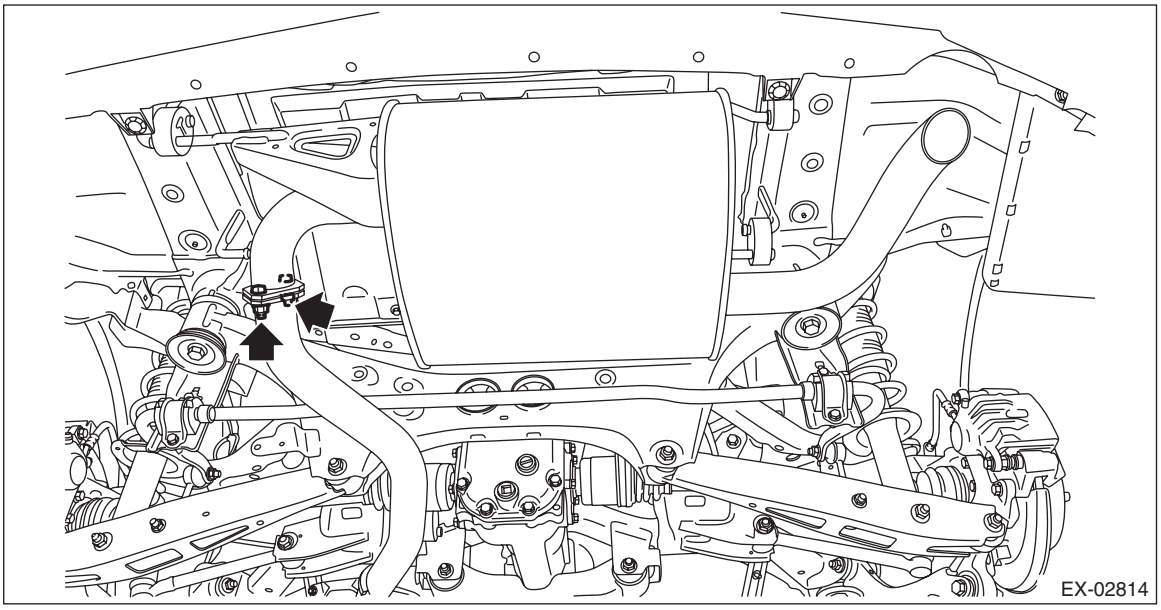


Tightening torque:
48 N·m (4.9 kgf-m, 35.4 ft-lb)

- 4 door model



- 5 door model



C: INSPECTION

1) Check the connections and welded parts for exhaust leaks.
2) Make sure there are no holes or rusting.
3) Check the cushion rubber for wear or crack.

COOLING

CO(H4DO(w/o HEV))

		Page
1.	General Description	2
2.	Radiator Fan System	10
3.	Engine Coolant	16
4.	Water Pump	19
5.	Water Pipe Assembly	24
6.	Thermostat	64
7.	Radiator	78
8.	Radiator Cap	88
9.	Radiator Main Fan and Fan Motor	89
10.	Radiator Sub Fan and Fan Motor	93
11.	Reservoir Tank	97
12.	Engine Cooling System Trouble in General	98

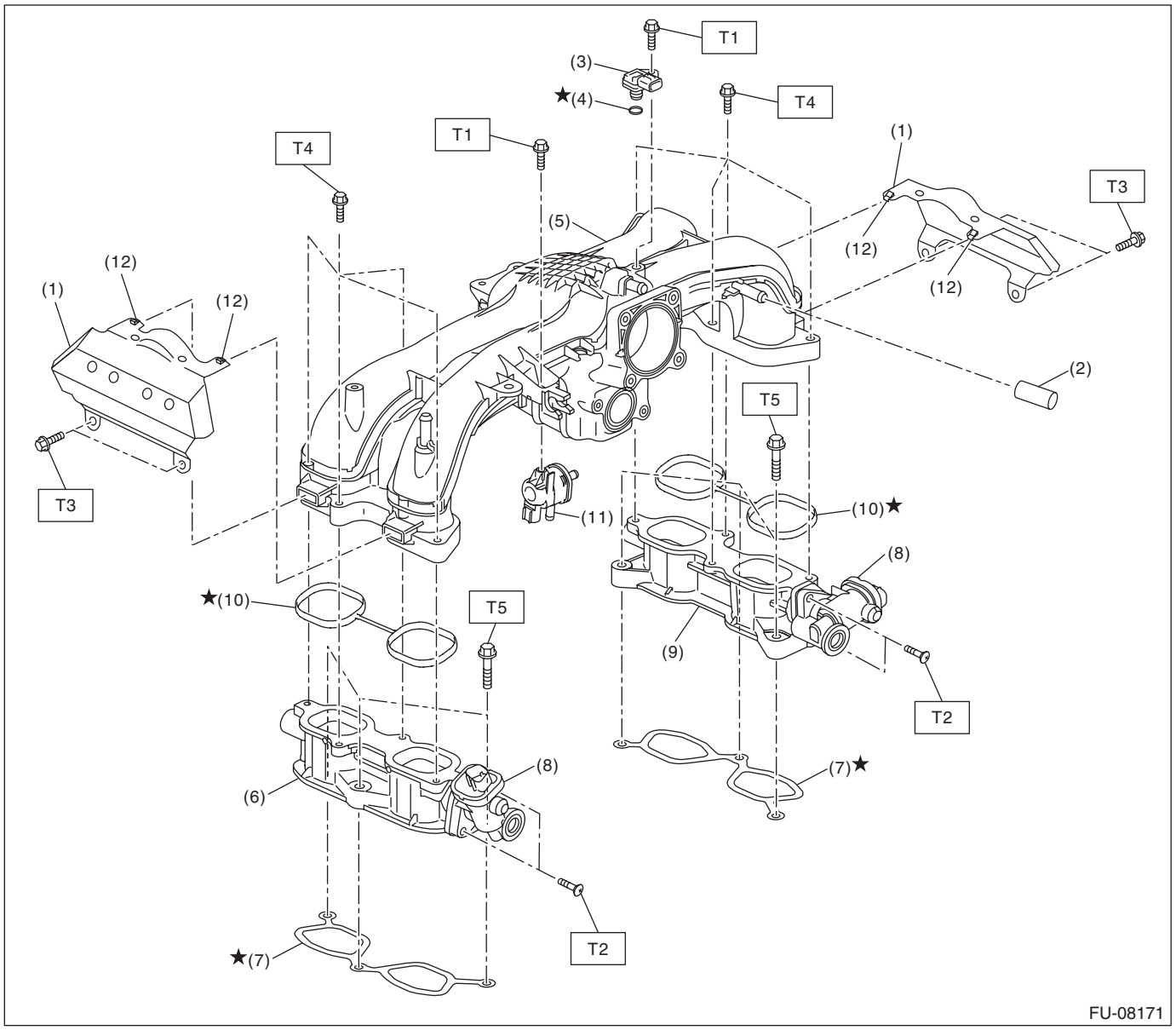
1. General Description

A: SPECIFICATION

Fuel tank	Capacity	Except for XV model	55 L (14.5 US gal, 12.1 Imp gal)
		XV model	60 L (15.9 US gal, 13.2 Imp gal)
	Location		Under rear seat
Fuel pump	Type		Impeller
	Shutoff discharge pressure		750 kPa (7.7 kg/cm^2, 108.8 psi), or less
	Discharge rate		82 L (21.7 US gal, 18 Imp gal)/h or more [12.5 V at 343 kPa (3.5 kg/cm^2, 49.7 psi)]
Fuel filter			In-tank type

B: COMPONENT

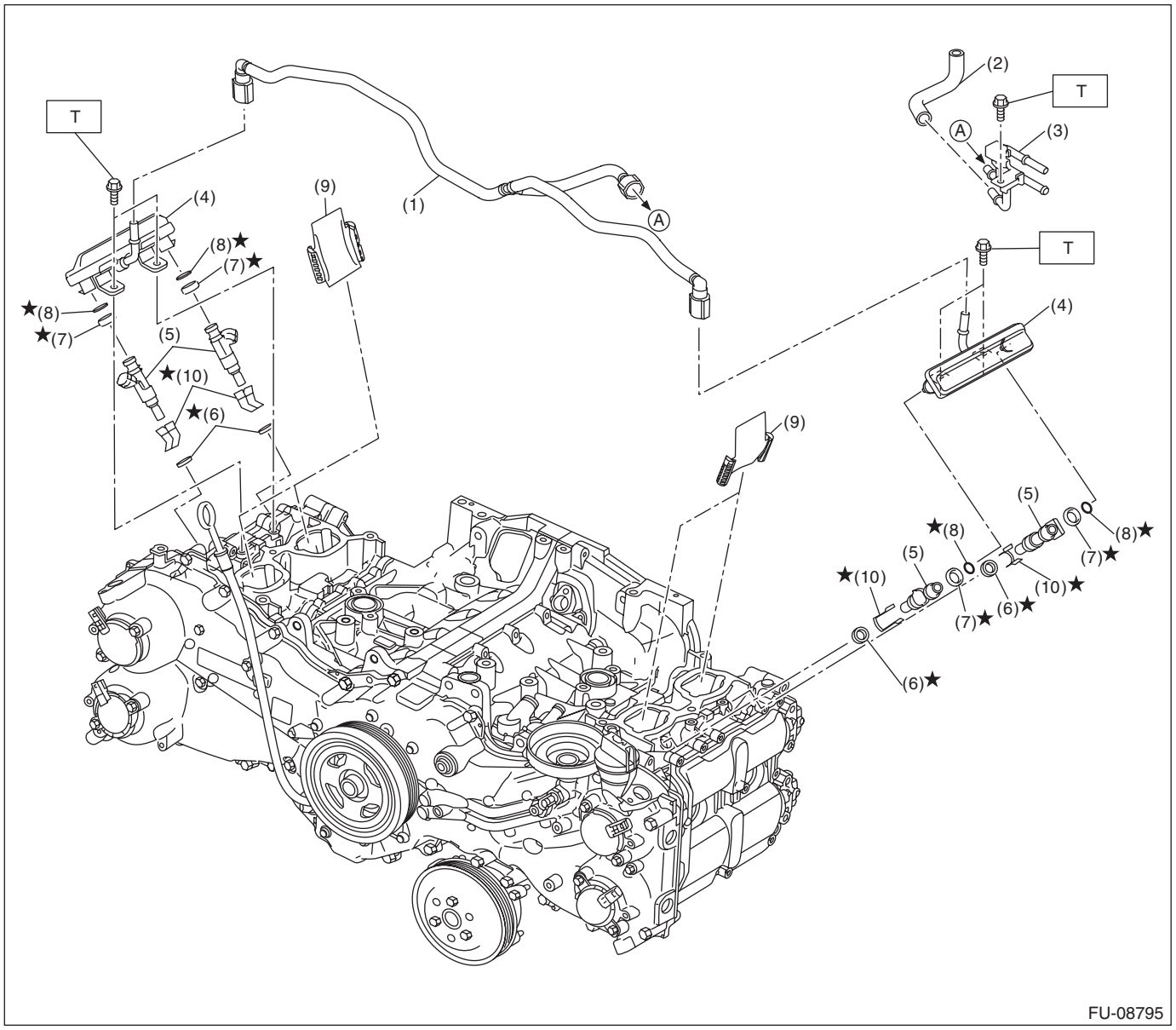
1. INTAKE MANIFOLD 1



(1)	Intake manifold protector	(7)	Gasket	
(2)	Cap	(8)	Tumble generator valve actuator	
(3)	Manifold absolute pressure sensor	(9)	Tumble generator valve RH	
(4)	O-ring	(10)	Gasket	
(5)	Intake manifold	(11)	Purge control solenoid valve	
(6)	Tumble generator valve LH	(12)	Cushion	

Tightening torque: N·m (kgf-m, ft-lb)
T1: 3.4 (0.3, 2.5)
T2: 6 (0.6, 4.4)
T3: 6.4 (0.7, 4.7)
T4: 8.3 (0.8, 6.1)
T5: 25 (2.5, 18.4)

2. INTAKE MANIFOLD 2

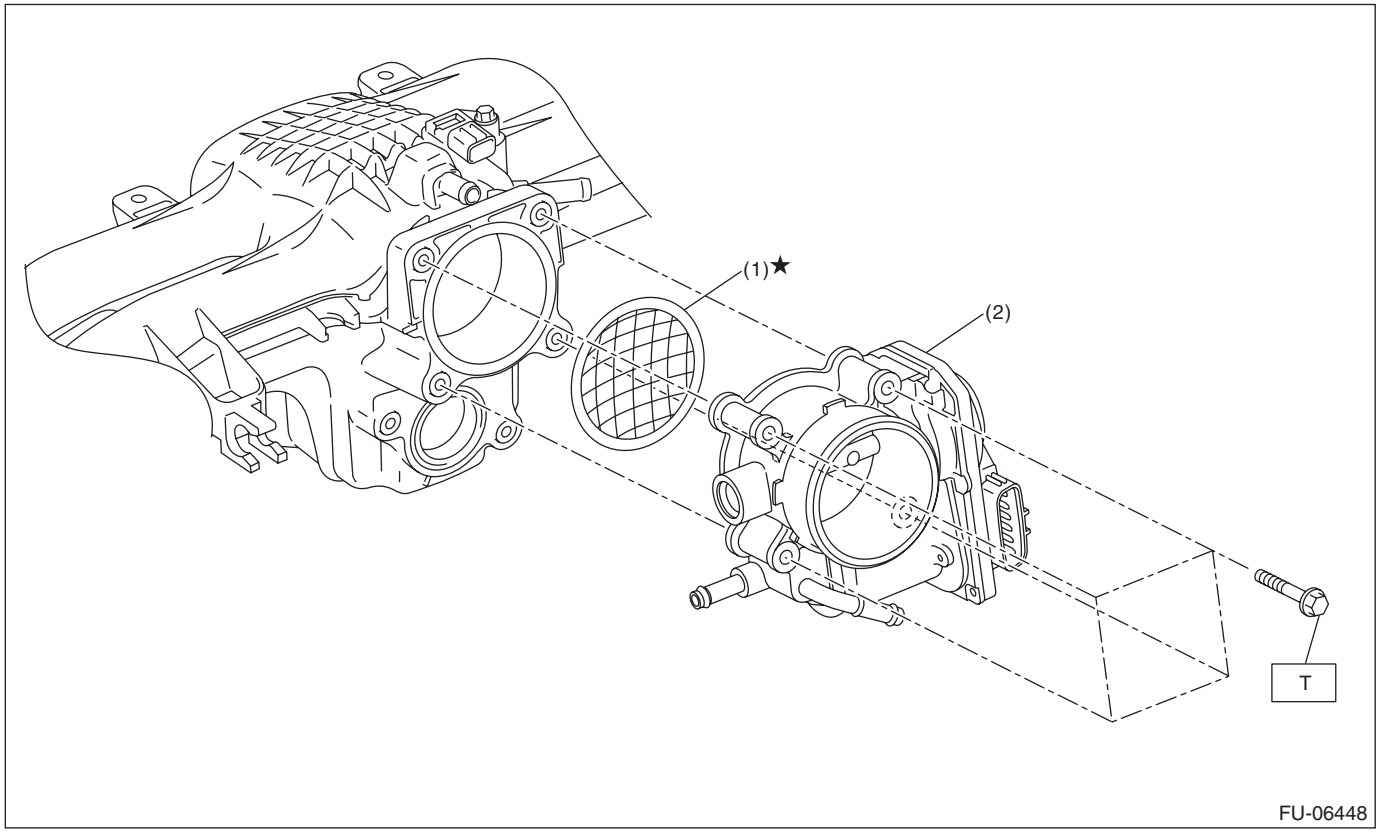


FU-08795

(1) Fuel delivery pipe
(2) Vacuum hose
(3) Fuel pipe A
(4) Fuel pipe B
(5) Fuel injector
(6) Seal ring
(7) Rubber
(8) O-ring
(9) Cylinder head plate
(10) Fuel injector holder

Tightening torque: N·m (kgf-m, ft-lb)
T: 6.4 (0.7, 4.7)

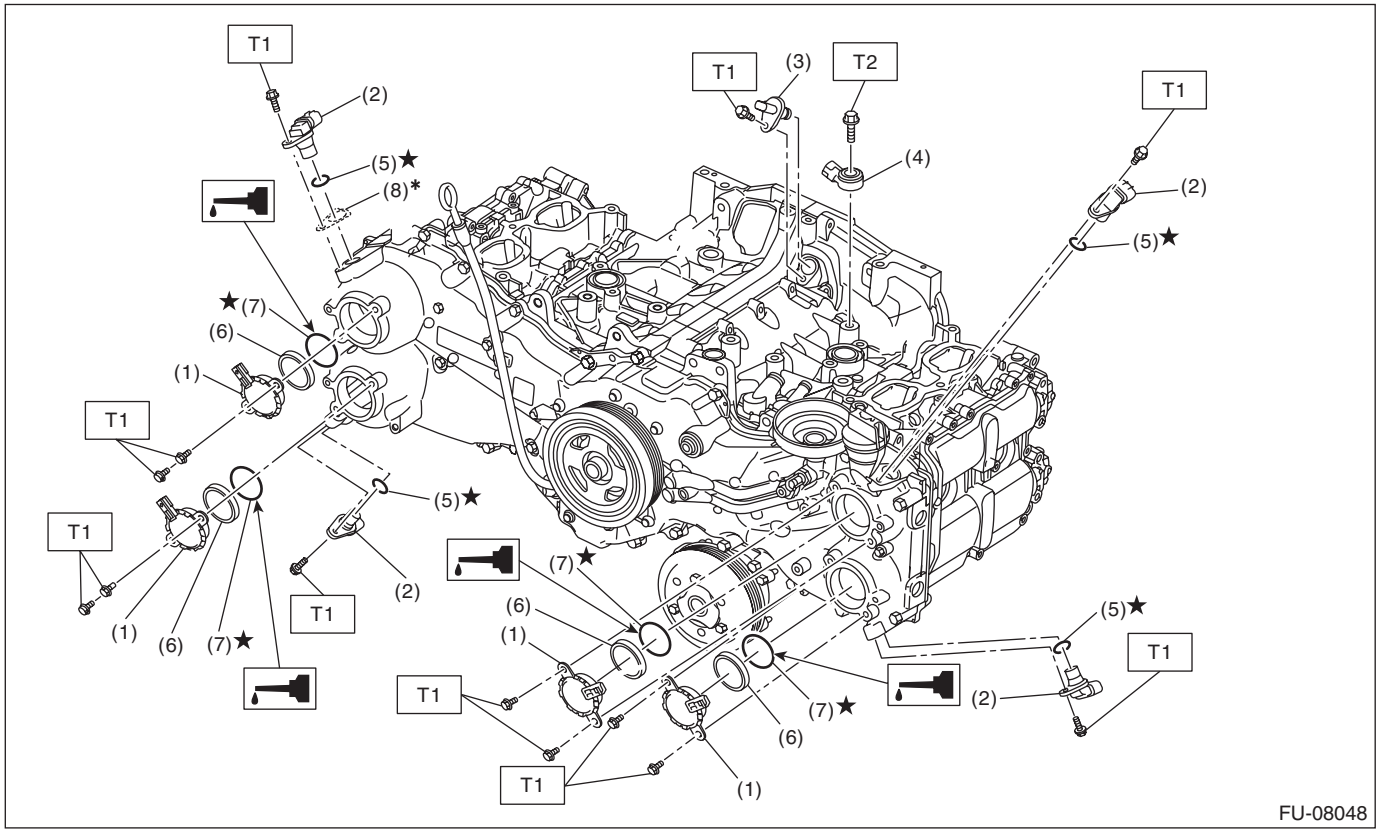
3. THROTTLE BODY



(1) Gasket
(2) Throttle body

Tightening torque: N·m (kgf-m, ft-lb)
T: 8 (0.8, 5.9)

4. CRANKSHAFT POSITION, CAMSHAFT POSITION AND KNOCK SENSORS

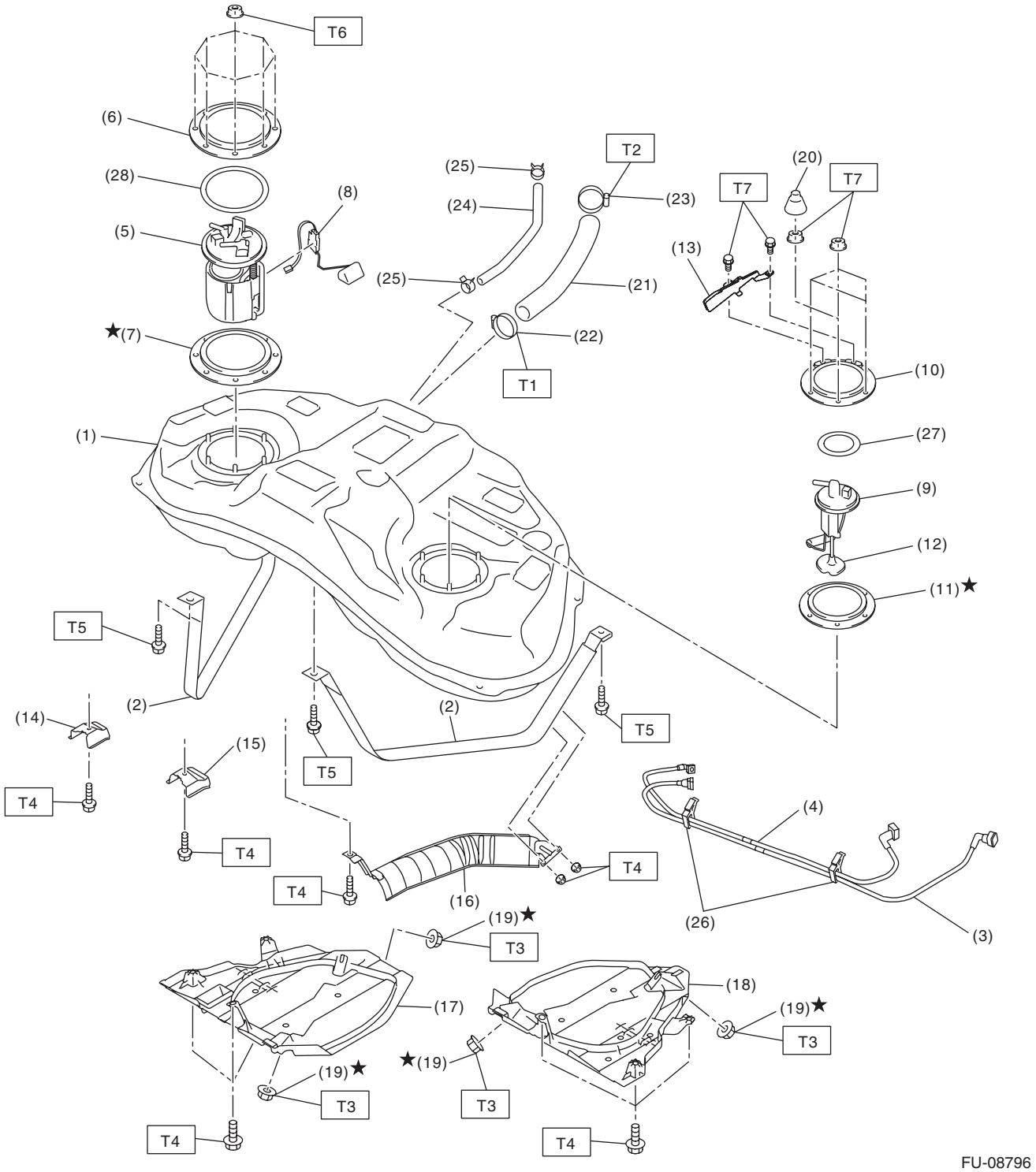


(1) Oil control solenoid
(2) Camshaft position sensor
(3) Crankshaft position sensor
(4) Knock sensor
(5) O-ring
(6) Back-up ring
(7) O-ring
(8) Spacer

* Zero or one spacer for gap adjustment.

Tightening torque: N·m (kgf-m, ft-lb)
T1: 6.4 (0.7, 4.7)
T2: 24 (2.4, 17.7)

5. FUEL TANK

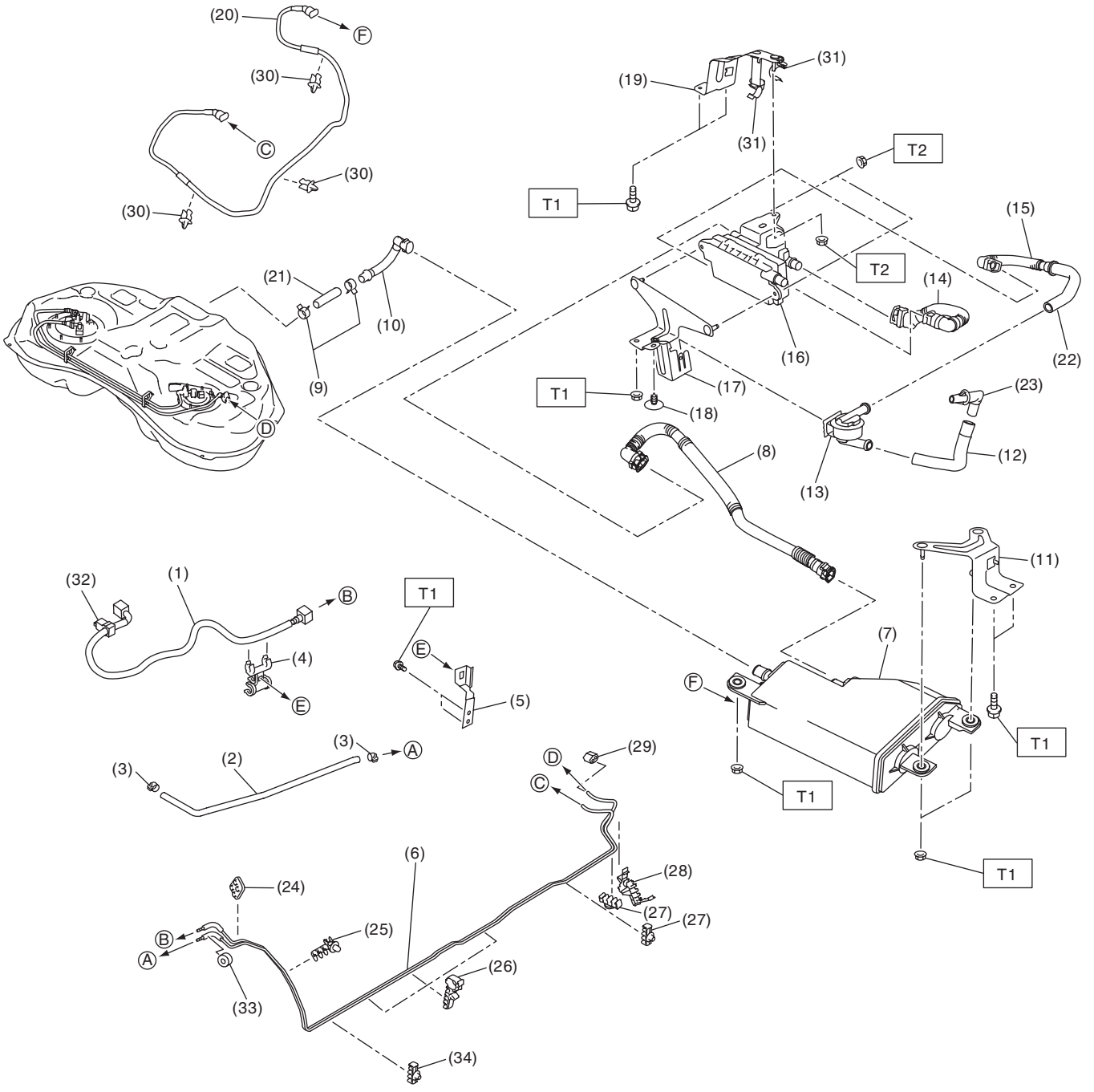

T6
(6)
(28)
(8)
(5)
(25)
(24)
T2
(23)
(20)
T7
T7
(13)
(25)
(21)
★(7)
(22)
T1
(10)
(1)
(27)
(9)
(12)
(11)★
T5
(2)
(2)
T5
T5
(14)
(15)
T4
T4
T4
T4
(4)
(16)
(19)★
T3
(26)
(3)
(17)
(18)
(19)★
T3
★(19)
T3
(19)★
T3
T4
T4
FU-08796

(1) Fuel tank
(2) Fuel tank band
(3) Delivery tube
(4) Jet pump tube
(5) Fuel pump ASSY
(6) Fuel pump upper plate
(7) Fuel pump gasket
(8) Fuel level sensor
(9) Fuel sub level sensor
(10) Fuel sub level sensor upper plate
(11) Fuel sub level sensor gasket
(12) Fuel sub level sensor filter
(13) Fuel sub level sensor protector
(14) Stopper RH
(15) Stopper LH
(16) Heat shield cover
(17) Fuel tank protector RH
(18) Fuel tank protector LH
(19) Self-locking nut
(20) Rubber cap
(21) Fuel filler hose
(22) Clamp
(23) Clamp
(24) Air vent hose
(25) Clip
(26) Tube clamp
(27) Fuel sub level sensor upper plate cushion
(28) Fuel pump upper plate cushion

Tightening torque: N·m (kgf-m, ft-lb)

T1: 2 (0.2, 1.5)
T2: 2.5 (0.3, 1.8)
T3: 9 (0.9, 6.6)
T4: 18 (1.8, 13.3)
T5: 33 (3.4, 24.3)
T6: <Ref. to FU(H4DO(w/o HEV))-141, INSTALLATION, Fuel Pump.>
T7: <Ref. to FU(H4DO(w/o HEV))-150, INSTALLATION, Fuel Sub Level Sensor.>

6. FUEL LINE

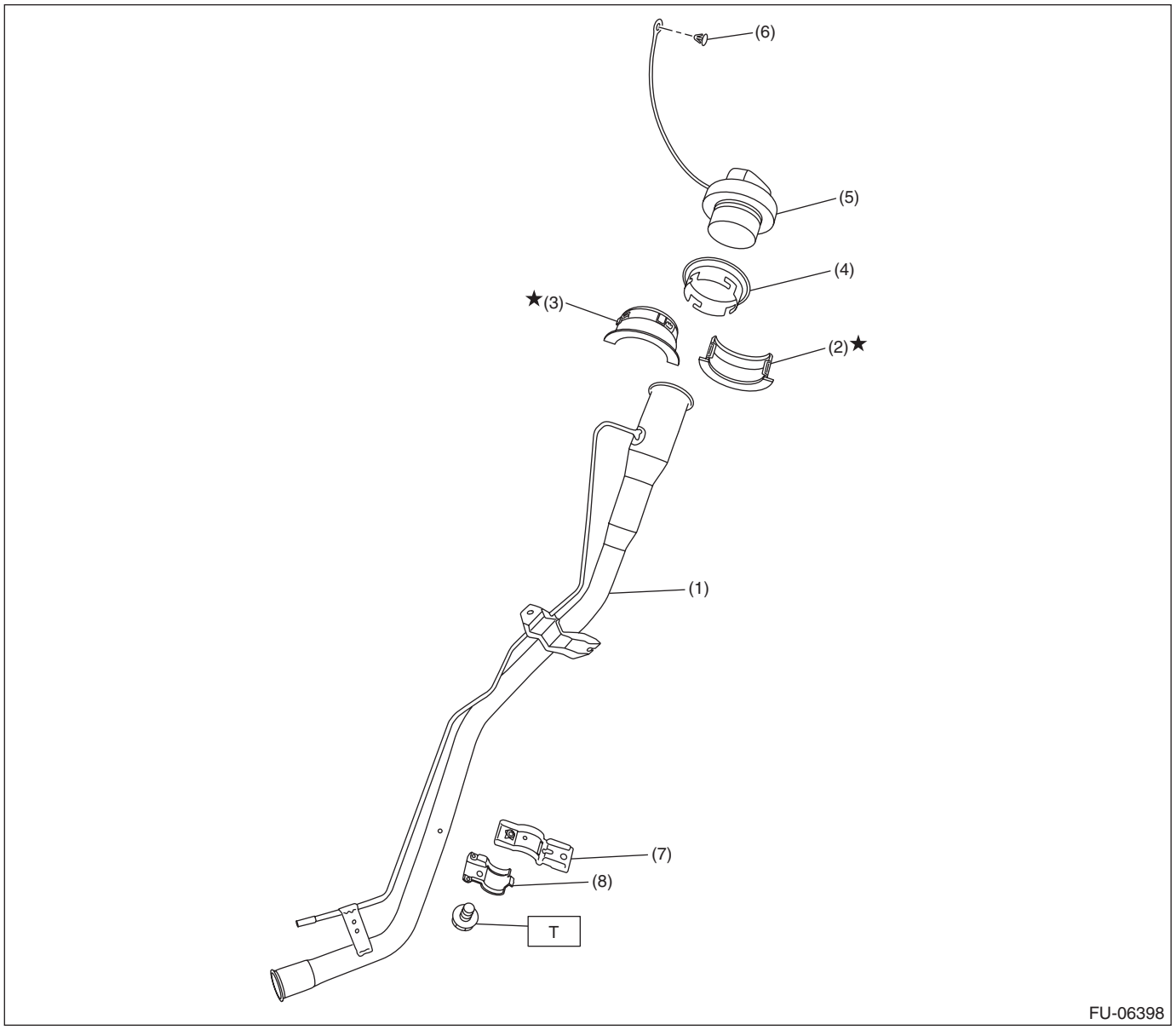


FU-08922

(1) Fuel delivery tube
(2) Evaporation hose
(3) Clip
(4) Hose clamp
(5) Hose clamp bracket
(6) Fuel pipe ASSY
(7) Canister
(8) Drain tube A
(9) Clip
(10) Vent tube
(11) Canister bracket
(12) Intake hose
(13) Drain separator
(14) Drain tube B
(15) Drain tube C
(16) Leak check valve ASSY
(17) Leak check valve bracket A
(18) Clip
(19) Leak check valve bracket B
(20) Purge pipe
(21) Vent hose
(22) Drain hose
(23) Connector
(24) Fuel pipe front grommet
(25) Pipe clamp
(26) Pipe clamp
(27) Pipe clamp
(28) Pipe clamp
(29) Fuel pipe rear grommet
(30) Pipe clamp
(31) Tube clamp
(32) Tube clamp
(33) Bushing
(34) Pipe clamp

Tightening torque: N·m (kgf-m, ft-lb)
T1: 7.5 (0.8, 5.5)
T2: 18 (1.8, 13.3)

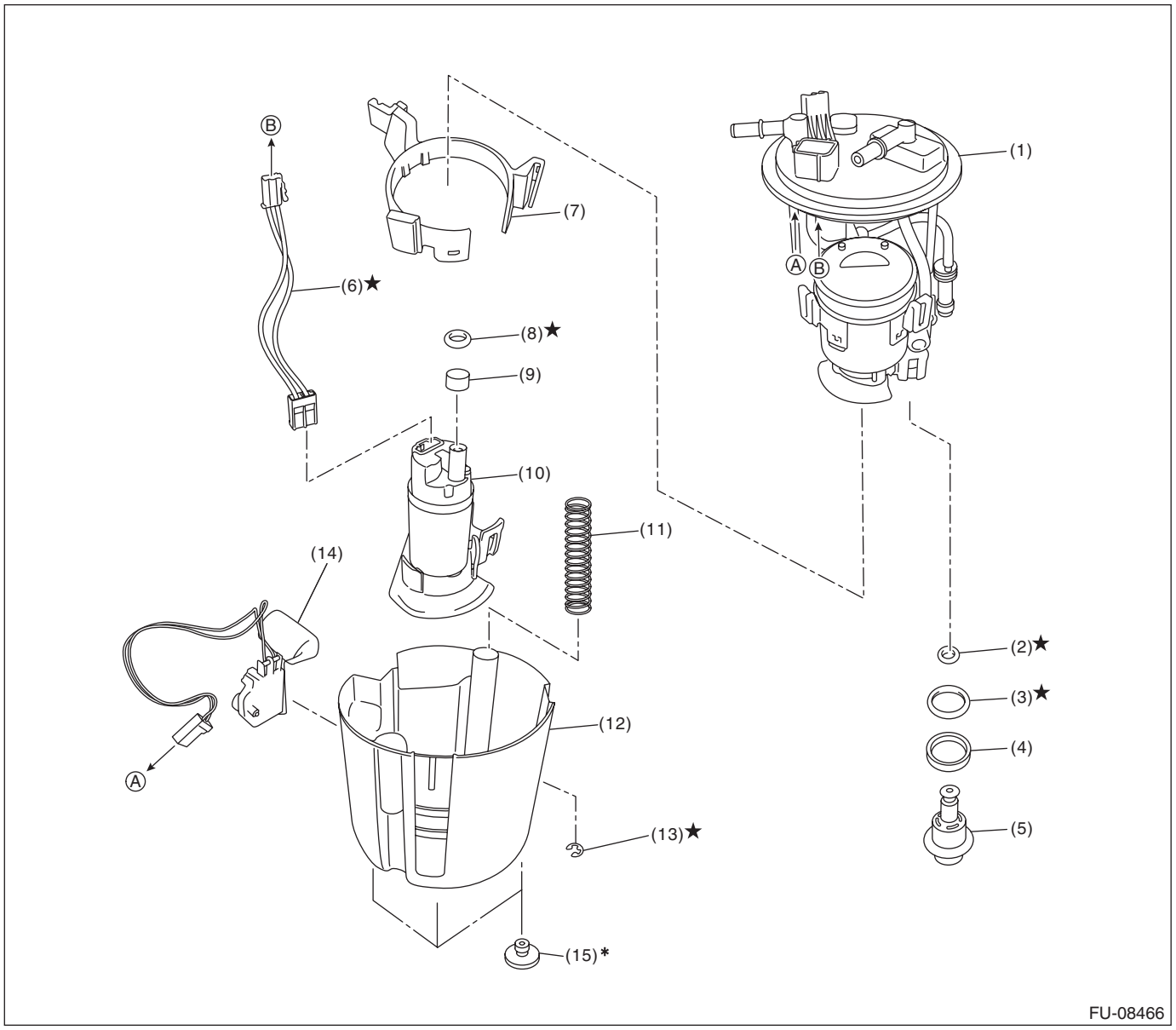
7. FUEL FILLER PIPE



(1) Fuel filler pipe ASSY
(2) Neck holder A
(3) Neck holder B
(4) Fuel filler pipe protector
(5) Fuel filler cap
(6) Clip
(7) Upper bracket
(8) Lower bracket

Tightening torque: N·m (kgf-m, ft-lb)
T: 7.5 (0.8, 5.5)

8. FUEL PUMP



(1)	Fuel filter ASSY	(6)	Connector cable	(11)	Spring
(2)	O-ring	(7)	Fuel pump holder	(12)	Fuel chamber ASSY
(3)	O-ring	(8)	O-ring	(13)	Clip
(4)	Back-up ring	(9)	Spacer	(14)	Fuel level sensor
(5)	Pressure regulator	(10)	Fuel pump	(15)	Cushion

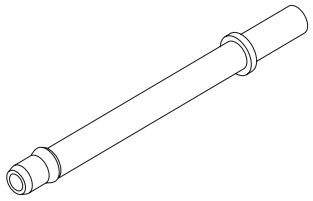
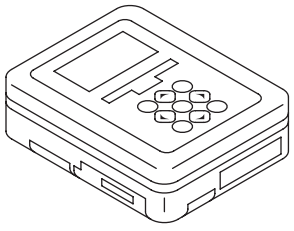
* When removing the cushion from the fuel chamber assembly, replace it with a new part.

C: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a work cap, and protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Place “NO OPEN FLAMES” signs near the working area.
- Prepare a container and cloth to prevent scattering of fuels when performing work where fuels can be spilled. If the oil spills, wipe it off immediately to prevent from penetrating into floor or flowing out for environmental protection.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Follow all government and local regulations concerning disposal of refuse when disposing fuel.

D: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18471AA000	18471AA000	FUEL PIPE ADAPTER	Used for draining fuel.
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for setting of each function and trouble-shooting for electrical system. NOTE: For detailed operation procedures of Subaru Select Monitor III, refer to “PC application help for Subaru Select Monitor”.

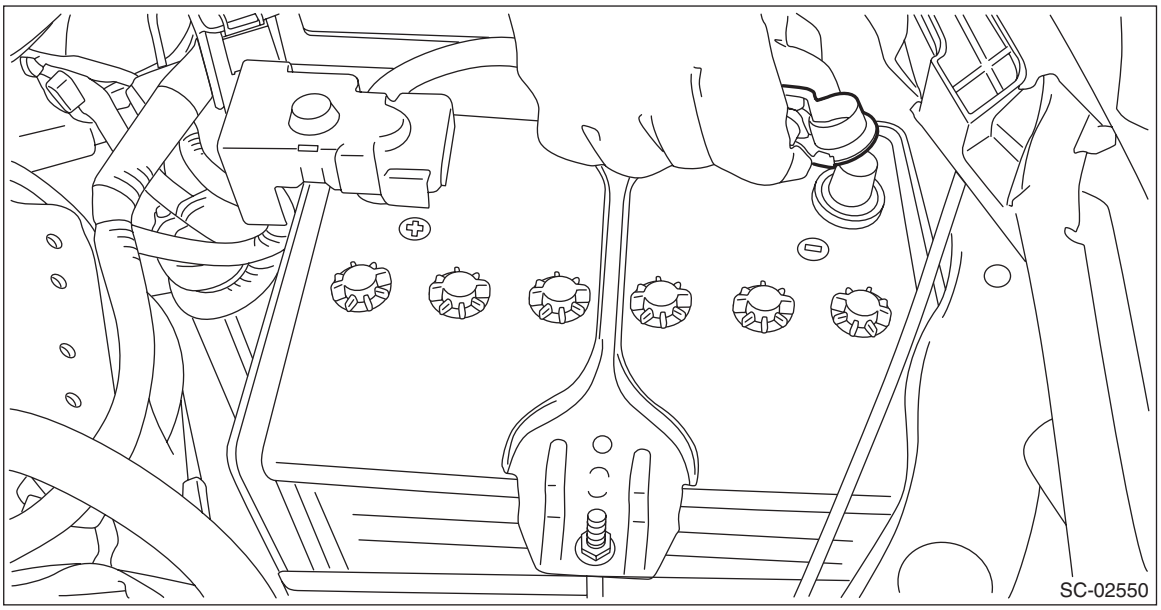
2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance and voltage.
Oscilloscope	Used for inspecting the waveform of each sensor.
Mighty Vac	Used for inspecting the manifold absolute pressure sensor.

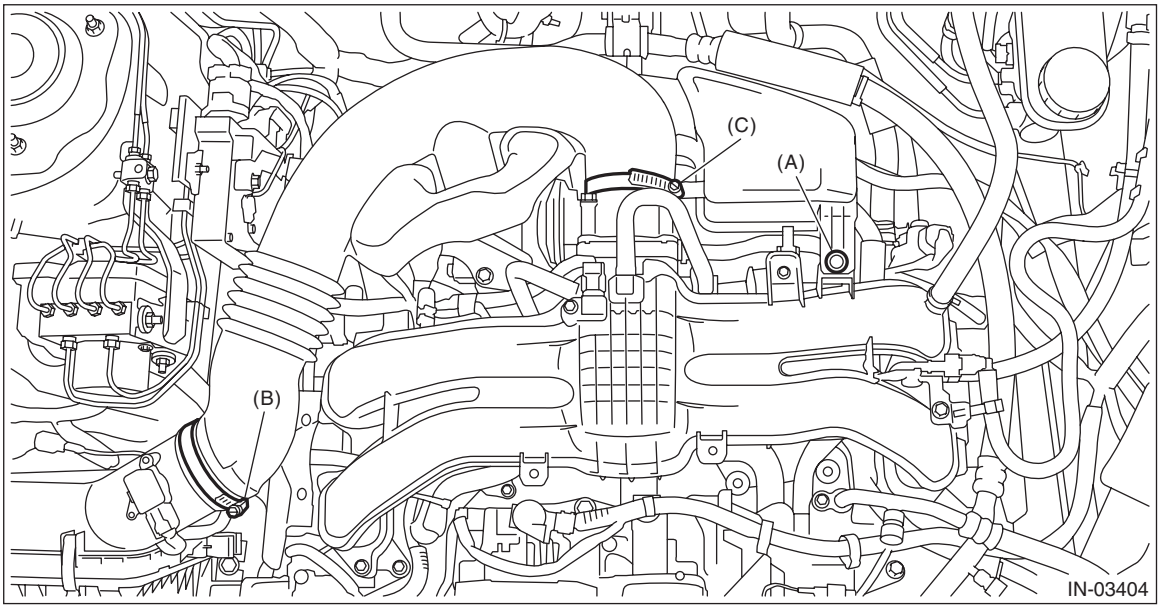
2. Throttle Body

A: REMOVAL

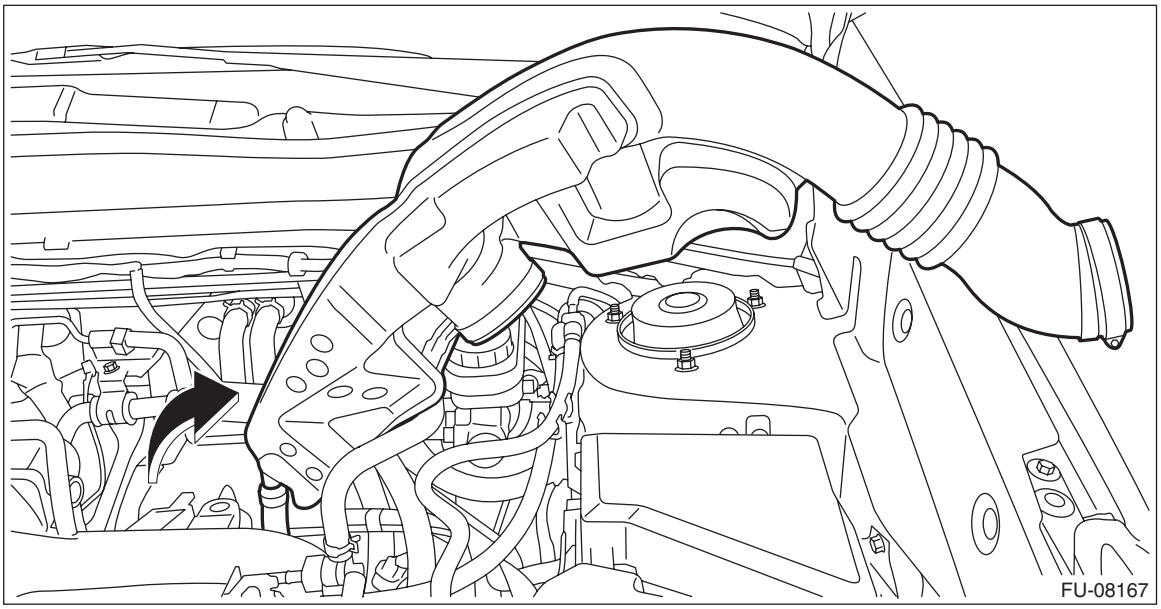
1) Disconnect the ground cable from battery.



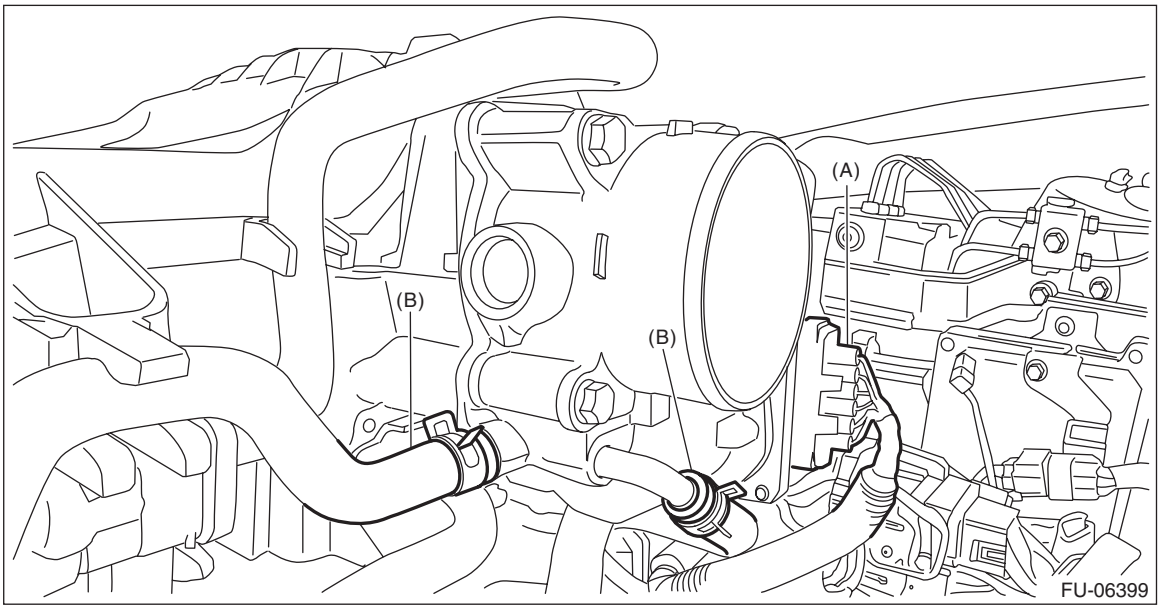
2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-32, REMOVAL, Front Under Cover.>
4) Drain approximately 3.0 L (3.2 US qt, 2.6 Imp qt) of coolant. <Ref. to CO(H4DO(w/o HEV))-16, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
5) Remove the clip (A), and loosen the clamps (B) and (C) securing the air intake boot.



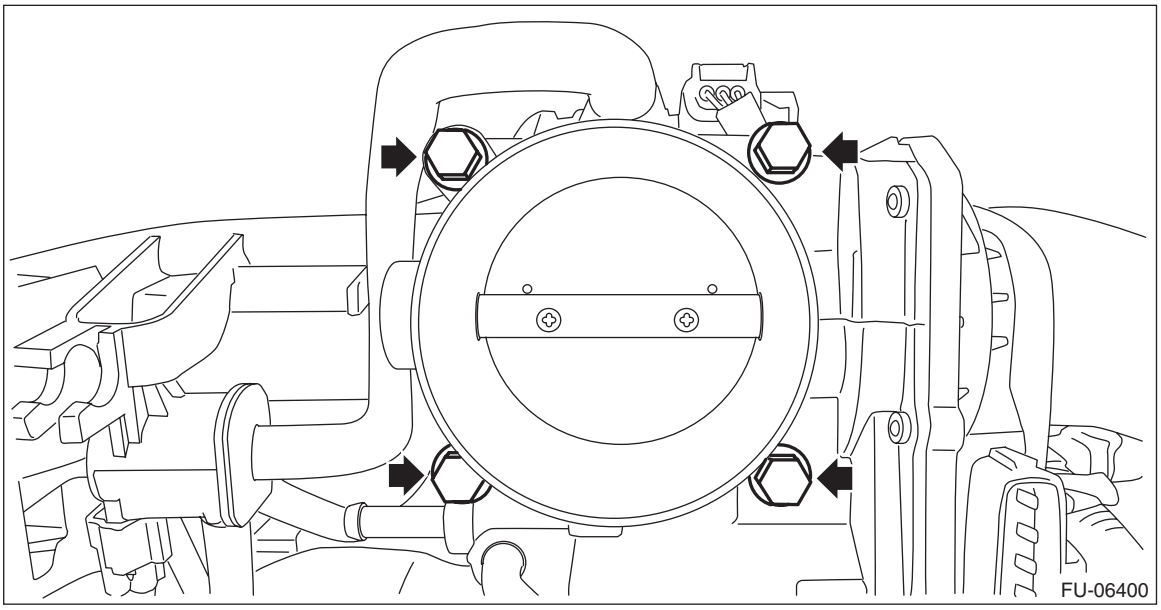
6) Remove the air intake boot from the air cleaner case (rear) and throttle body, and move it to the left side wheel apron.



7) Disconnect the connectors (A) from the throttle position sensor.
8) Disconnect the preheater hose (B) from the throttle body.



9) Remove the throttle body from the intake manifold.



B: INSTALLATION

Install in the reverse order of removal.

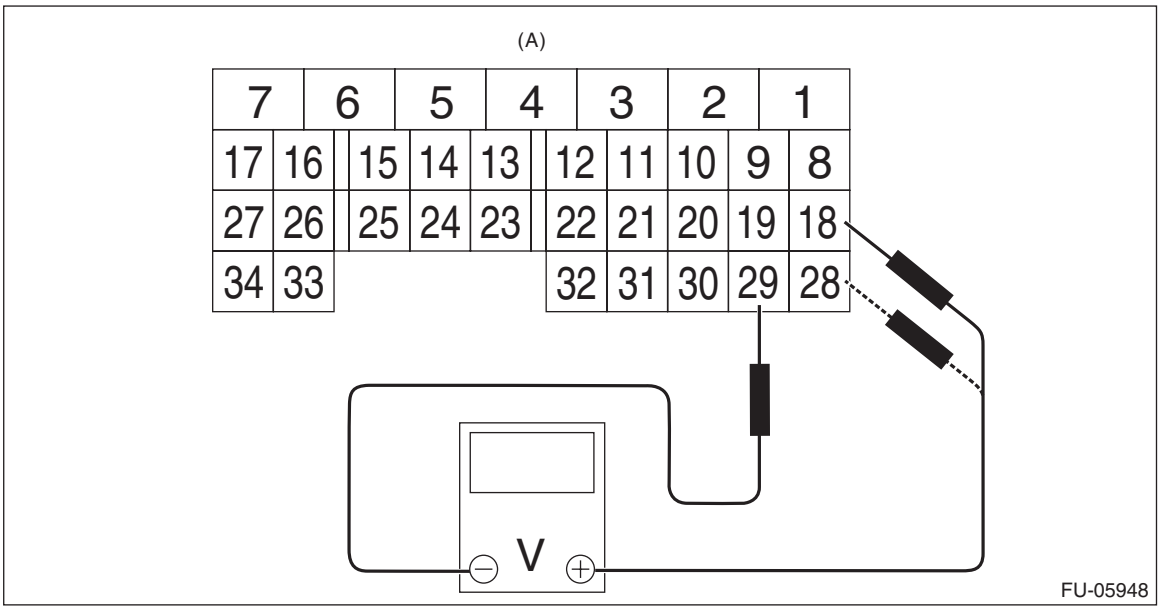
NOTE:
Use a new gasket.

Tightening torque:
8 N·m (0.8 kgf-m, 5.9 ft-lb)

C: INSPECTION

1. THROTTLE SENSOR (METHOD WITH CIRCUIT TESTER)

1) Remove the glove box. <Ref. to EI-78, REMOVAL, Glove Box.>
2) Turn the ignition switch to ON. (engine OFF)
3) Measure the voltage between ECM connector terminals.



(A) To ECM connector

Throttle sensor	Accelerator pedal	Terminal No.	Standard
Main	Not depressed (full closed)	18 (+) and 29 (–)	Approx. 0.6 V
	Depressed (full opened)		Approx. 4.0 V
Sub	Not depressed (full closed)	28 (+) and 29 (–)	Approx. 1.5 V
	Depressed (full opened)		Approx. 4.2 V

4) After inspection, install the related parts in the reverse order of removal.

2. THROTTLE SENSOR (METHOD WITH SUBARU SELECT MONITOR)

1) Turn the ignition switch to ON. (engine OFF)
2) Read the throttle opening angle signal and voltage of throttle sensor using Subaru Select Monitor. <Ref. to EN(H4DO w/o HEV)(diag)-37, DISPLAY ENGINE CURRENT DATA, OPERATION, Subaru Select Monitor.>

Throttle sensor	Throttle opening angle signal	Standard
Main	0.0%	Approx. 0.6 V
	100.0%	Approx. 4.0 V
Sub	0.0%	Approx. 1.5 V
	100.0%	Approx. 4.2 V

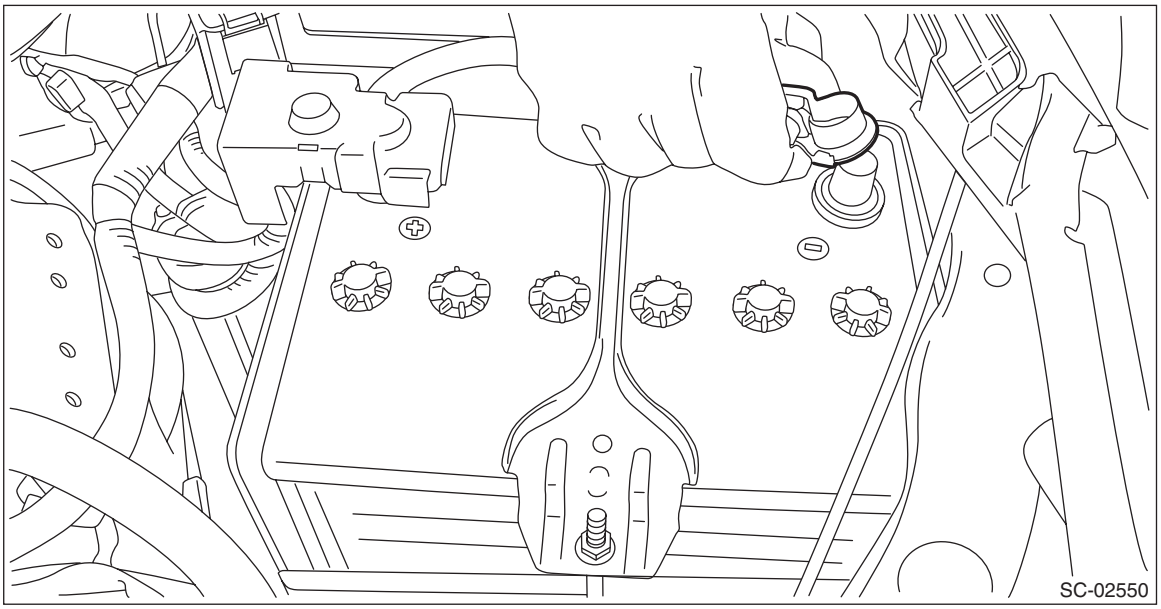
3. OTHER INSPECTIONS

1) Check that the throttle body has no deformation, cracks or other damages.
2) Check that the preheater hose has no cracks, damage or loose part.

3. Intake Manifold

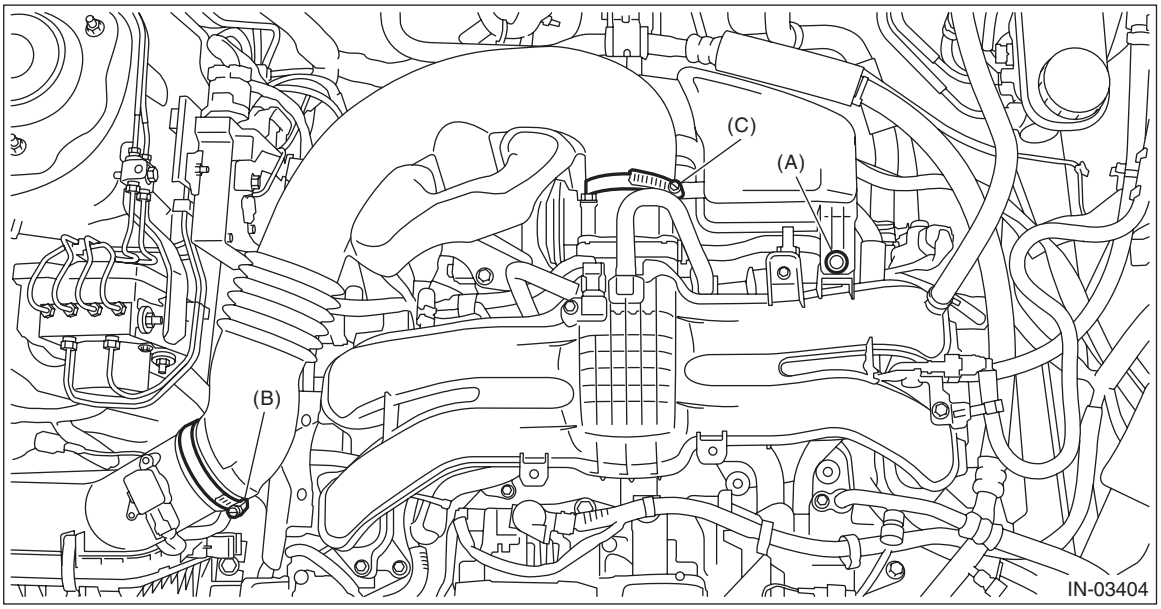
A: REMOVAL

1) Release the fuel pressure. <Ref. to FU(H4DO(w/o HEV))-109, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Disconnect the ground cable from battery.

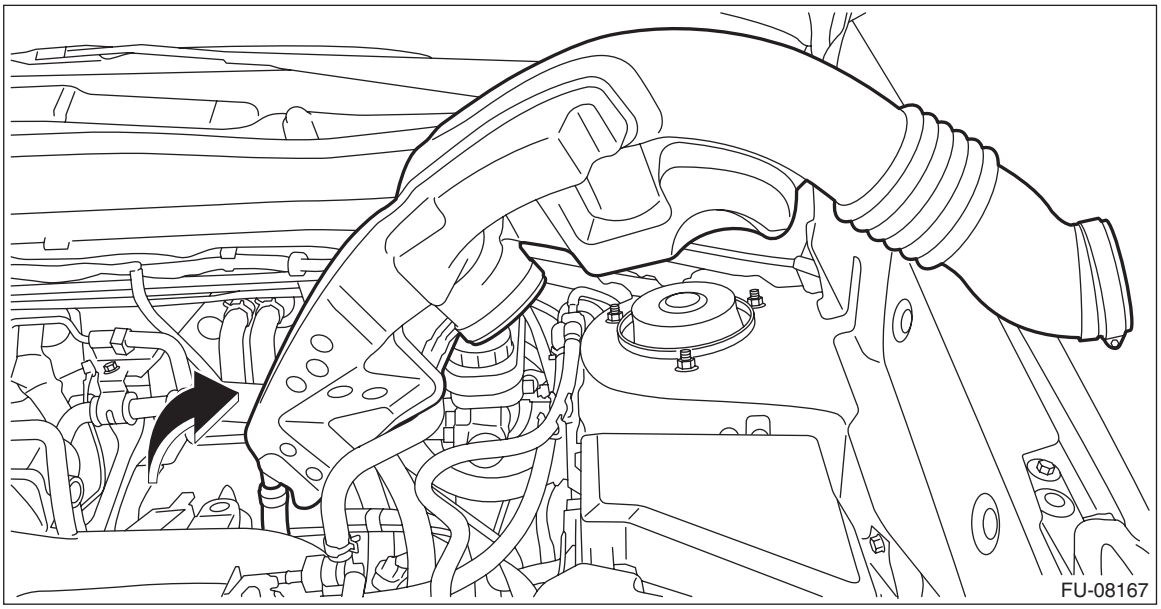


3) Open the fuel filler lid and remove the fuel filler cap.

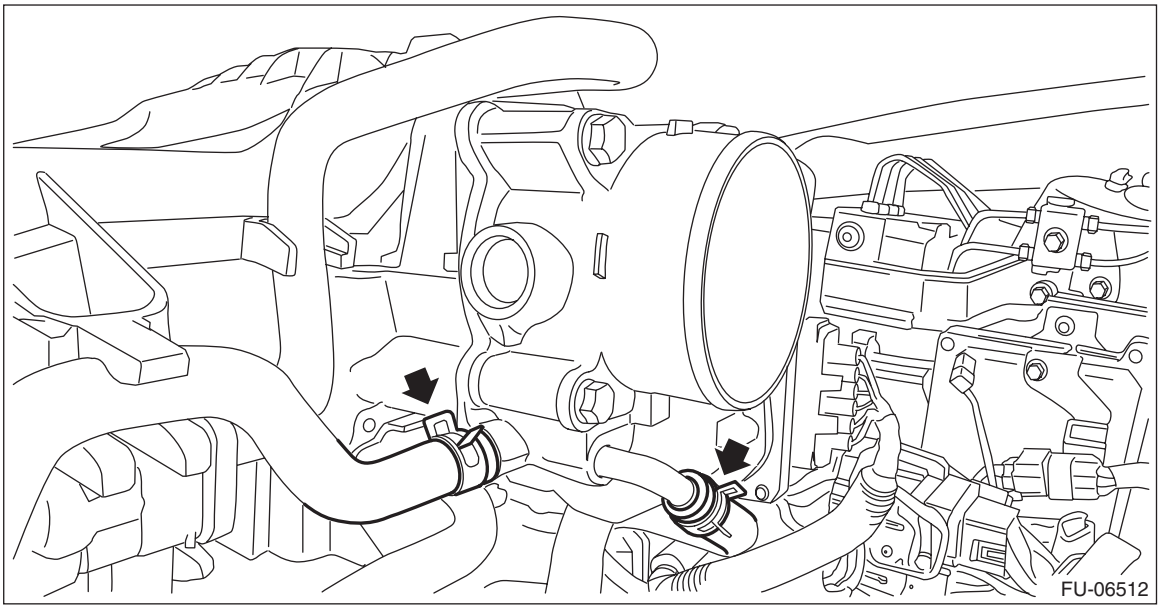
NOTE:
This operation is required to release the inner pressure of the fuel tank.
4) Lift up the vehicle.
5) Remove the under cover. <Ref. to EI-32, REMOVAL, Front Under Cover.>
6) Drain approximately 3.0 L (3.2 US qt, 2.6 Imp qt) of coolant. <Ref. to CO(H4DO(w/o HEV))-16, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
7) Remove the clip (A), and loosen the clamps (B) and (C) securing the air intake boot.



8) Remove the air intake boot from the air cleaner case (rear) and throttle body, and move it to the left side wheel apron.

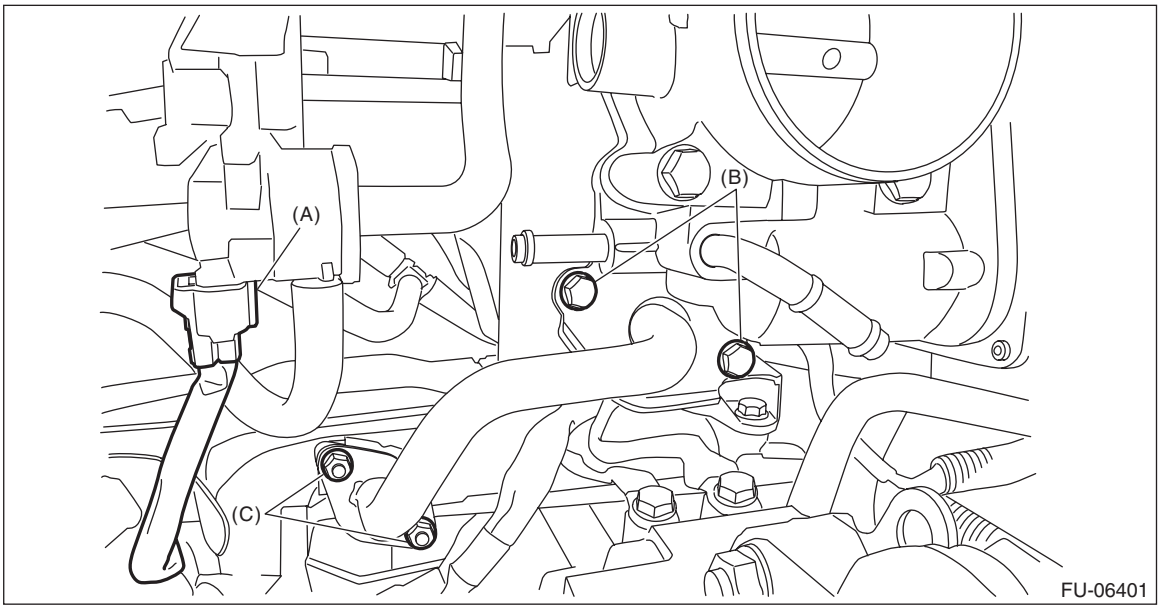


9) Disconnect the preheater hose from throttle body.

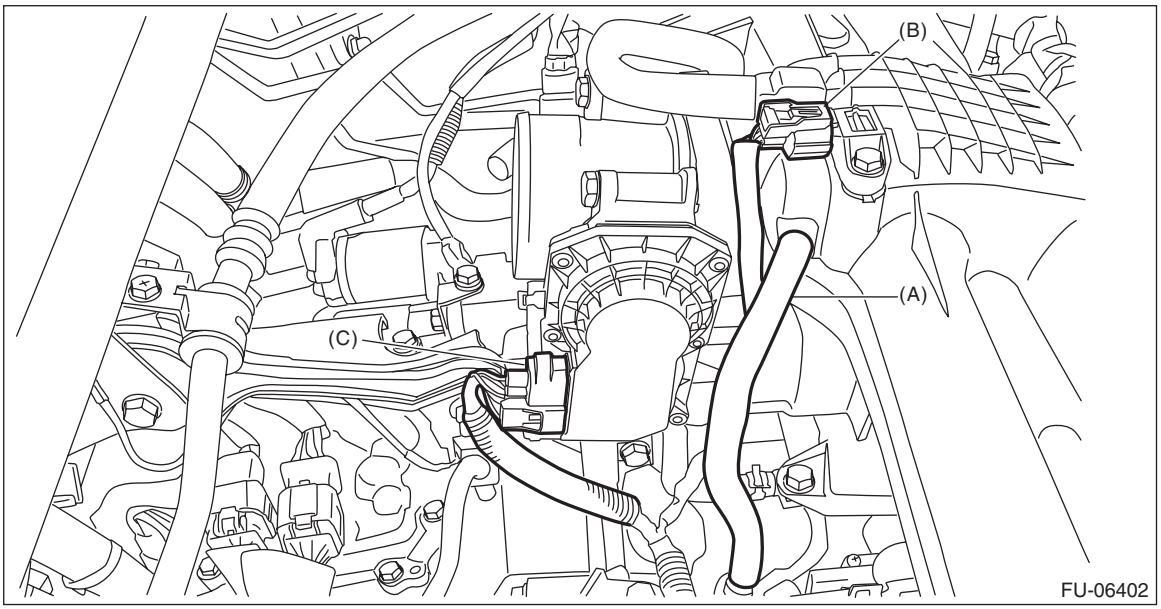


10) Disconnect the connector (A) from the purge control solenoid valve.
11) Loosen the bolt (B) which secures the EGR pipe to the intake manifold.

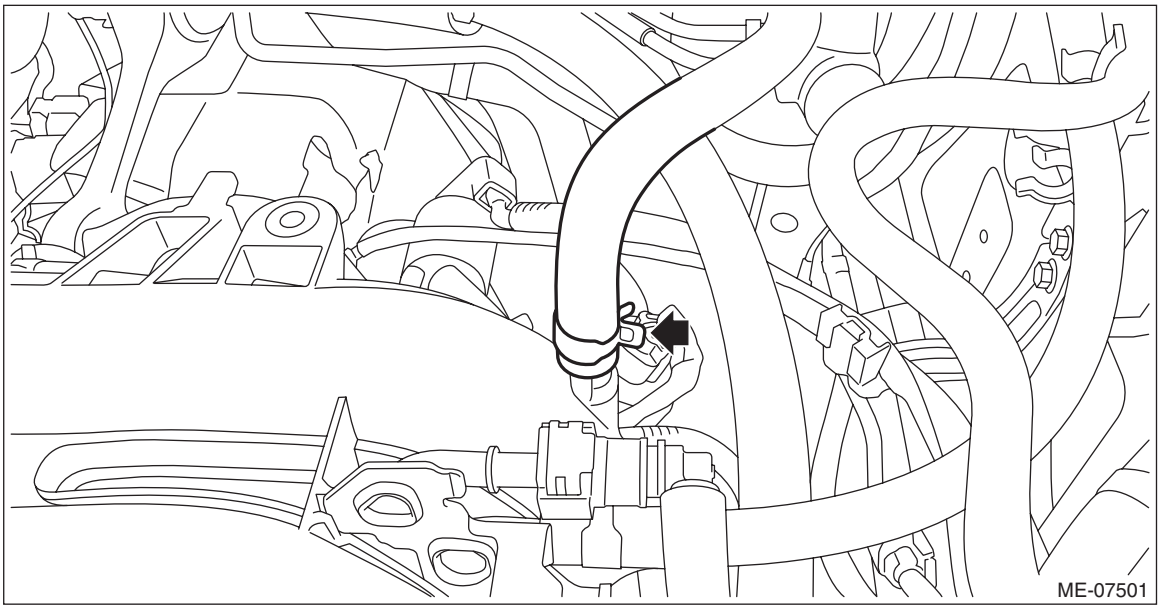
12) Remove the nut (C) which holds EGR pipe from the water pipe assembly.



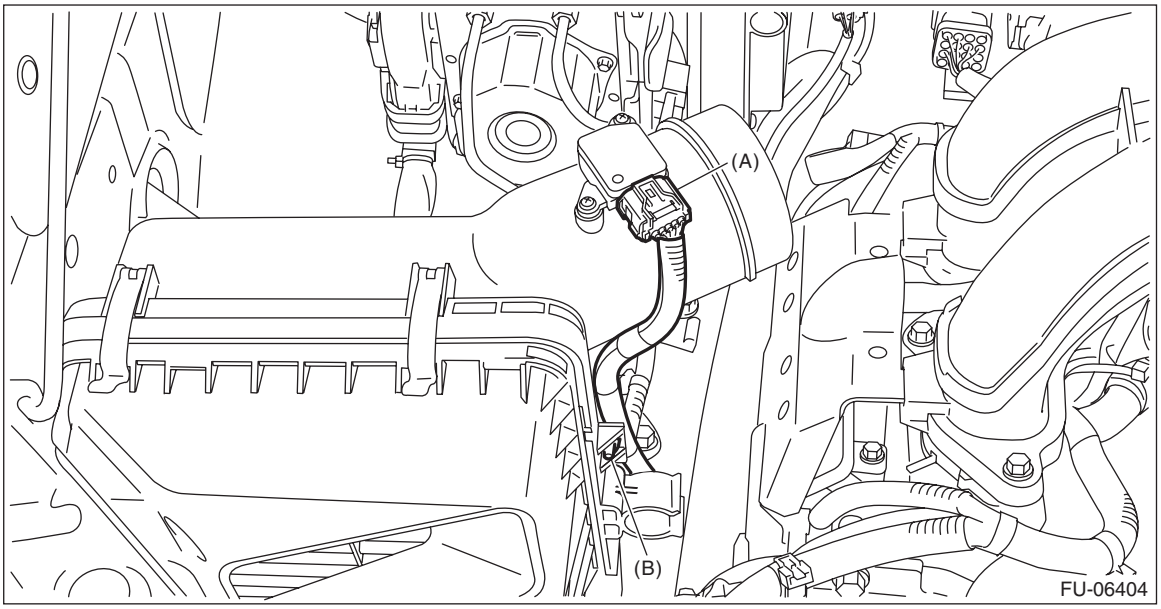
13) Disconnect the PCV hose (A) from intake manifold.
14) Disconnect the connector (B) from manifold absolute pressure sensor.
15) Disconnect the connector (C) from the throttle position sensor.



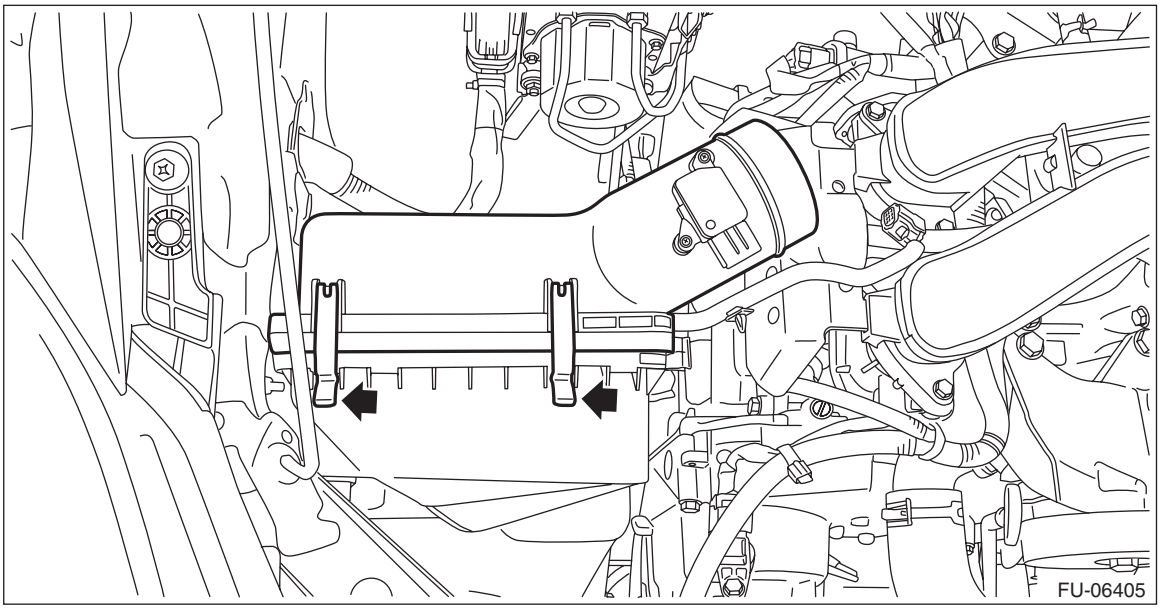
16) Disconnect the brake booster vacuum hose from the intake manifold.



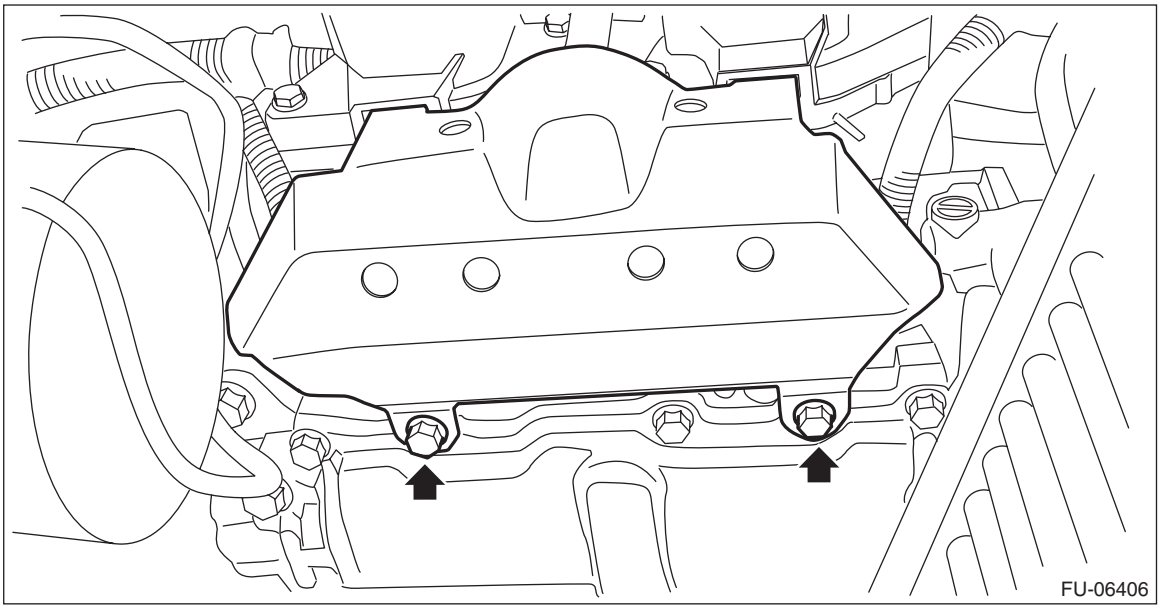
17) Disconnect the connector (A) from the mass air flow and intake air temperature sensor, and remove the clip (B) which holds the mass air flow and intake air temperature sensor harness.



18) Remove the air cleaner case (rear).



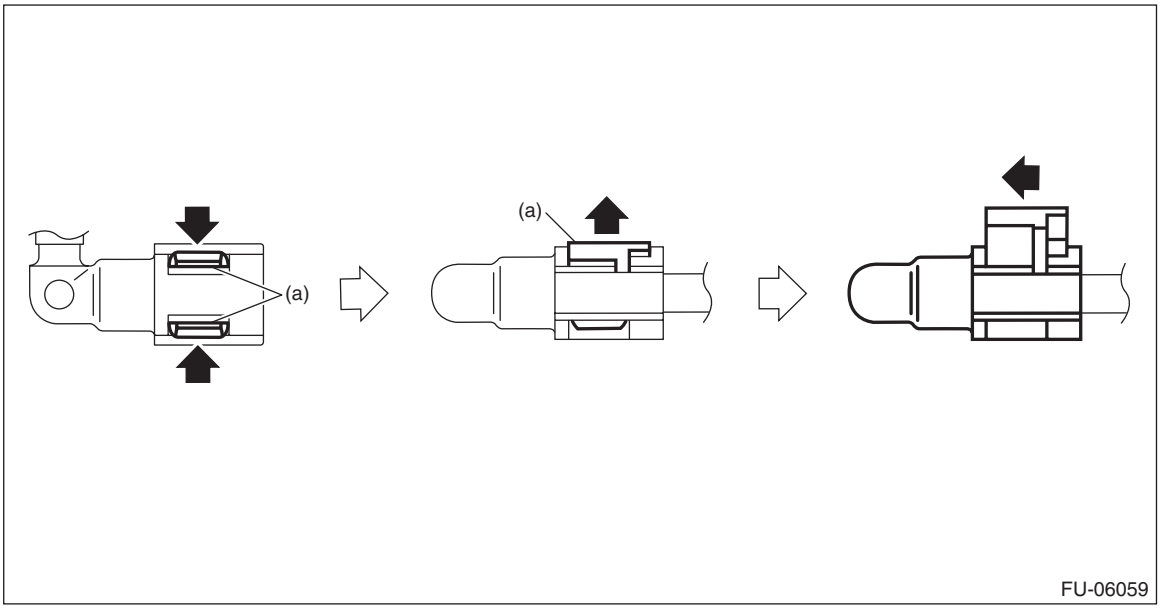
19) Remove the intake manifold protector RH.



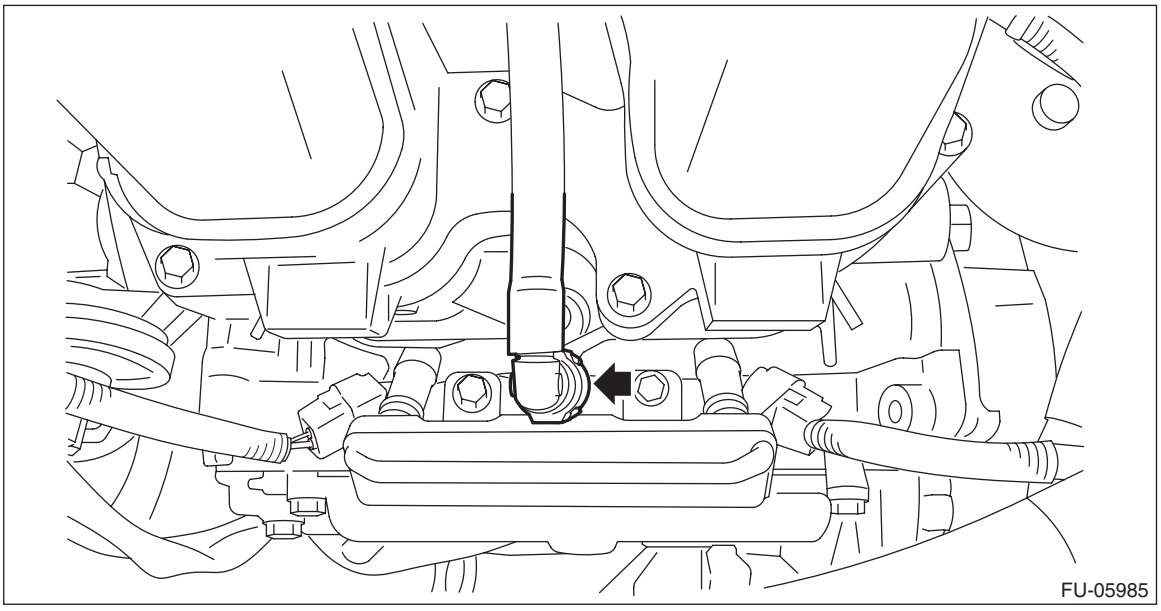
20) Disconnect the fuel delivery pipe from the fuel pipe RH.

CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from the pipes using a container or cloth.**

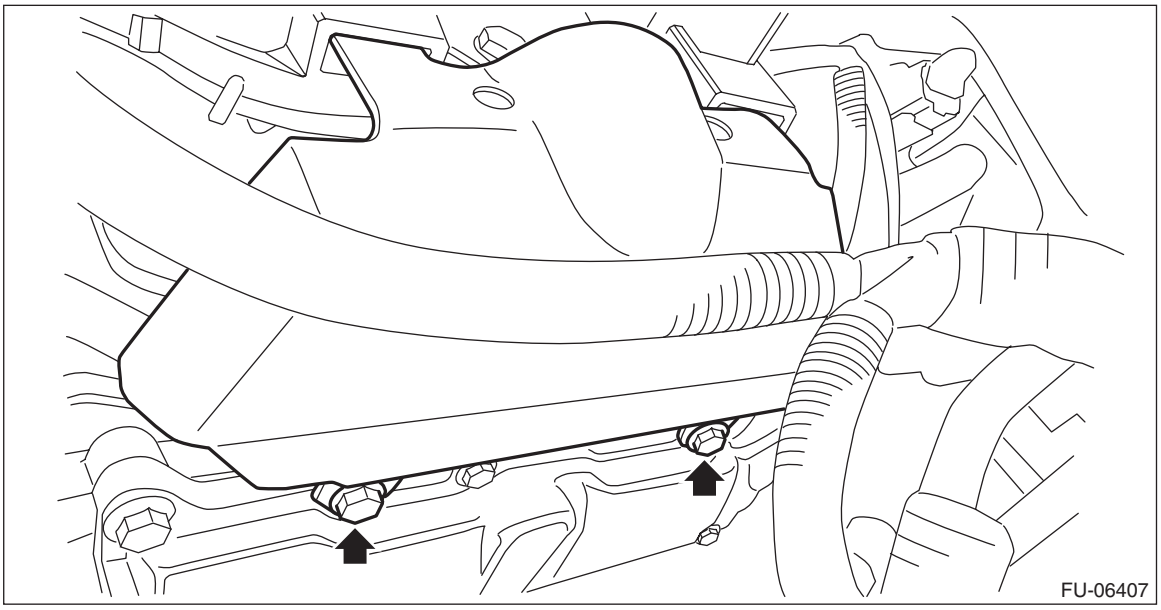
NOTE:
Disconnect the quick connector as shown in the figure.



(a) Slider



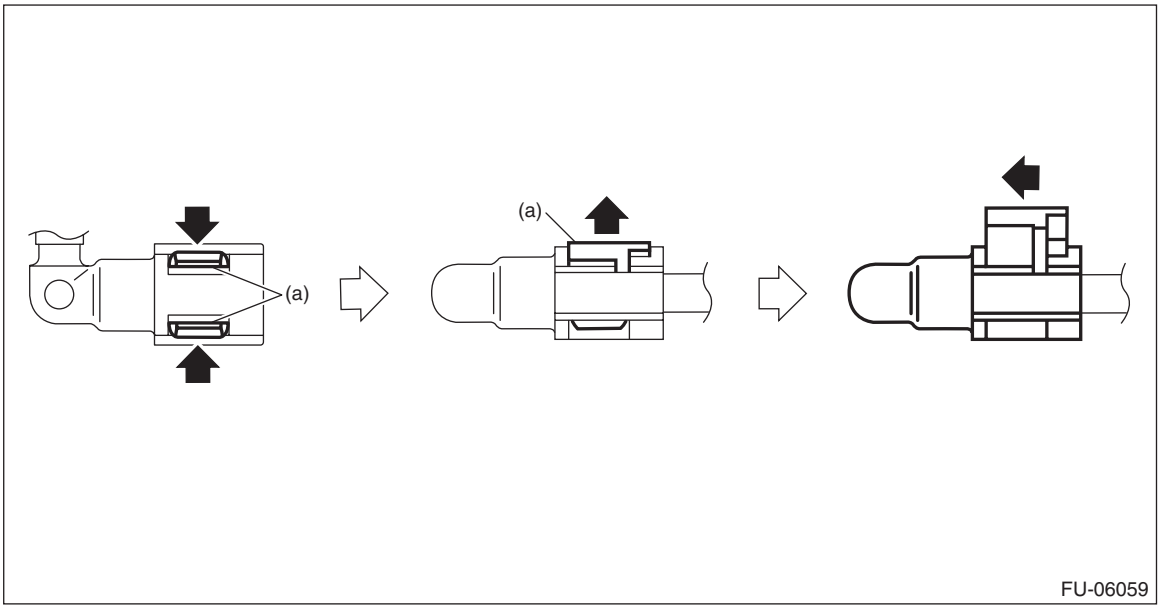
21) Remove the intake manifold protector LH.



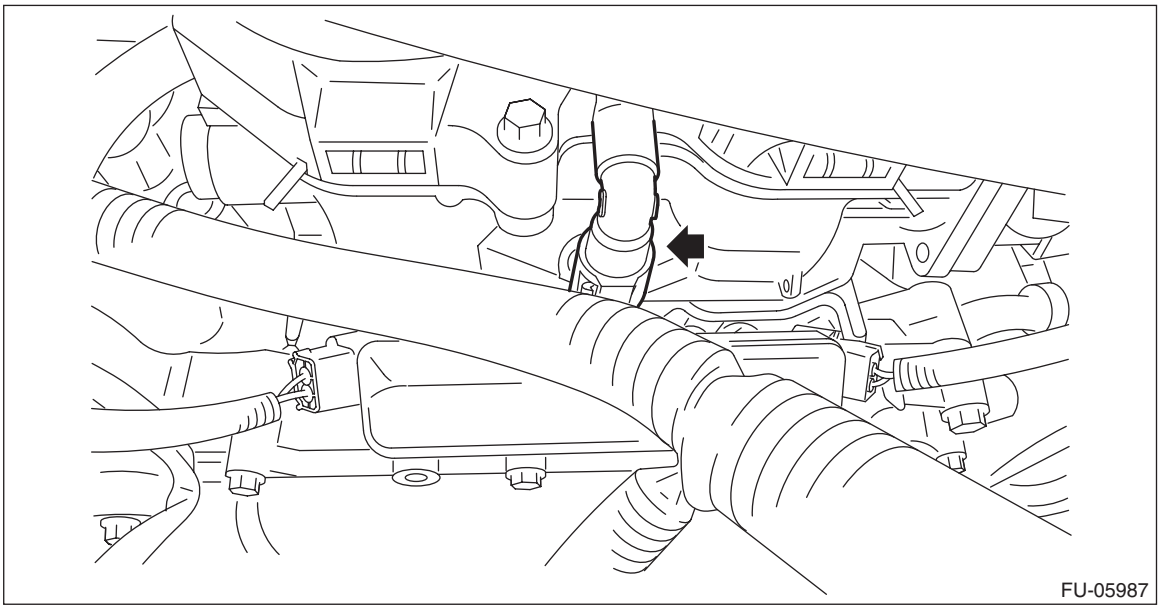
22) Disconnect the fuel delivery pipe from the fuel pipe LH.

CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from the pipes using a container or cloth.**

NOTE:
Disconnect the quick connector as shown in the figure.



(a) Slider

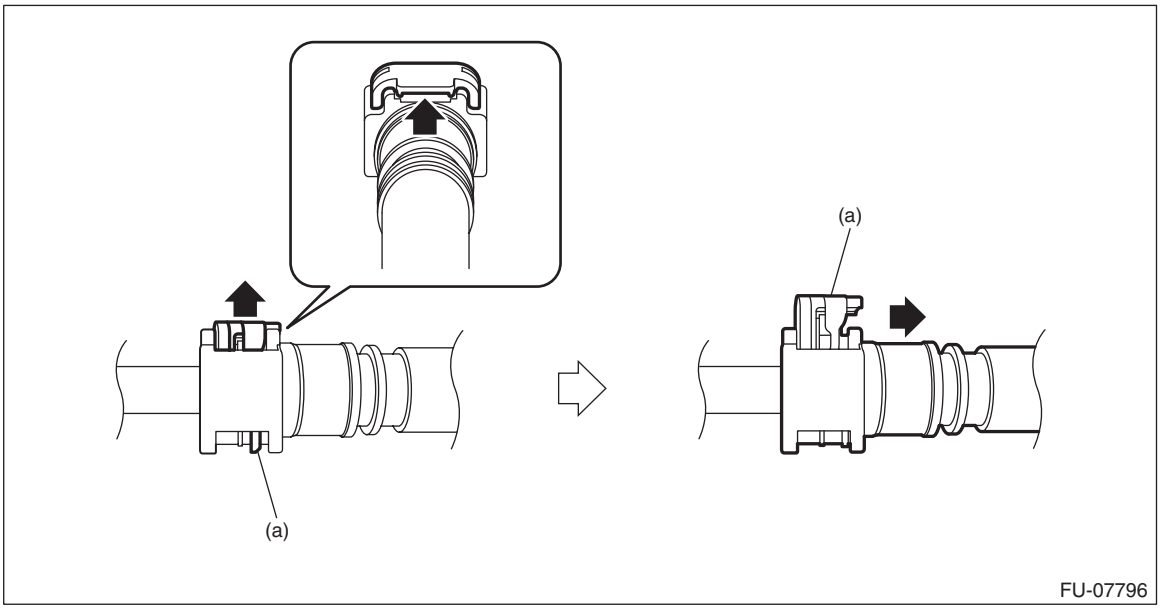


23) Disconnect the fuel delivery tube and evaporation hose.

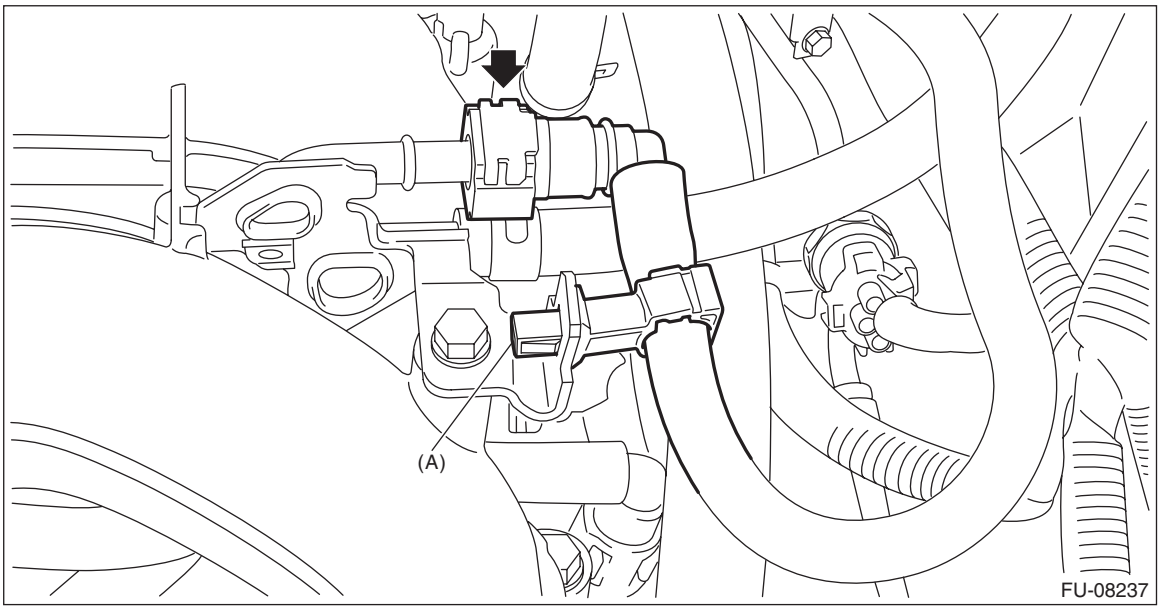
CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from the tubes using a container or cloth.**

(1) Disconnect the quick connector on the fuel delivery tube from the fuel pipe assembly, and remove the clip (A) securing the fuel delivery tube.

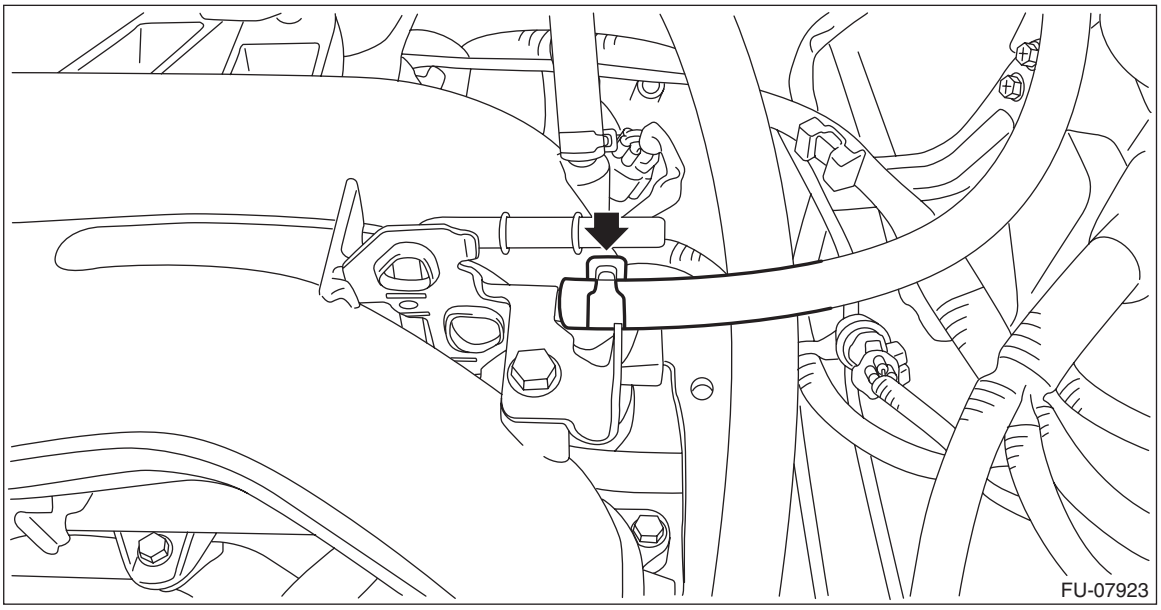
NOTE:
Disconnect the quick connector as shown in the figure.



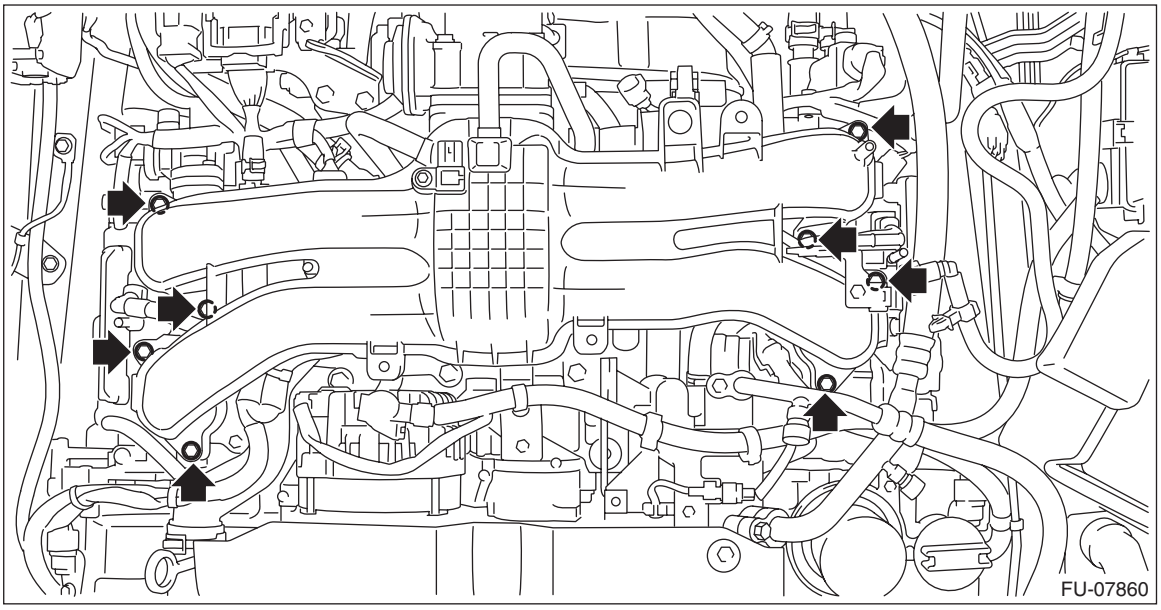
(a) Slider



(2) Disconnect the evaporation hose from the fuel pipe assembly.



24) Remove the intake manifold from the tumble generator valve assembly.



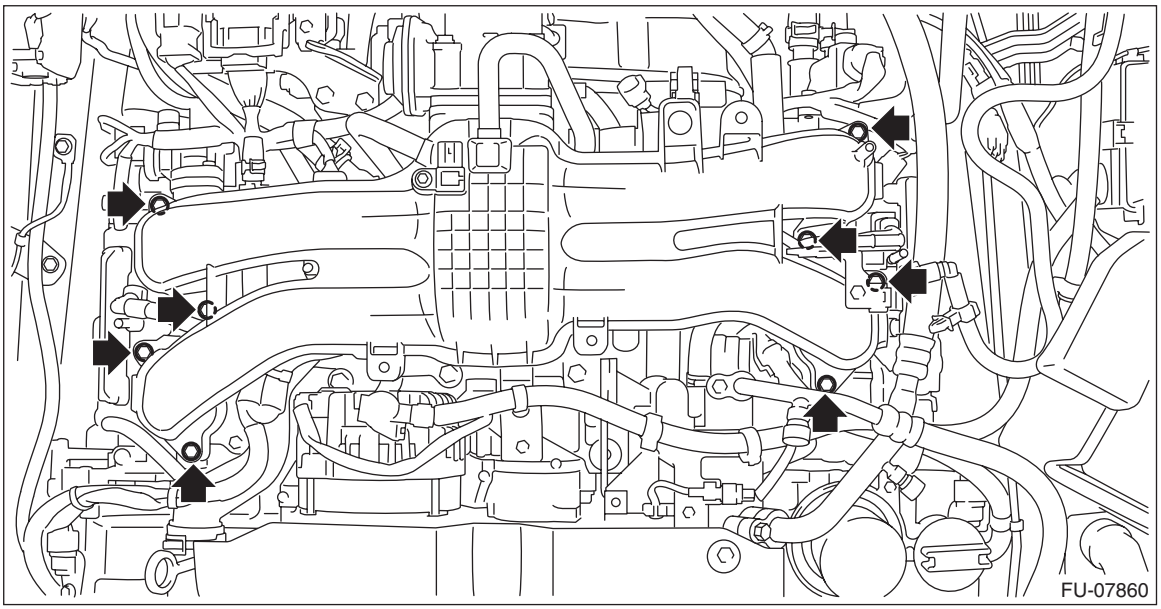
25) Remove the engine wiring harness. <Ref. to FU(H4DO(w/o HEV))-43, REMOVAL, Engine Wiring Harness.>

B: INSTALLATION

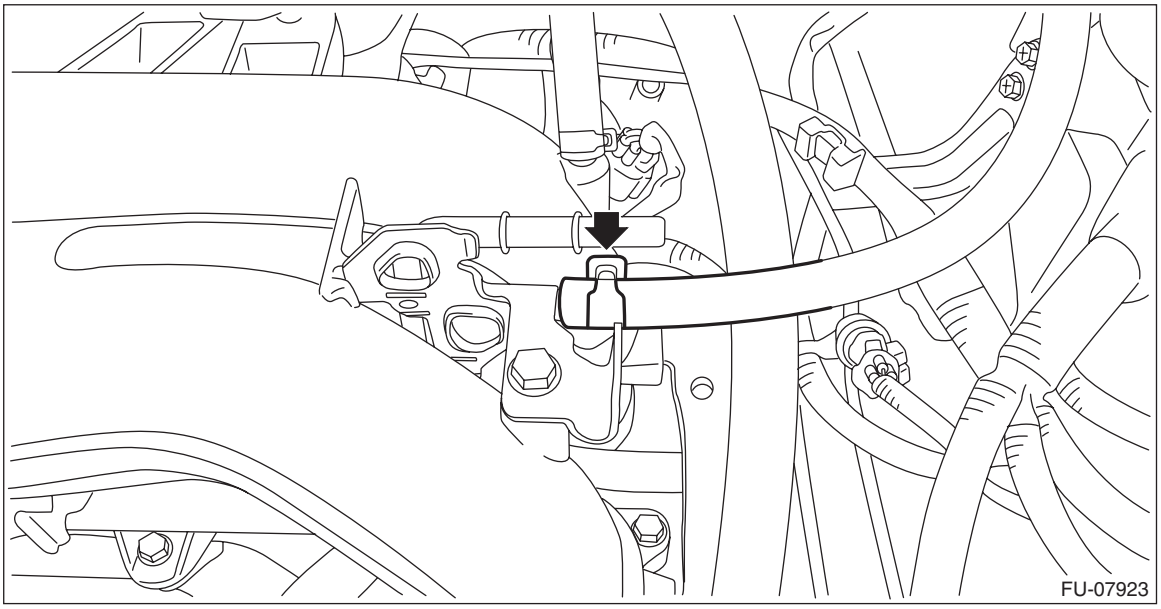
1) Install the engine wiring harness. <Ref. to FU(H4DO(w/o HEV))-47, INSTALLATION, Engine Wiring Harness.>
2) Install the intake manifold to the tumble generator valve assembly.

NOTE:
Use a new gasket.

Tightening torque:
8.3 N·m (0.8 kgf-m, 6.1 ft-lb)



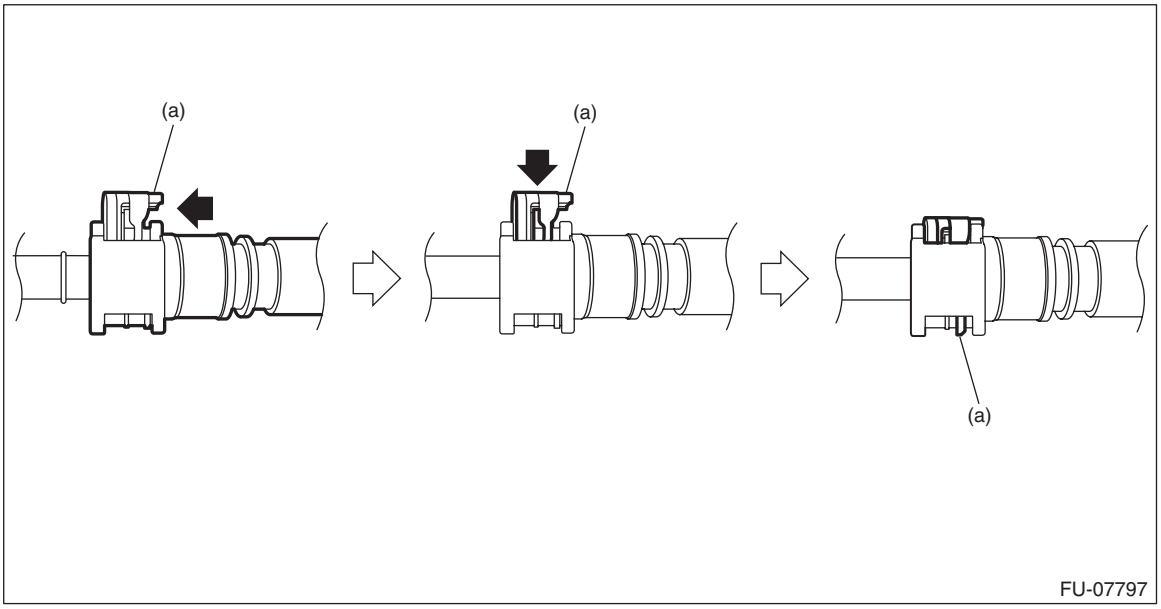
3) Connect the fuel delivery tube and evaporation hose.
(1) Connect the evaporation hose to fuel pipe assembly.



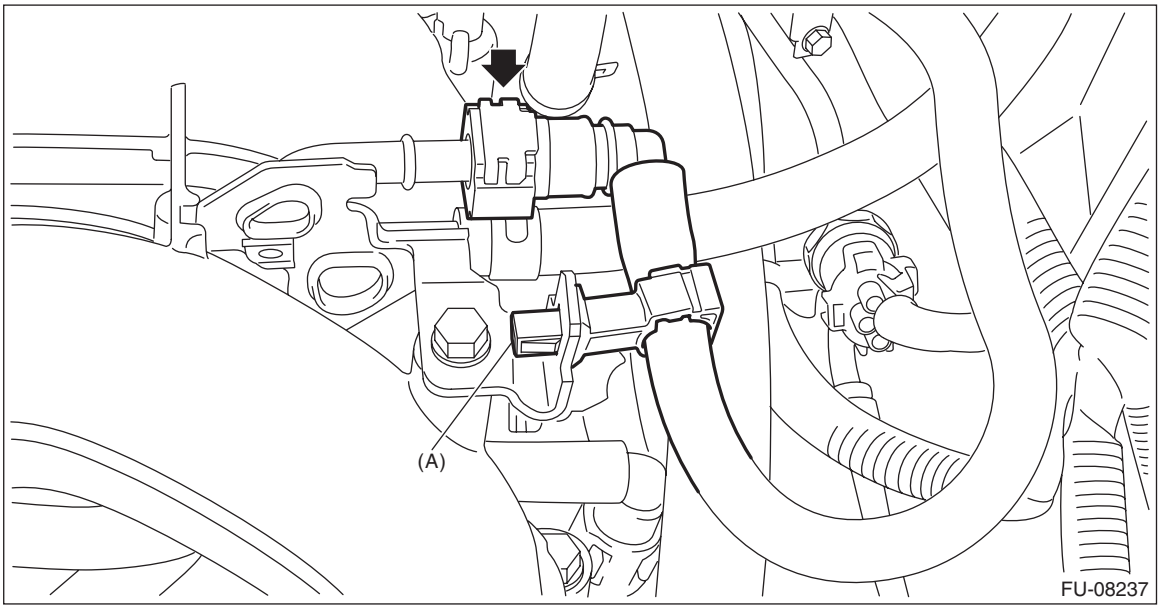
(2) Connect the quick connector of the fuel delivery tube to the fuel pipe assembly, and secure the fuel delivery tube using clip (A).

CAUTION:
• Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
• When connecting the quick connector, make sure to insert it all the way in before locking the slider.
• When it is difficult to lock the slider, check that the connector is fully inserted.
• After locking the slider, check again that the quick connector is securely connected.

NOTE:
Connect the quick connector as shown in the figure.



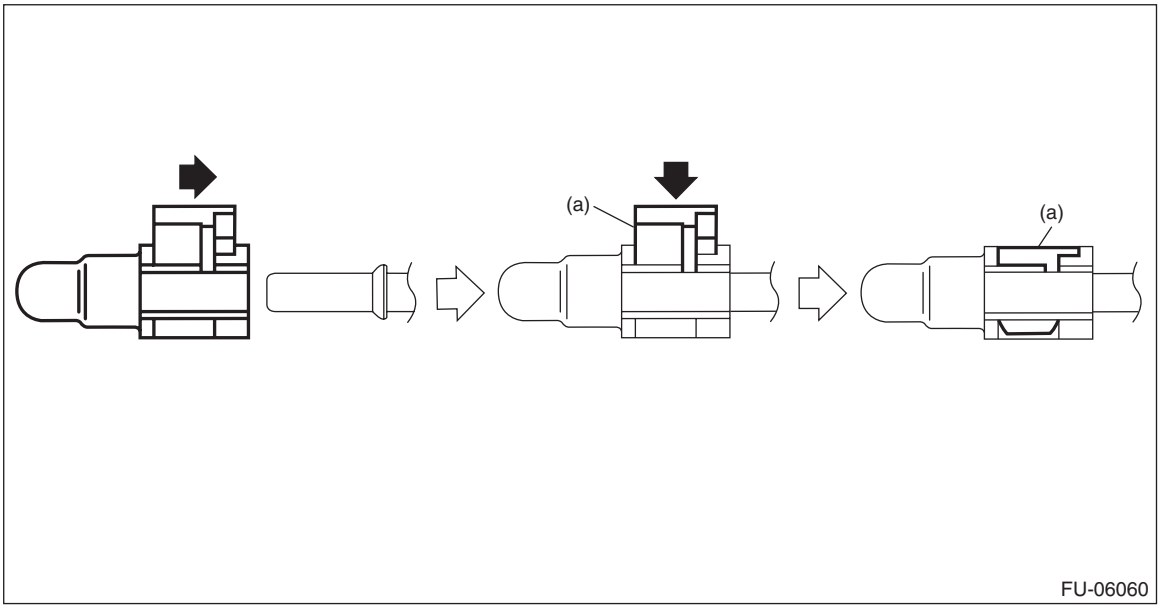
(a) Slider



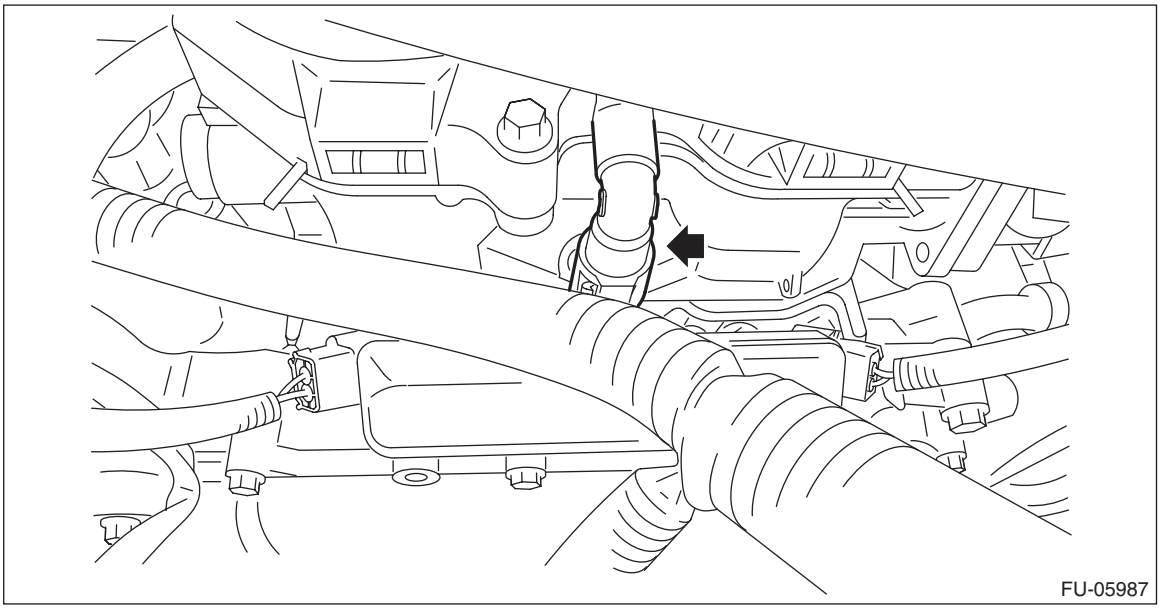
4) Connect the fuel delivery pipe to the fuel pipe LH.

CAUTION:
- **Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.**
- **When connecting the quick connector, make sure to insert it all the way in before locking the slider.**
- **When it is difficult to lock the slider, check that the connector is fully inserted.**
- **After locking the slider, check again that the quick connector is securely connected.**

NOTE:
Connect the quick connector as shown in the figure.

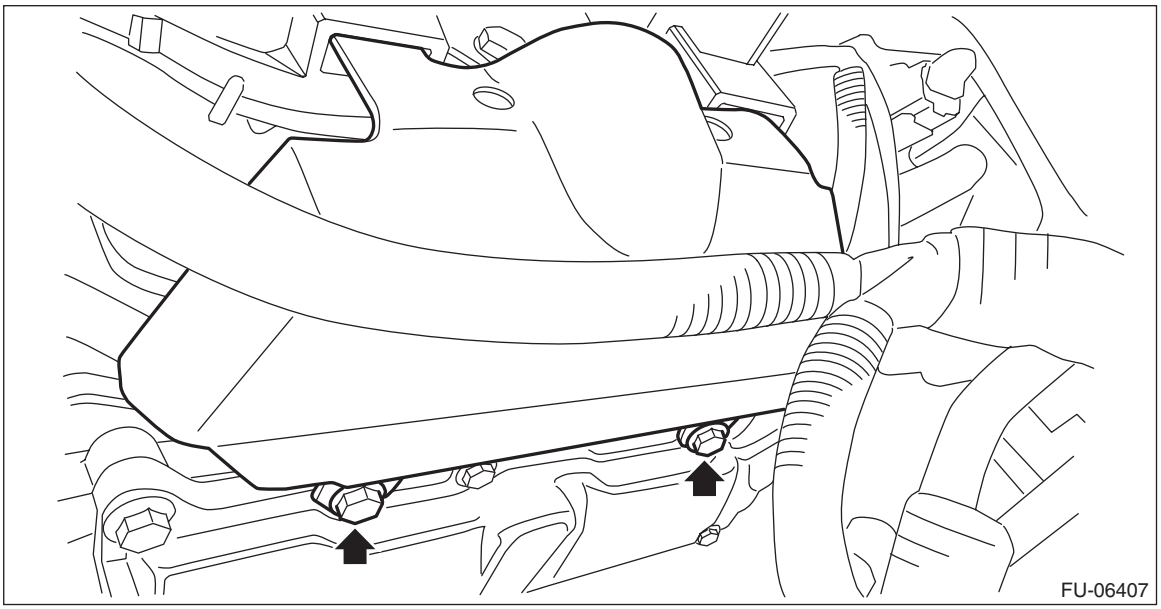


(a) Slider



5) Install the intake manifold protector LH.

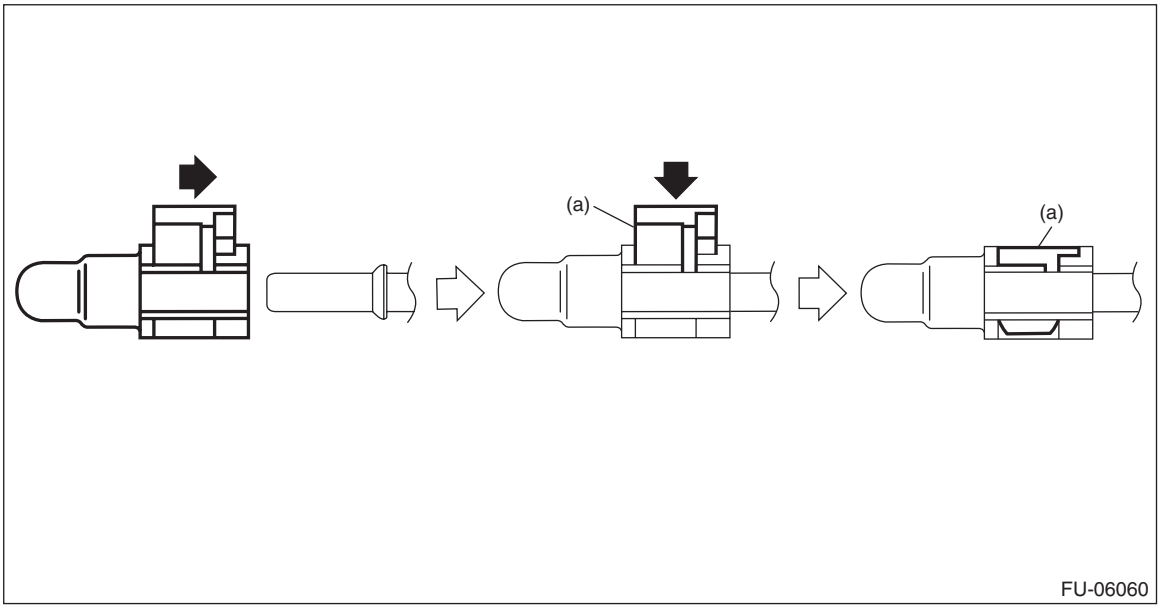
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



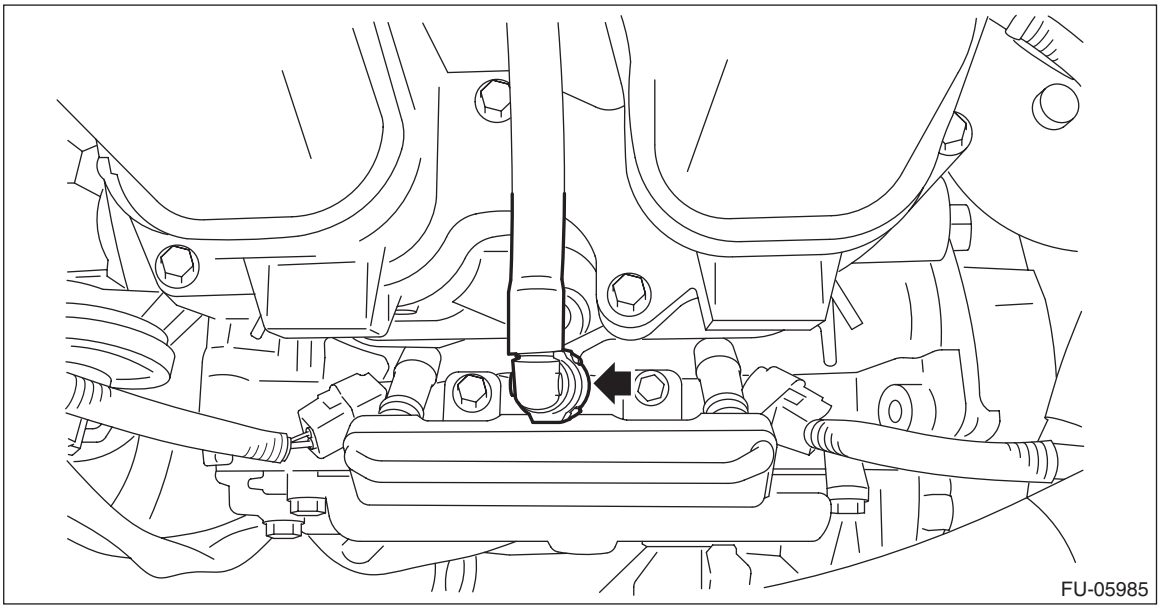
6) Connect the fuel delivery pipe to the fuel pipe RH.

CAUTION:
- **Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.**
- **When connecting the quick connector, make sure to insert it all the way in before locking the slider.**
- **When it is difficult to lock the slider, check that the connector is fully inserted.**
- **After locking the slider, check again that the quick connector is securely connected.**

NOTE:
Connect the quick connector as shown in the figure.

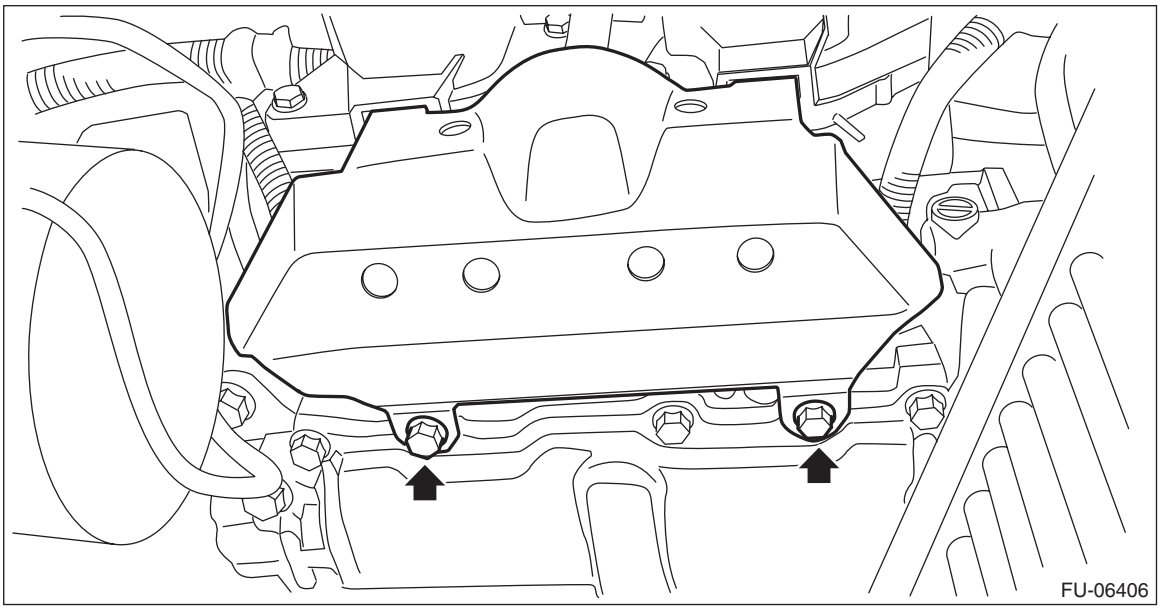


(a) Slider

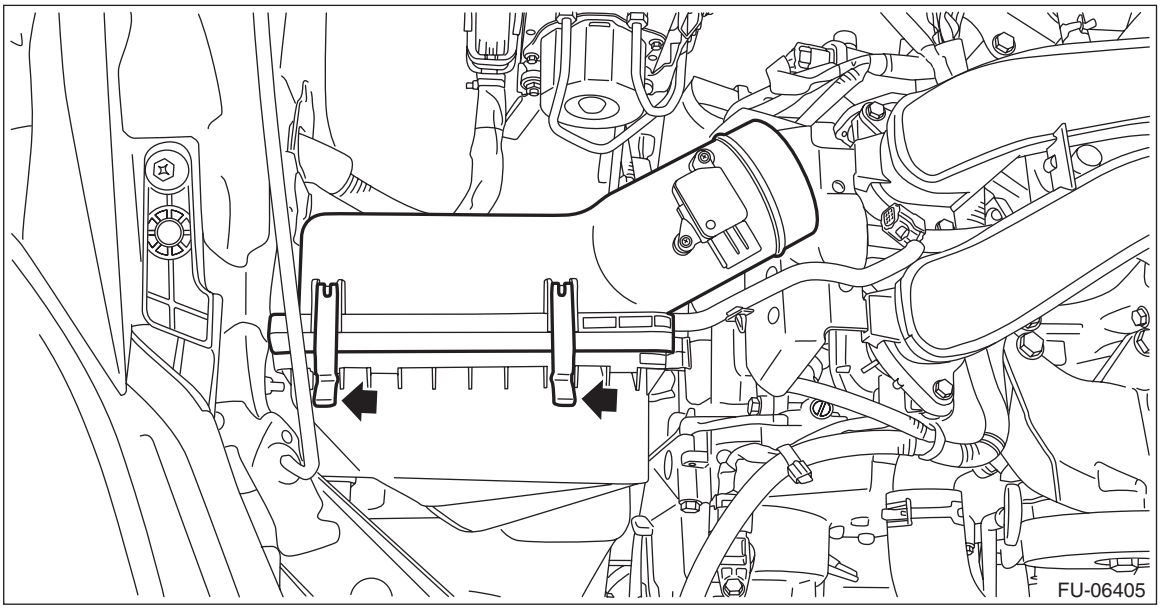


7) Install the intake manifold protector RH.

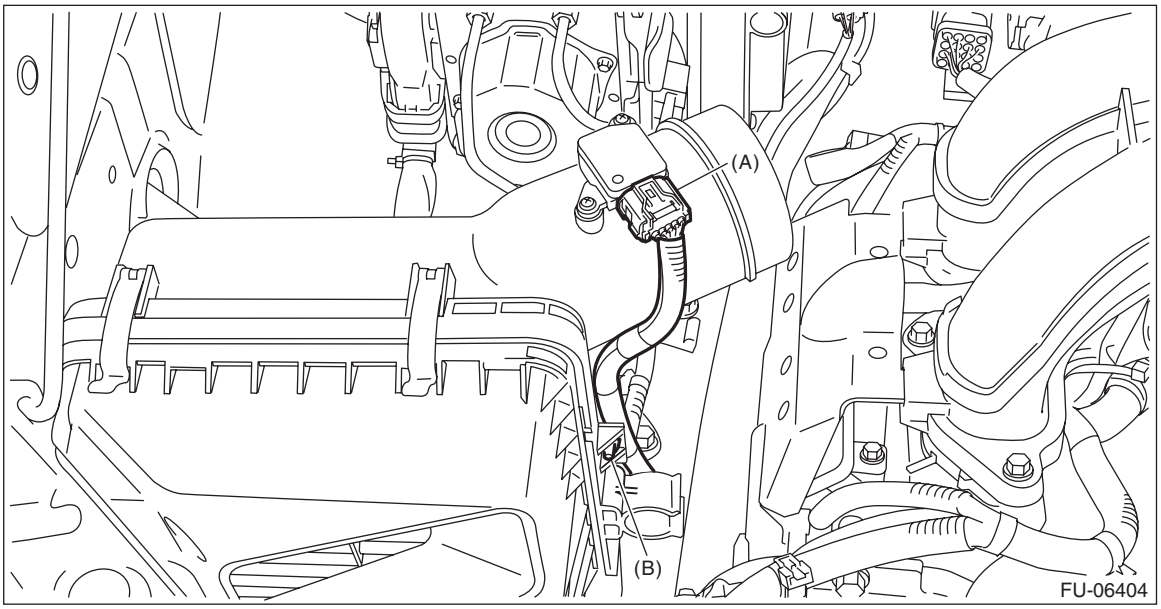
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



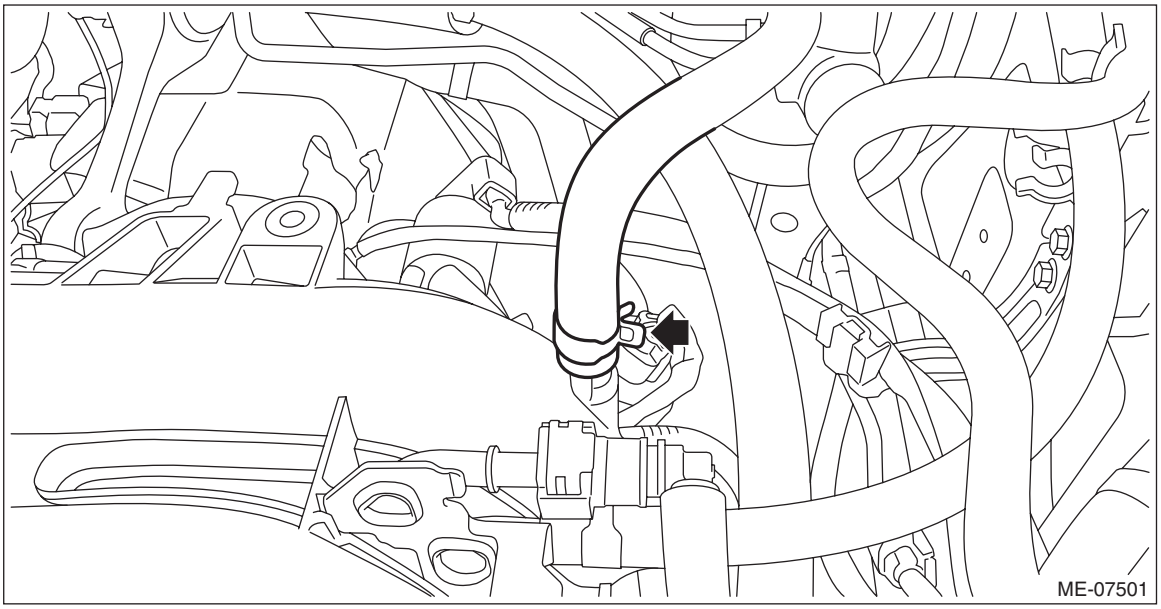
8) Install the air intake case (rear).



9) Install the clip (B) which secures the air flow and intake air temperature sensor harness, and connect the connector (A) to the air flow and intake air temperature sensor.

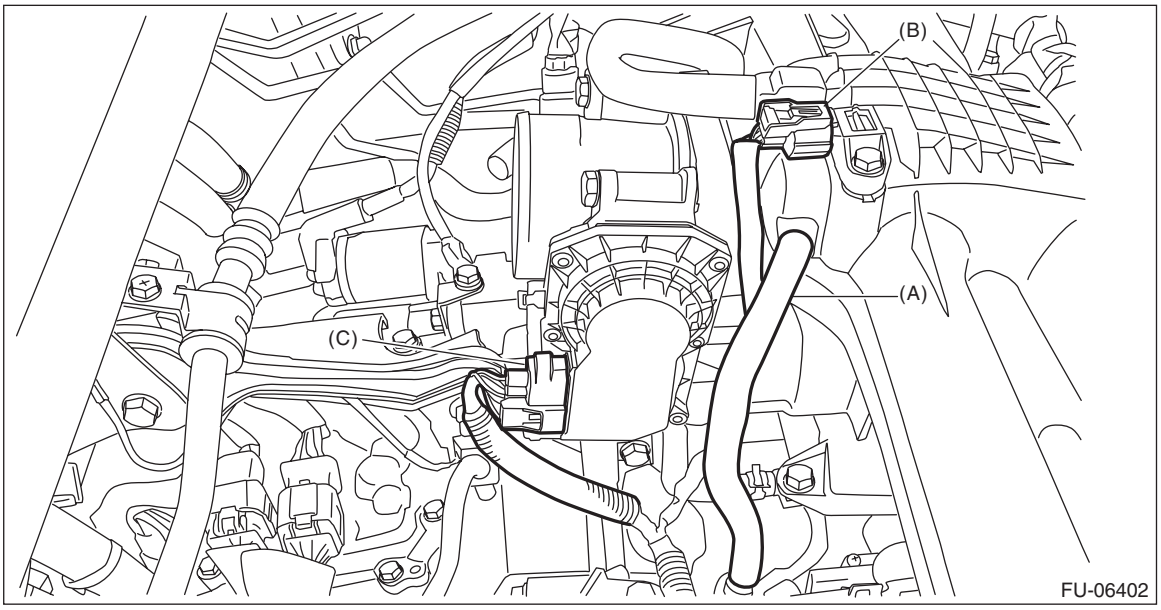


10) Connect the brake booster vacuum hose to the intake manifold.



11) Connect the PCV hose (A) to intake manifold.
12) Connect the connector (B) to the manifold absolute pressure sensor.

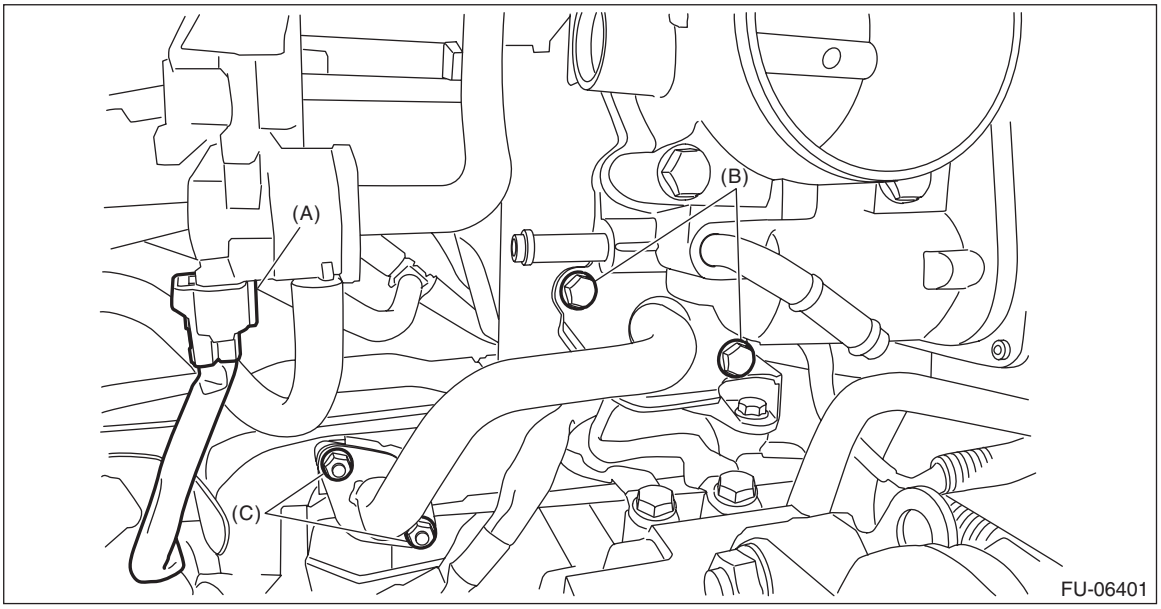
13) Connect the connector (C) to the throttle position sensor.



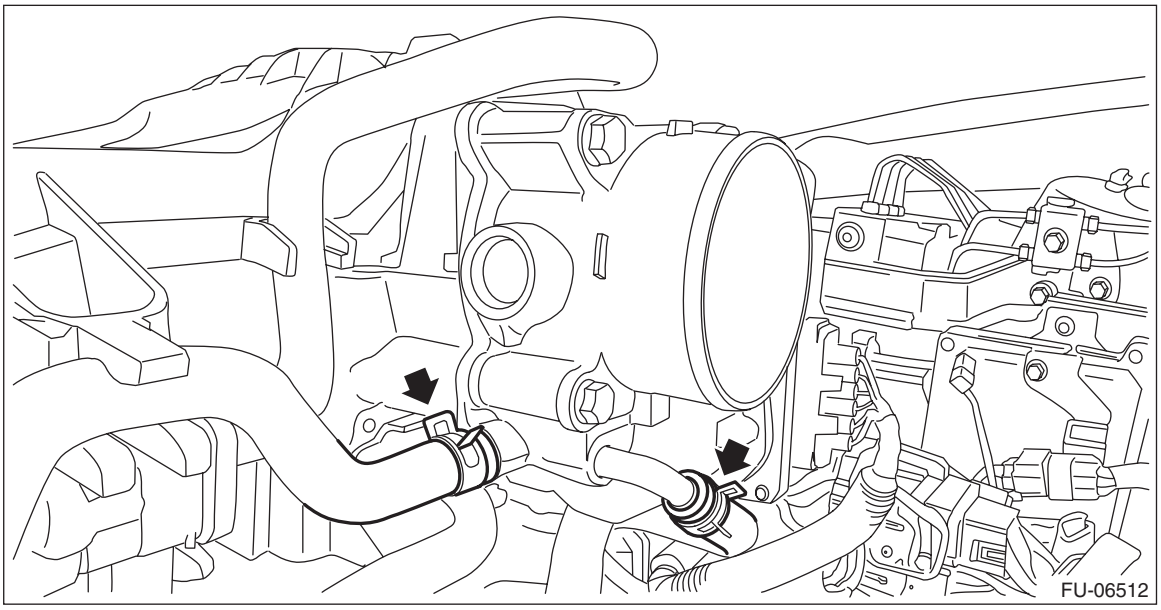
14) Connect the connector (A) to the purge control solenoid valve.
15) Tighten the nut (C) and bolt (B) which hold EGR pipe to the water pipe assembly.

NOTE:
- Use a new gasket.
- Always tighten the EGR pipe at (C) first, and then (B).

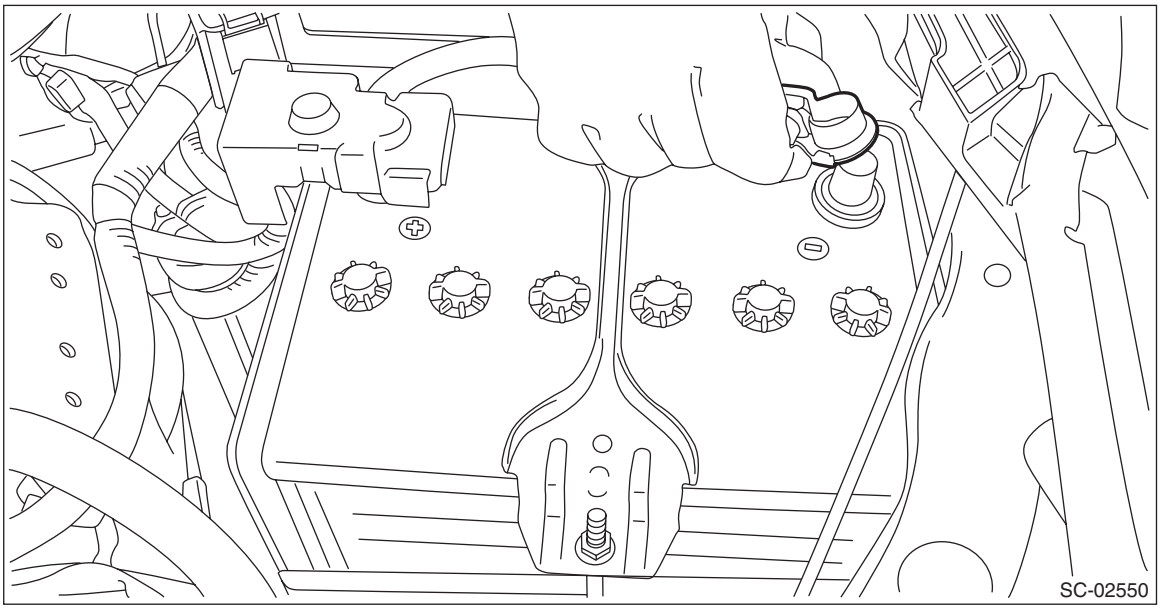
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



16) Install the preheater hose to the throttle body.



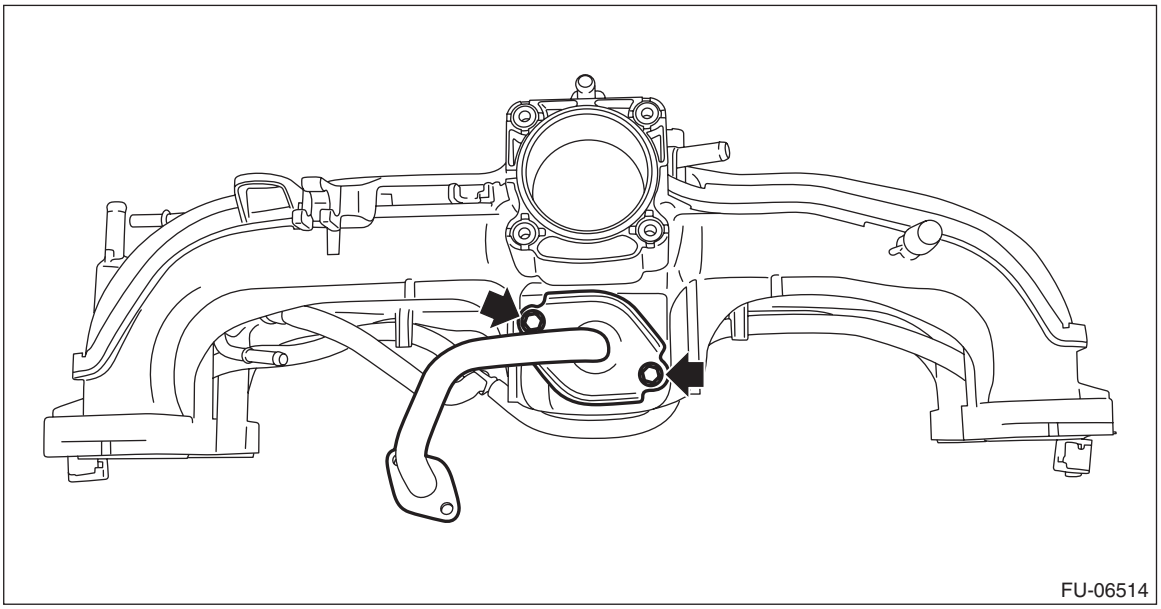
17) Install the air intake boot. <Ref. to IN(H4DO(w/o HEV))-12, INSTALLATION, Air Intake Boot.>
18) Lift up the vehicle.
19) Install the under cover. <Ref. to EI-32, INSTALLATION, Front Under Cover.>
20) Lower the vehicle.
21) Connect the battery ground terminal.



22) Fill engine coolant. <Ref. to CO(H4DO(w/o HEV))-16, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

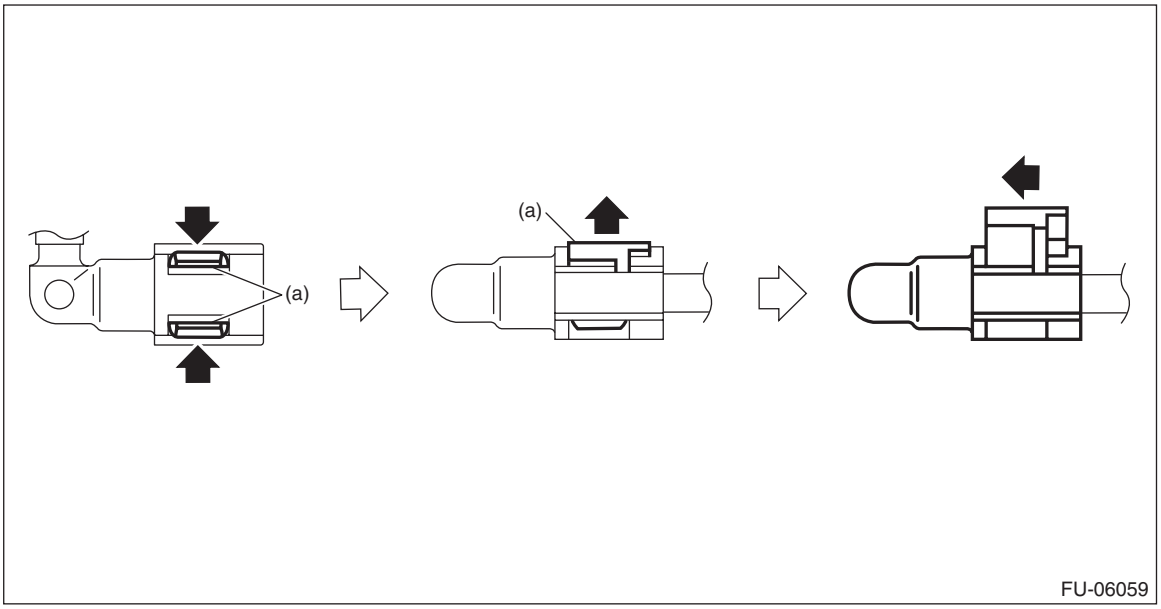
C: DISASSEMBLY

1) Remove the throttle body. <Ref. to FU(H4DO(w/o HEV))-14, REMOVAL, Throttle Body.>
2) Remove the purge control solenoid valve. <Ref. to EC(H4DO(w/o HEV))-18, REMOVAL, Purge Control Solenoid Valve.>
3) Remove the manifold absolute pressure sensor. <Ref. to FU(H4DO(w/o HEV))-76, REMOVAL, Manifold Absolute Pressure Sensor.>
4) Remove the EGR pipe from intake manifold.

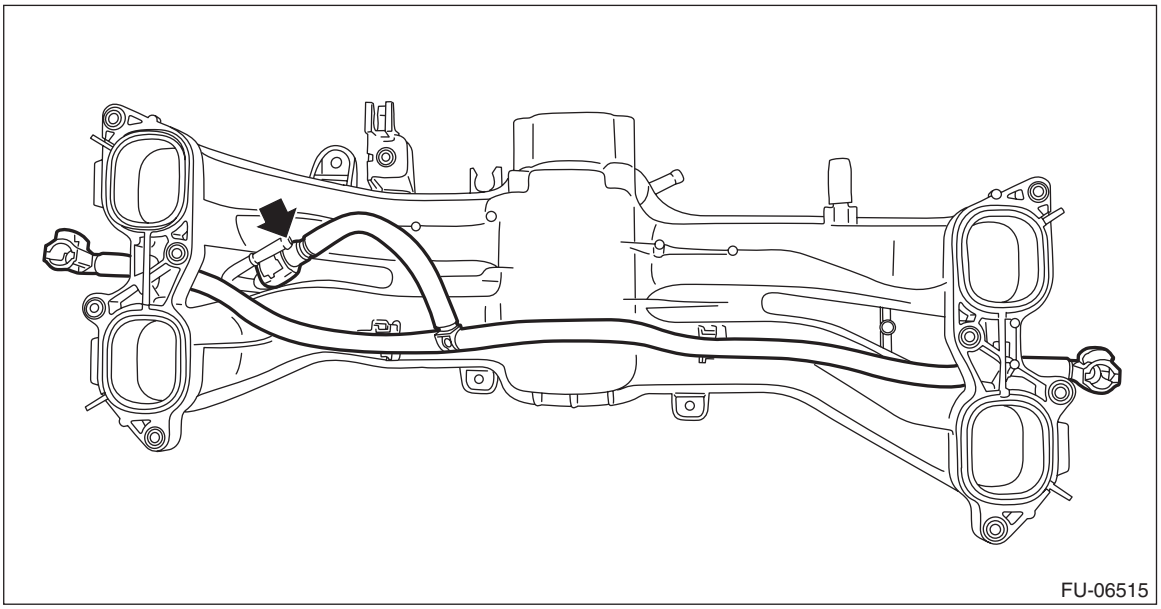


5) Remove the fuel delivery pipe from intake manifold.

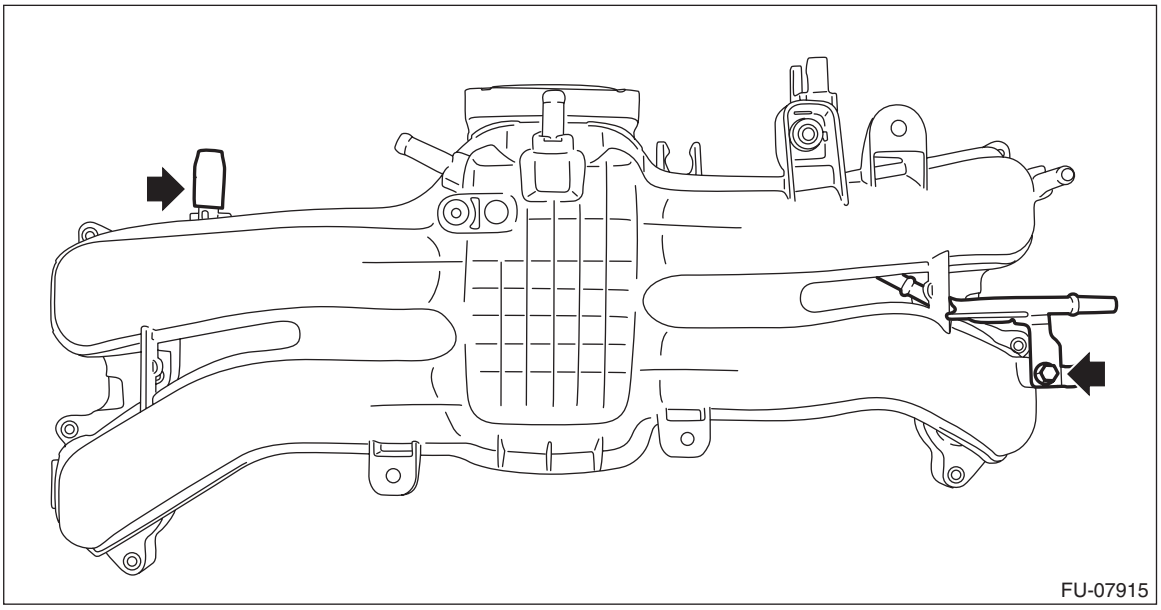
NOTE:
Disconnect the quick connector as shown in the figure.



(a) Slider



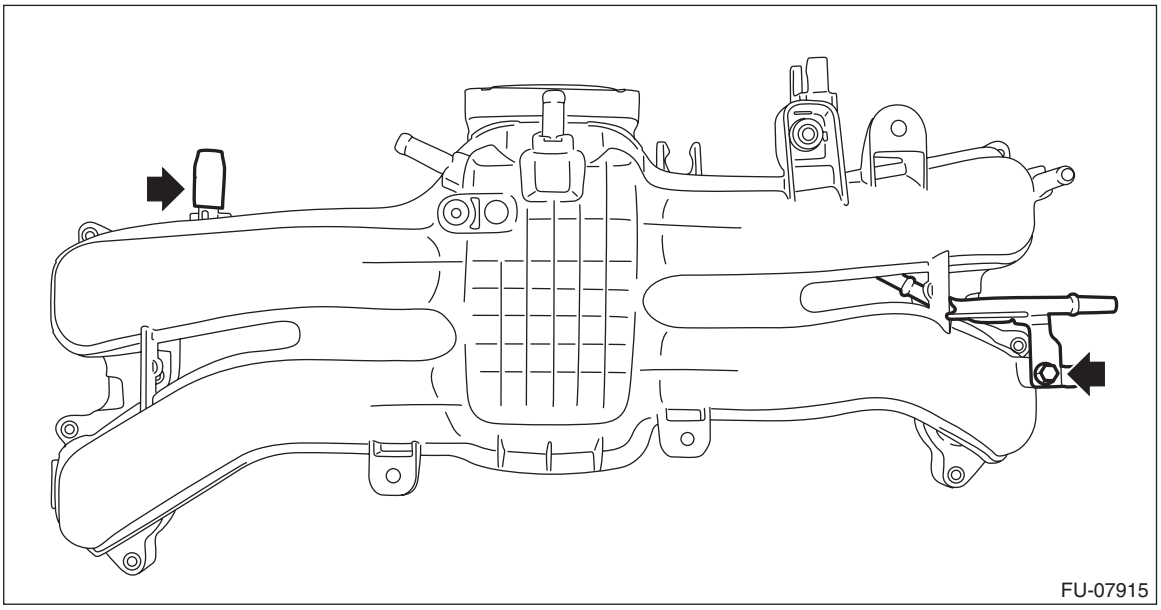
6) Remove the fuel pipe and cap from the intake manifold.



D: ASSEMBLY

1) Install the fuel pipe and cap to the intake manifold.

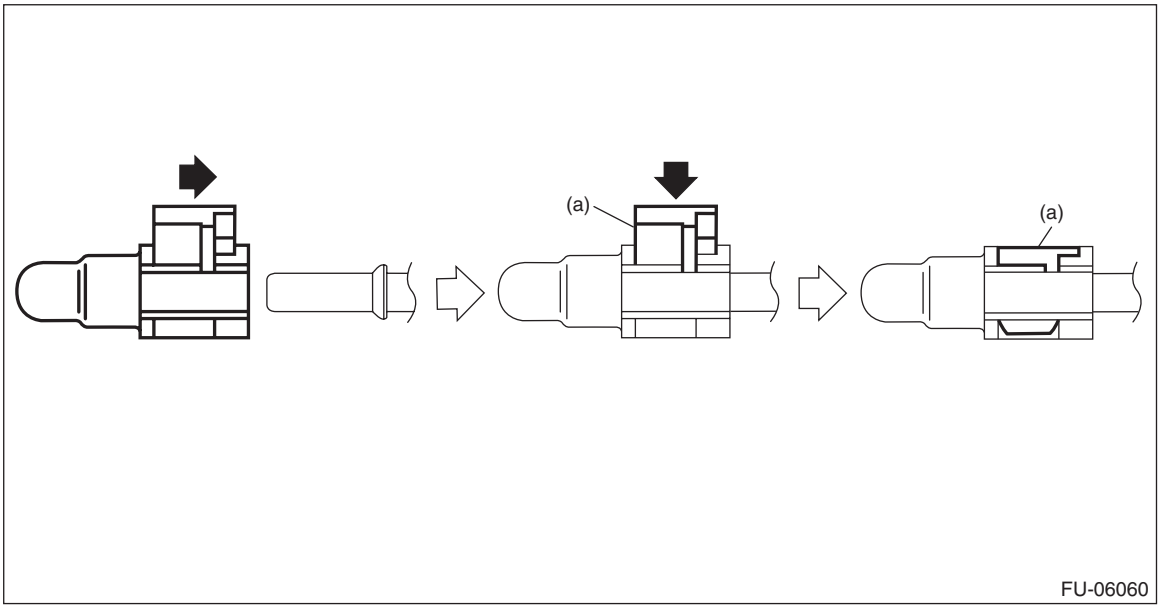
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



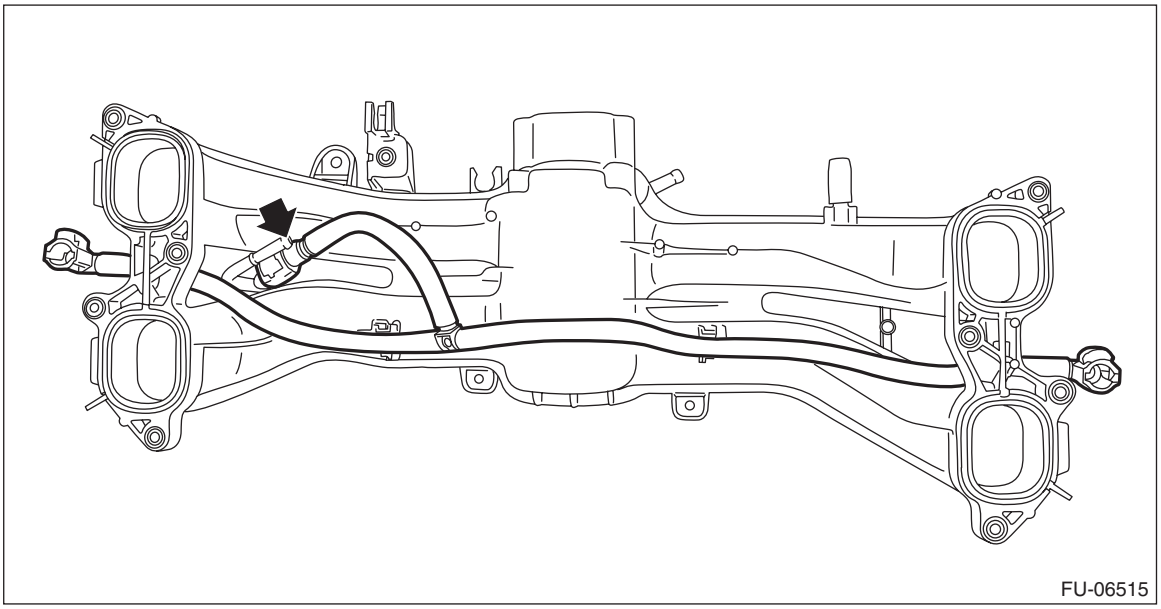
2) Install the fuel delivery pipe to the intake manifold.

CAUTION:
• Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
• When connecting the quick connector, make sure to insert it all the way in before locking the slider.
• When it is difficult to lock the slider, check that the connector is fully inserted.
• After locking the slider, check again that the quick connector is securely connected.

NOTE:
Connect the quick connector as shown in the figure.

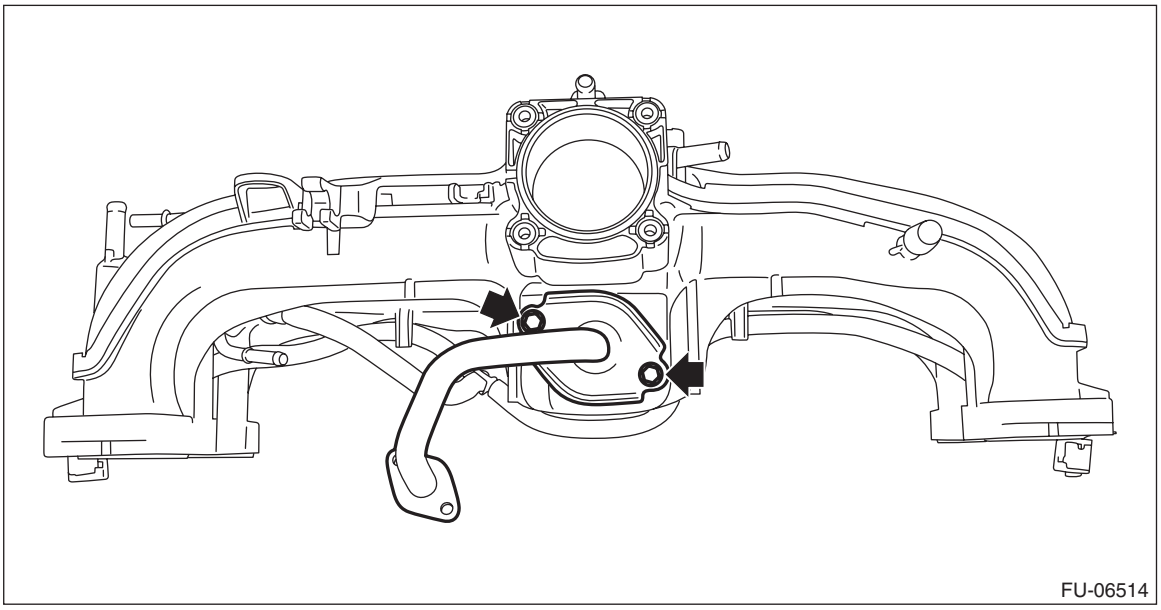


(a) Slider



3) Temporarily install the EGR pipe to the intake manifold.

NOTE:
- Use a new gasket.
- Tighten the EGR pipe when installing the intake manifold.



4) Install the manifold absolute pressure sensor. <Ref. to FU(H4DO(w/o HEV))-76, INSTALLATION, Manifold Absolute Pressure Sensor.>
5) Install the purge control solenoid valve. <Ref. to EC(H4DO(w/o HEV))-20, INSTALLATION, Purge Control Solenoid Valve.>
6) Install the throttle body. <Ref. to FU(H4DO(w/o HEV))-16, INSTALLATION, Throttle Body.>

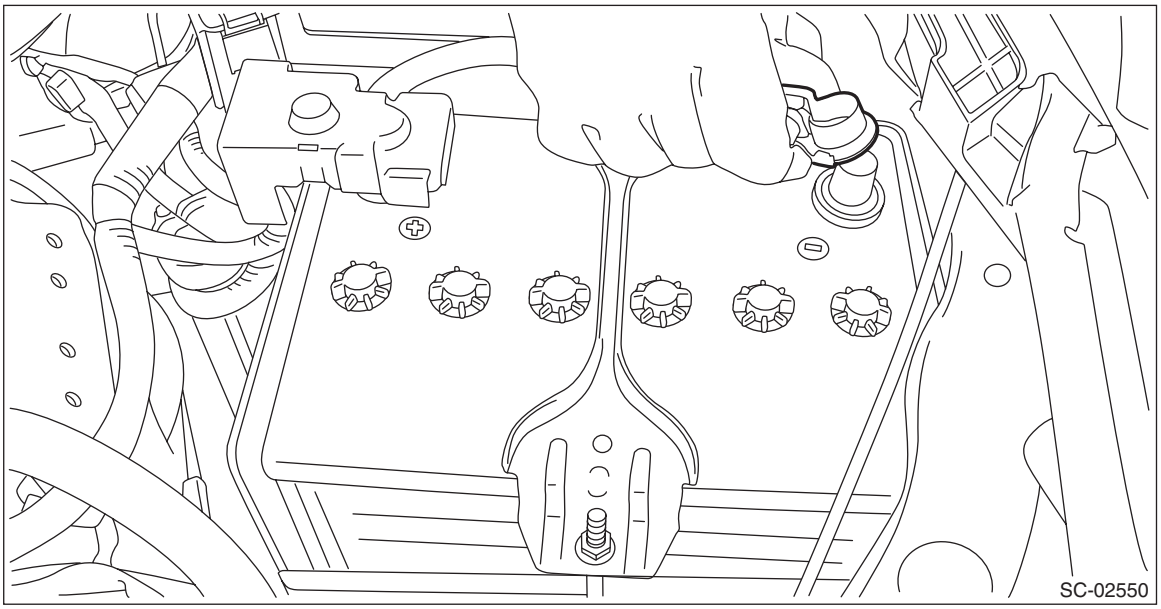
E: INSPECTION

1) Check that the intake manifold and fuel pipe have no deformation, cracks and other damages.
2) Check that the hose has no cracks, damage or loose part.

4. Engine Wiring Harness

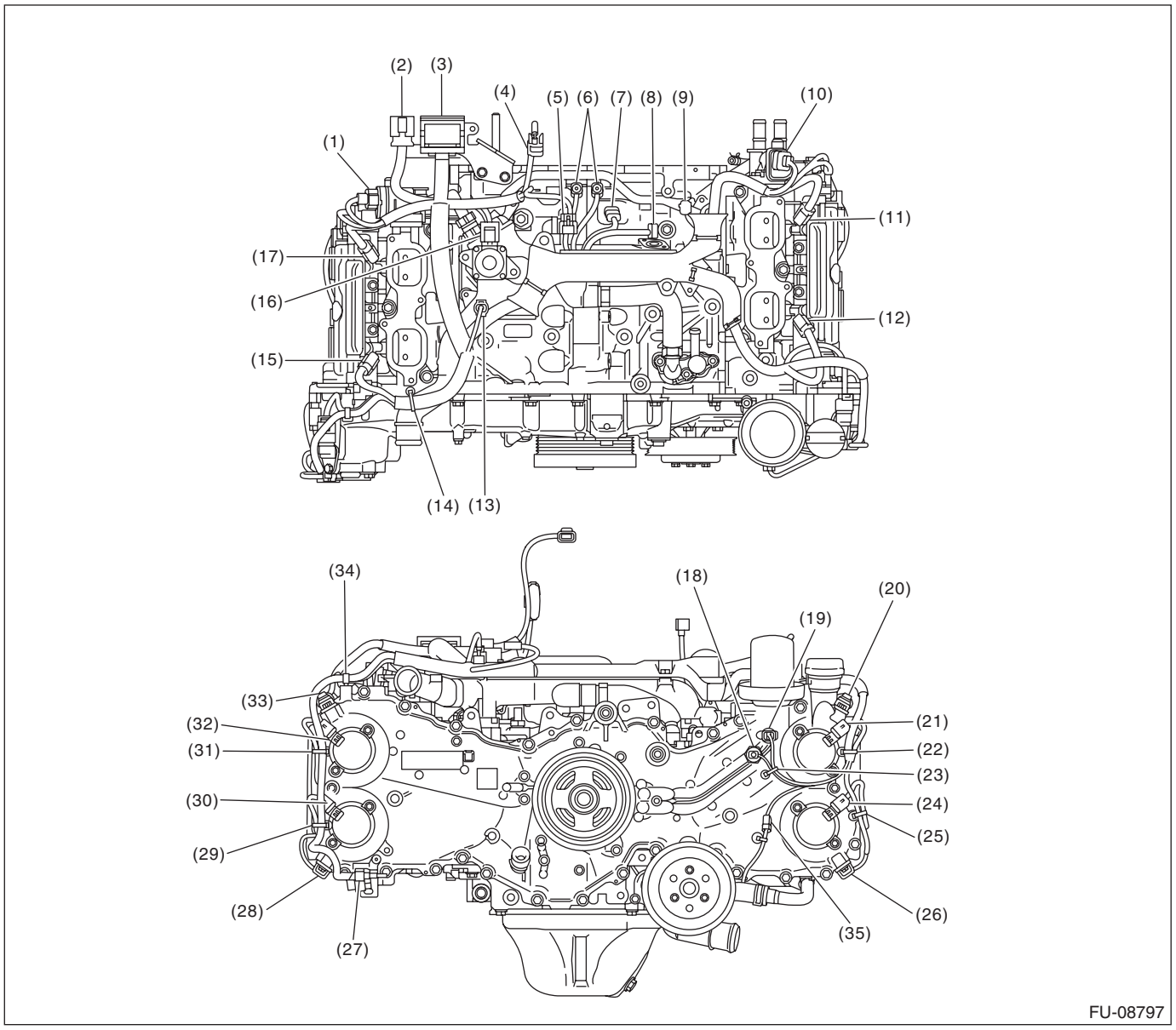
A: REMOVAL

1) Release the fuel pressure. <Ref. to FU(H4DO(w/o HEV))-109, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Disconnect the ground cable from battery.



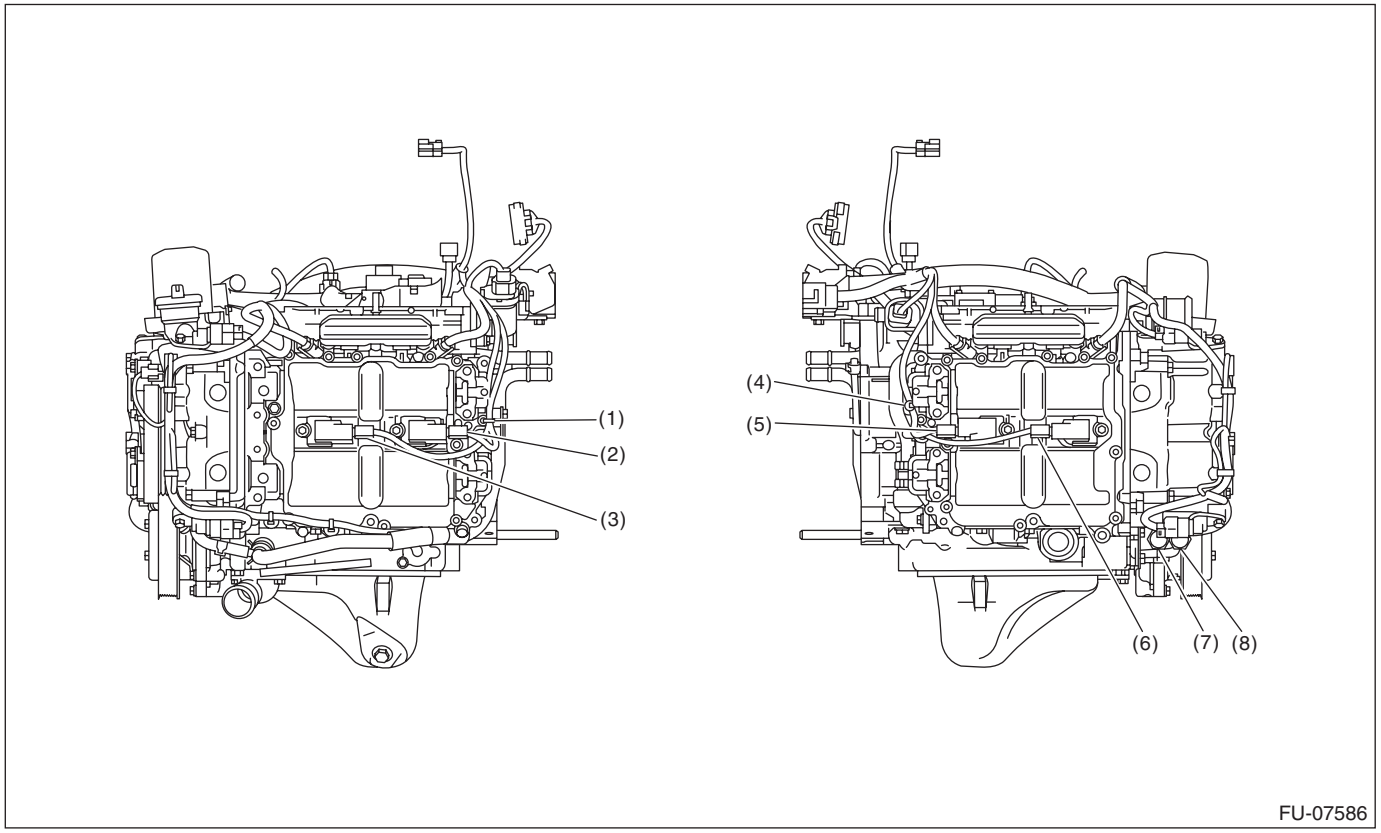
3) Open the fuel filler lid and remove the fuel filler cap.
4) Remove the intake manifold. <Ref. to FU(H4DO(w/o HEV))-19, REMOVAL, Intake Manifold.>

5) Disconnect the connector from the engine.
- Structural diagram 1



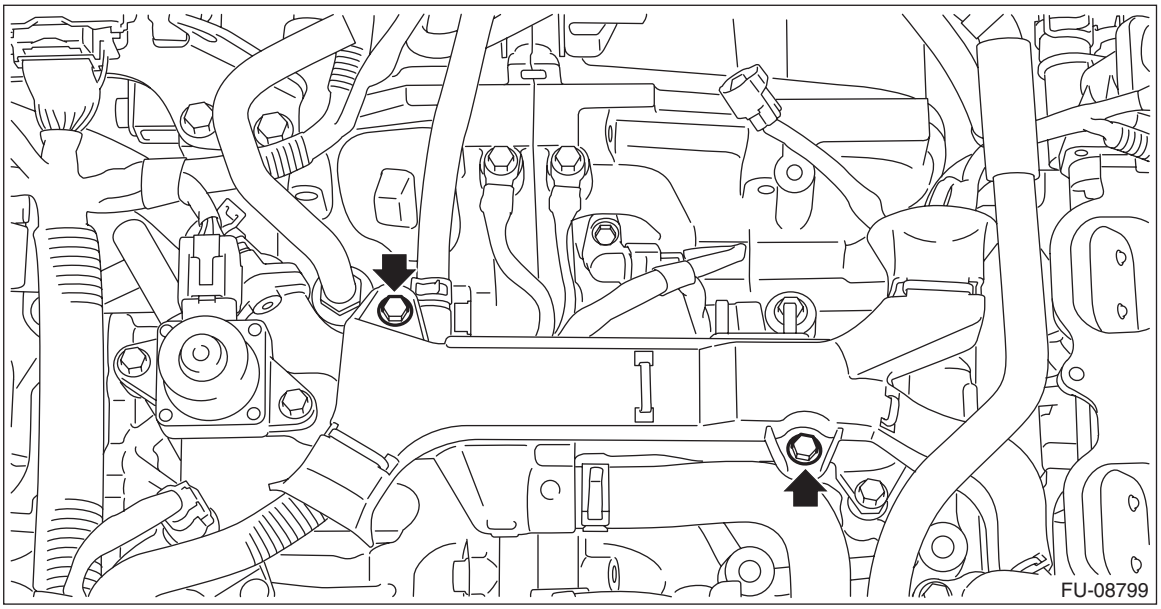
(1) Tumble generator valve actuator RH
(2) Engine harness connector (16P)
(3) Engine harness connector (54P)
(4) Throttle position sensor connector
(5) Manifold absolute pressure sensor connector
(6) Engine ground (2 locations)
(7) Crankshaft position sensor
(8) Knock sensor
(9) Purge control solenoid valve connector
(10) Tumble generator valve actuator LH
(11) Fuel injector (#4)
(12) Fuel injector (#2)
(13) Engine coolant temperature sensor
(14) Remove the clip from the screw hole.
(15) Fuel injector (#1)
(16) EGR valve
(17) Fuel injector (#3)
(18) Oil pressure switch
(19) Engine oil temperature sensor
(20) Intake camshaft position sensor LH
(21) Intake oil control solenoid LH
(22) Remove the clip from the screw hole.
(23) Remove the clip from the screw hole.
(24) Exhaust oil control solenoid LH
(25) Remove the clip from the screw hole.
(26) Exhaust camshaft position sensor LH
(27) Remove the clip from the oval hole.
(28) Exhaust camshaft position sensor RH
(29) Remove the clip from the screw hole.
(30) Exhaust oil control solenoid RH
(31) Remove the clip from the screw hole.
(32) Intake oil control solenoid RH
(33) Intake camshaft position sensor RH
(34) Remove the clip from the screw hole.
(35) Oil level switch connector

- Structural diagram 2



(1) Remove the clip from the screw hole.
(2) Ignition coil No. 4
(3) Ignition coil No. 2
(4) Remove the clip from the screw hole.
(5) Ignition coil No. 3
(6) Ignition coil No. 1
(7) Front oxygen (A/F) sensor
(8) Rear oxygen sensor

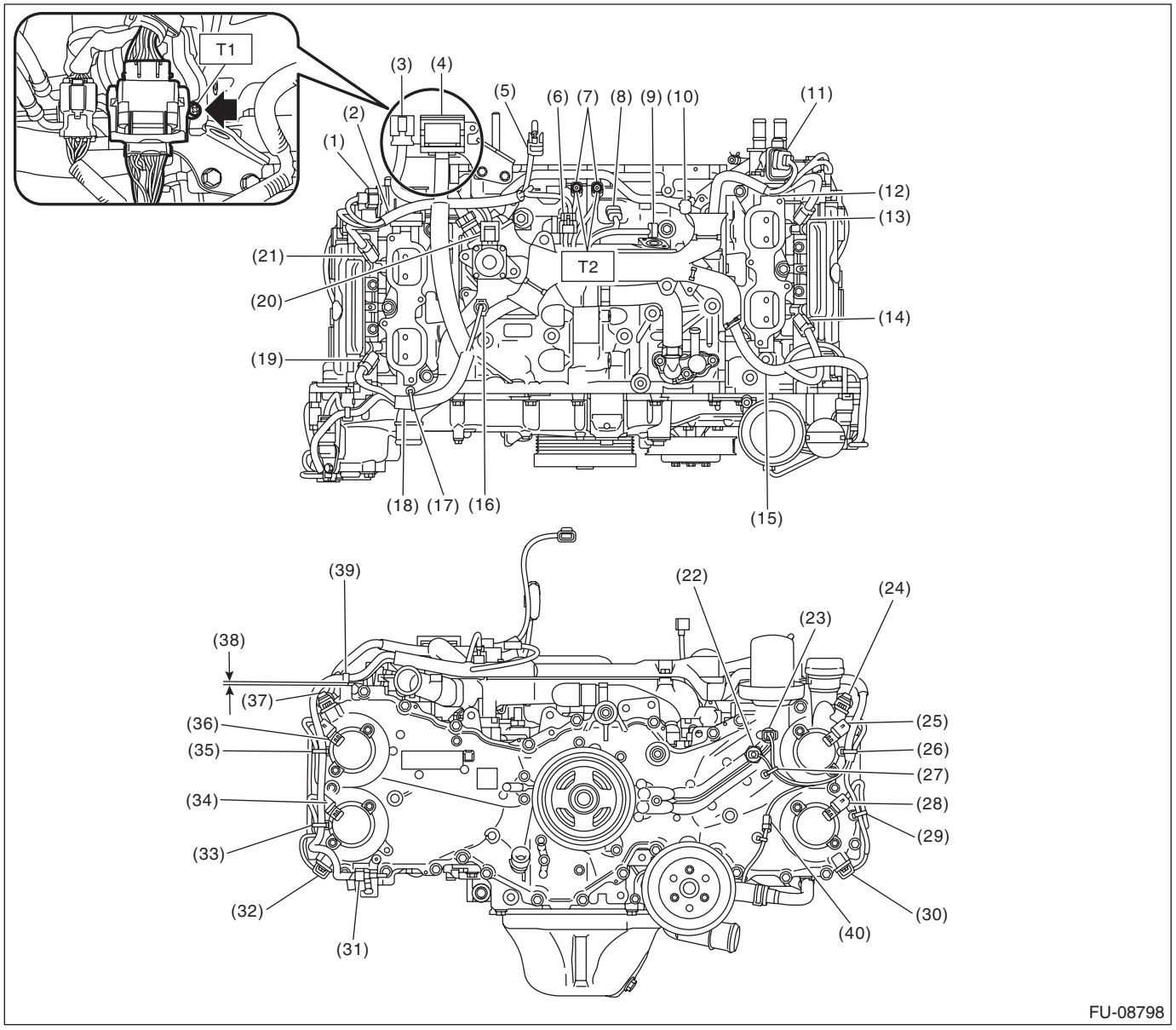
6) Remove the engine wiring harness.



B: INSTALLATION

1) Route the engine wiring harness around the engine and connect connectors.

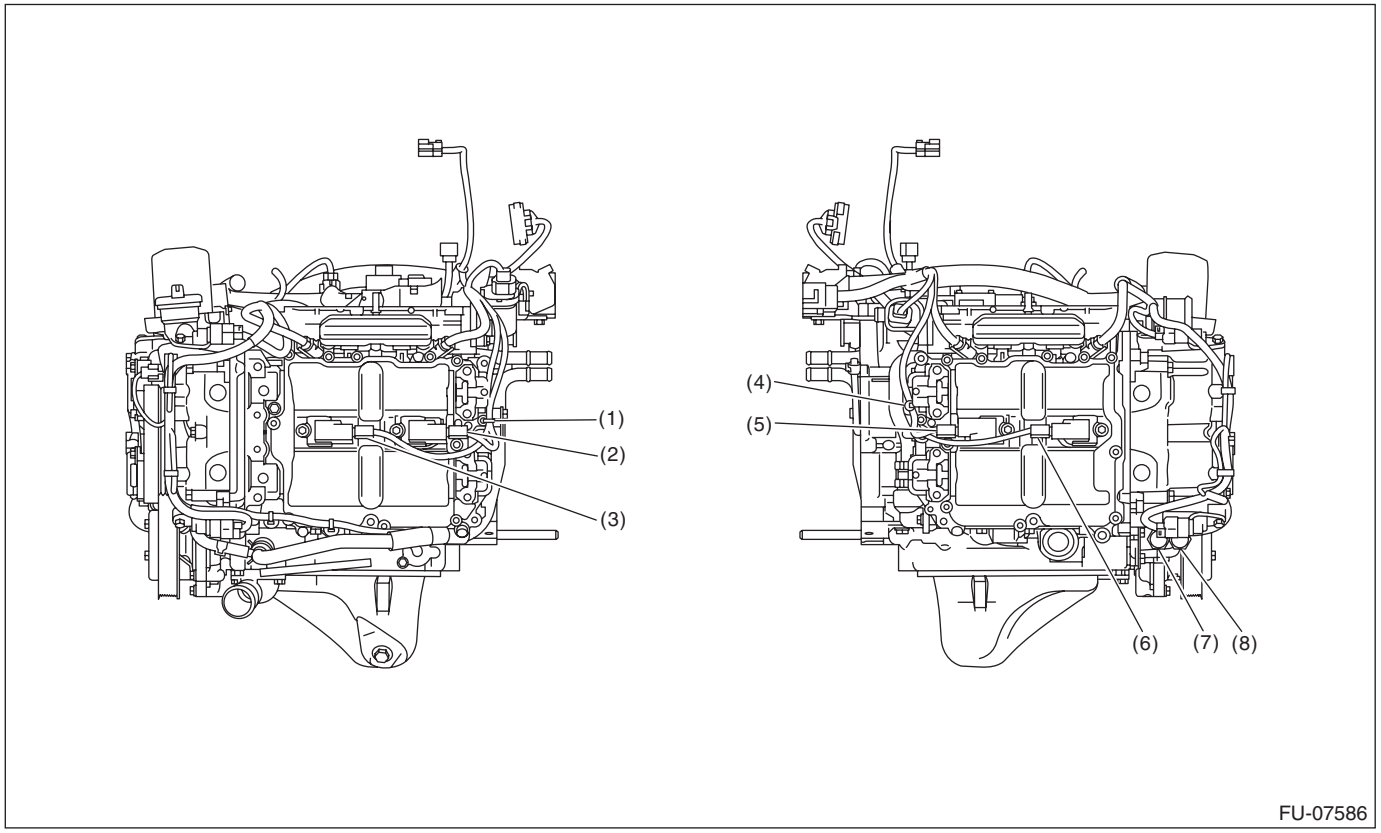
- Structural diagram 1



(1) Tumble generator valve actuator RH
(2) Be careful of pinching when installing the intake manifold.
(3) Engine harness connector (16P)
(4) Engine harness connector (54P)
(5) Throttle position sensor connector
(6) Manifold absolute pressure sensor connector
(7) Engine ground (2 locations)
(8) Crankshaft position sensor
(9) Knock sensor
(10) Purge control solenoid valve connector
(11) Tumble generator valve actuator LH
(12) Be careful of pinching when installing the intake manifold.
(13) Fuel injector (#4)
(14) Fuel injector (#2)
(15) Be careful of pinching when installing the intake manifold and A/C bracket.
(16) Engine coolant temperature sensor
(17) Secure the clip to the screw hole.
(18) Be careful of pinching when installing the intake manifold.
(19) Fuel injector (#1)
(20) EGR valve
(21) Fuel injector (#3)
(22) Oil pressure switch
(23) Engine oil temperature sensor
(24) Intake camshaft position sensor LH
(25) Intake oil control solenoid LH
(26) Secure the clip to the screw hole.
(27) Secure the clip to the screw hole.
(28) Exhaust oil control solenoid LH
(29) Secure the clip to the screw hole.
(30) Exhaust camshaft position sensor LH
(31) Secure the clip to the oval hole.
(32) Exhaust camshaft position sensor RH
(33) Secure the clip to the screw hole.
(34) Exhaust oil control solenoid RH
(35) Secure the clip to the screw hole.
(36) Intake oil control solenoid RH
(37) Intake camshaft position sensor RH
(38) Maximum of 0 — 2 mm (0 — 0.079 in) gap is allowed.
(39) Secure the clip to the screw hole.
(40) Oil level switch connector

Tightening torque: N·m (kgf-m, ft-lb)
T1: 7.5 (0.8, 5.5)
T2: 19 (1.9, 14.0)

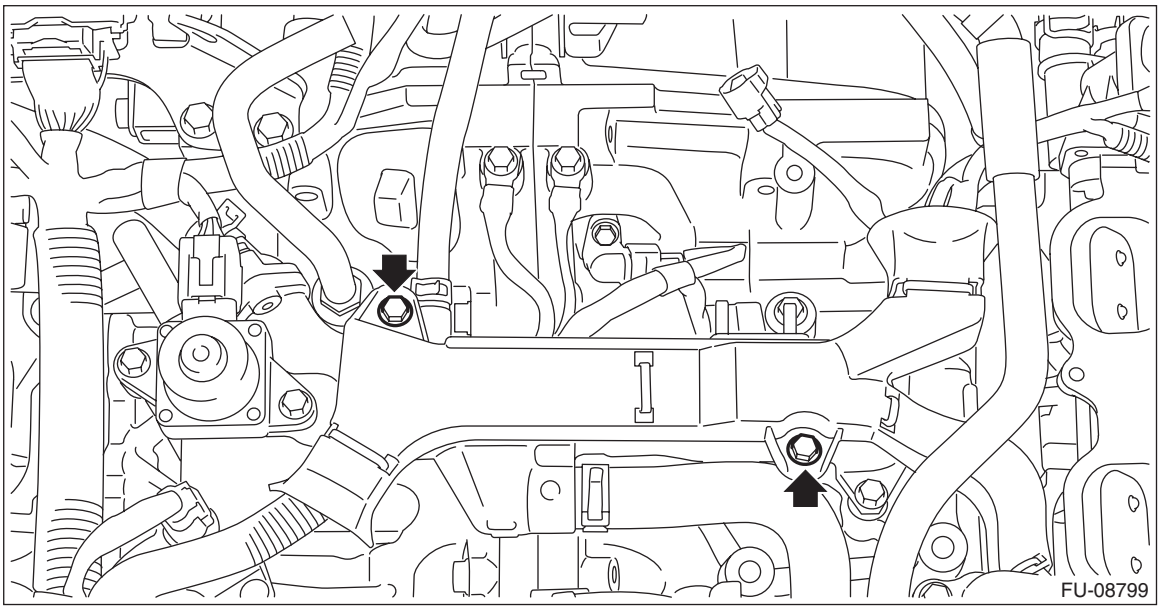
- Structural diagram 2



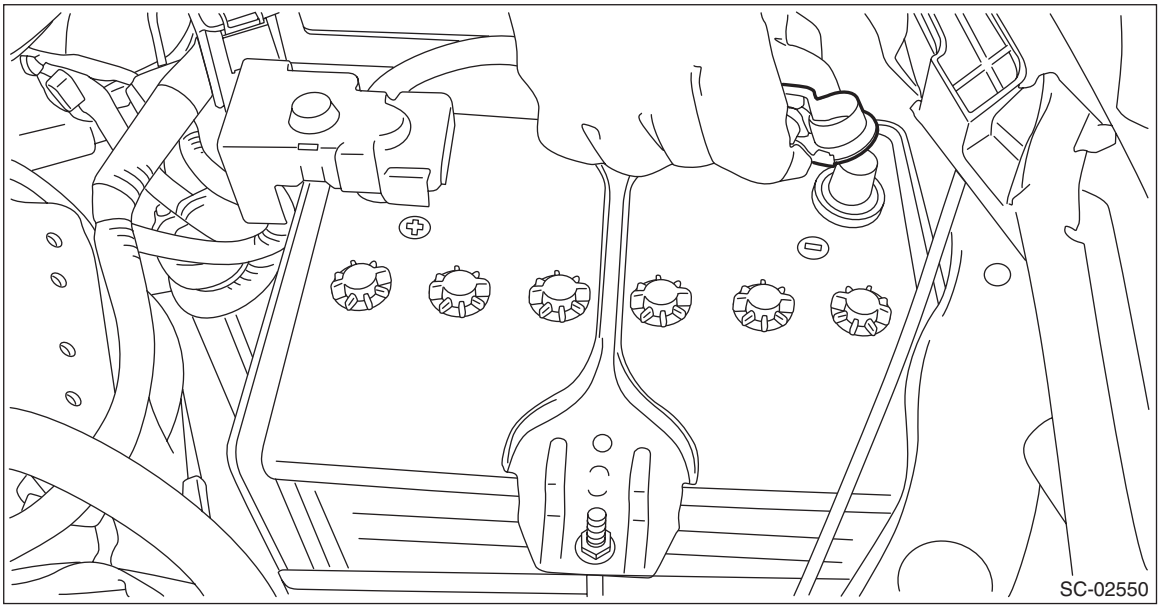
(1) Secure the clip to the screw hole.
(2) Ignition coil No. 4
(3) Ignition coil No. 2
(4) Secure the clip to the screw hole.
(5) Ignition coil No. 3
(6) Ignition coil No. 1
(7) Front oxygen (A/F) sensor
(8) Rear oxygen sensor

2) Install the engine wiring harness.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



3) Install the intake manifold. <Ref. to FU(H4DO(w/o HEV))-29, INSTALLATION, Intake Manifold.>
4) Connect the battery ground terminal.



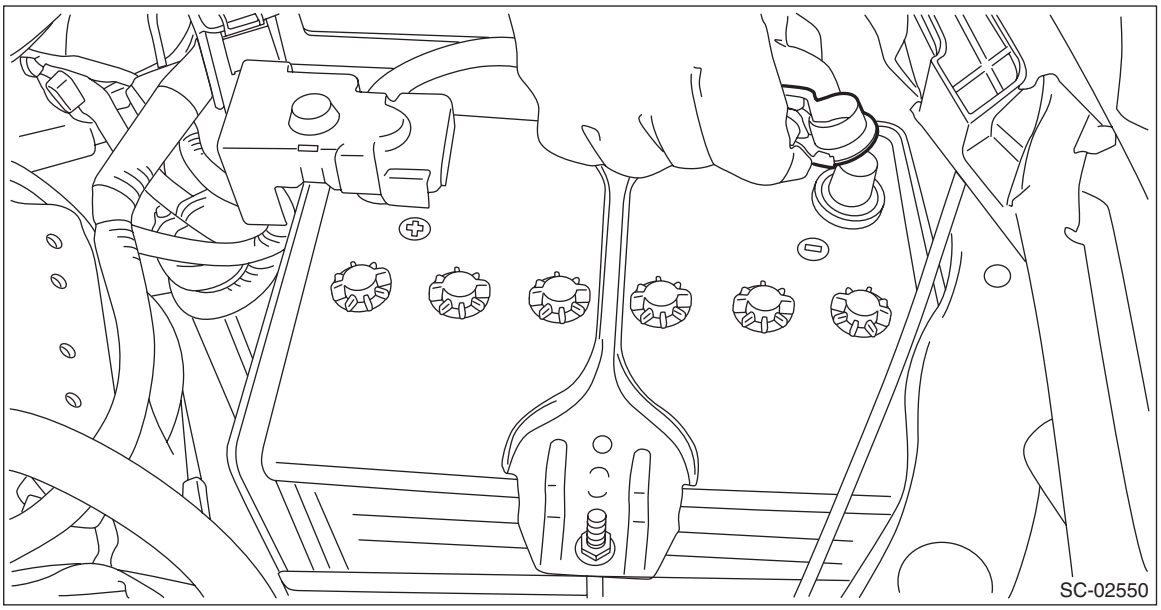
C: INSPECTION

Check that the engine wiring harness does not have deformation, cracks and any other damage.

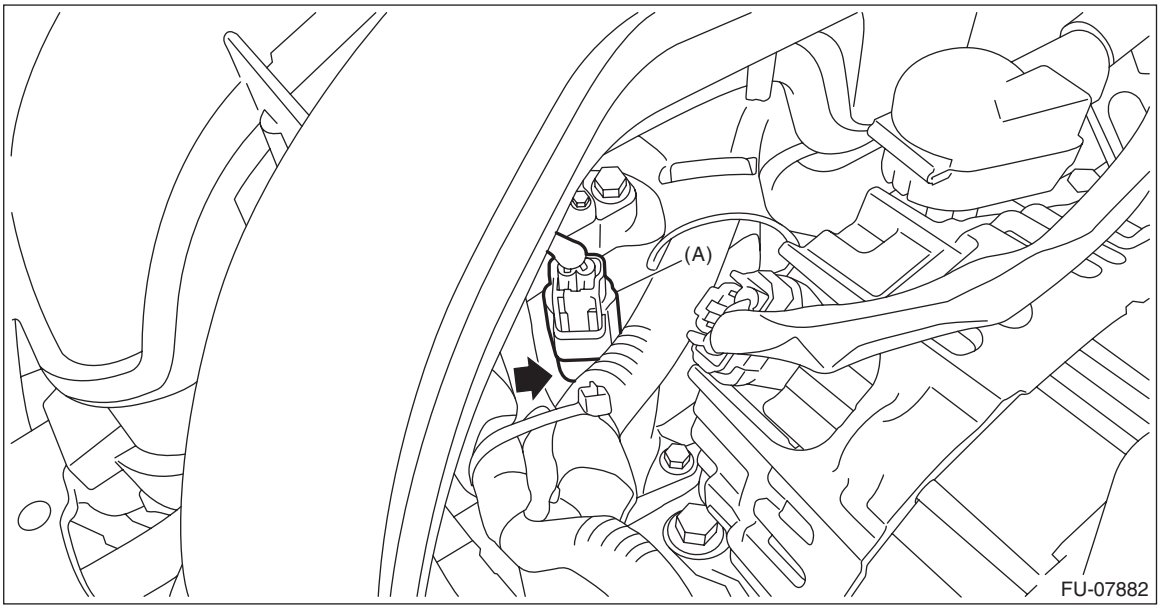
5. Engine Coolant Temperature Sensor

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Drain engine coolant. <Ref. to CO(H4DO(w/o HEV))-16, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
3) Disconnect the connector (A) from the engine coolant temperature sensor, and remove the engine coolant temperature sensor.



B: INSTALLATION

Install in the reverse order of removal.

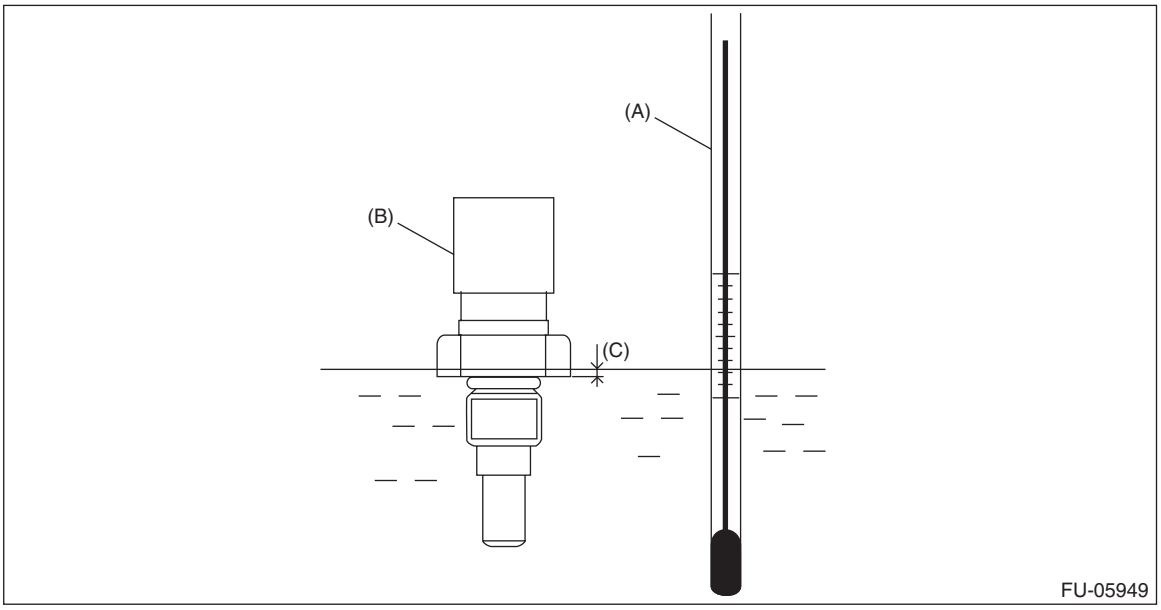
NOTE:
Use a new gasket.

Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)

C: INSPECTION

1) Check that the engine coolant temperature sensor has no deformation, cracks or other damages.
2) Immerse the engine coolant temperature sensor and a thermometer in water.

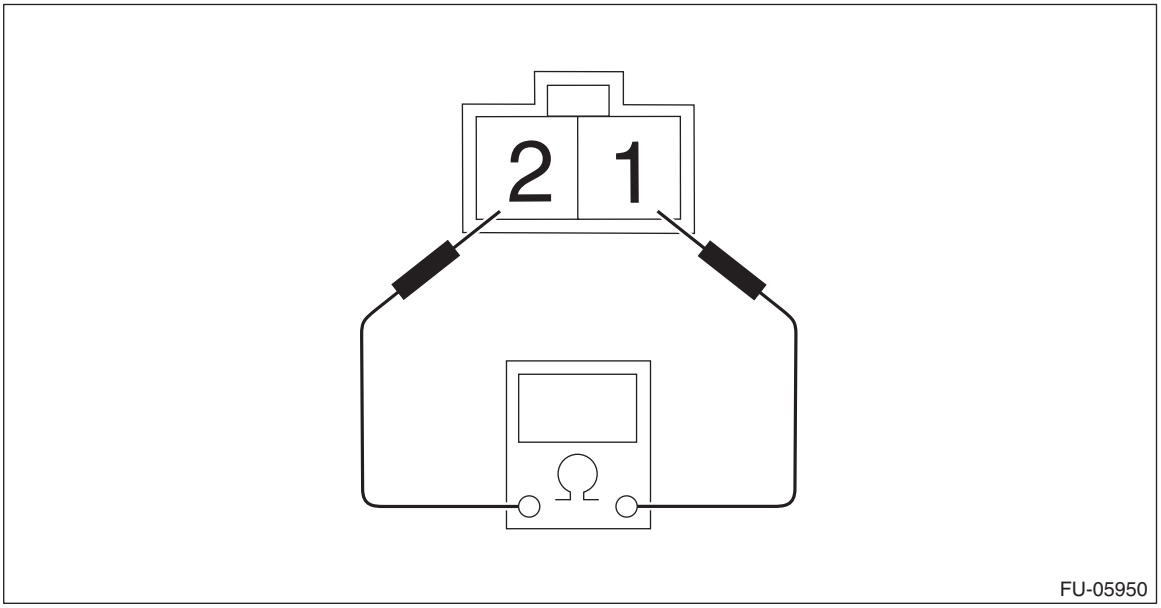
CAUTION:
Take care not to allow water to get into the engine coolant temperature sensor connector. Completely remove any water inside.



(A) Thermometer
(B) Engine coolant temperature sensor
(C) Hexagonal part height: To approx. $^1/_3$

3) Raise water temperature gradually, measure the resistance between the engine coolant temperature sensor terminals when the temperature is 20°C (68°F) and 80°C (176°F).

NOTE:
Agitate the water for even temperature distribution.

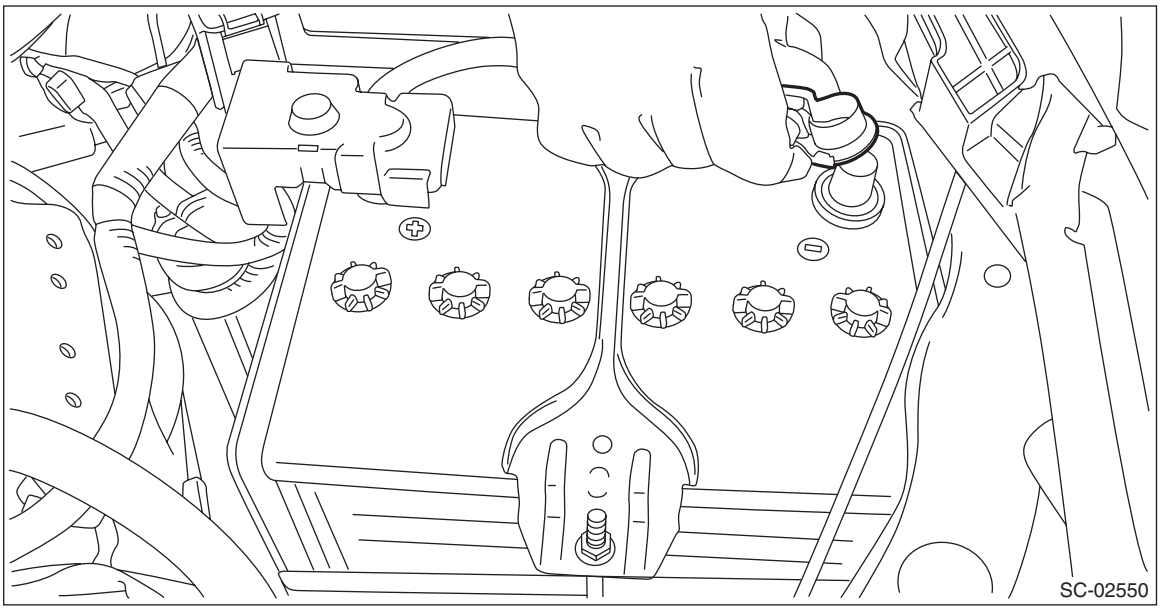


Water temperature	Terminal No.	Standard
20°C (68°F)	1 and 2	Approx. 2.45±0.2 kΩ
80°C (176°F)		Approx. 0.318±0.013 kΩ

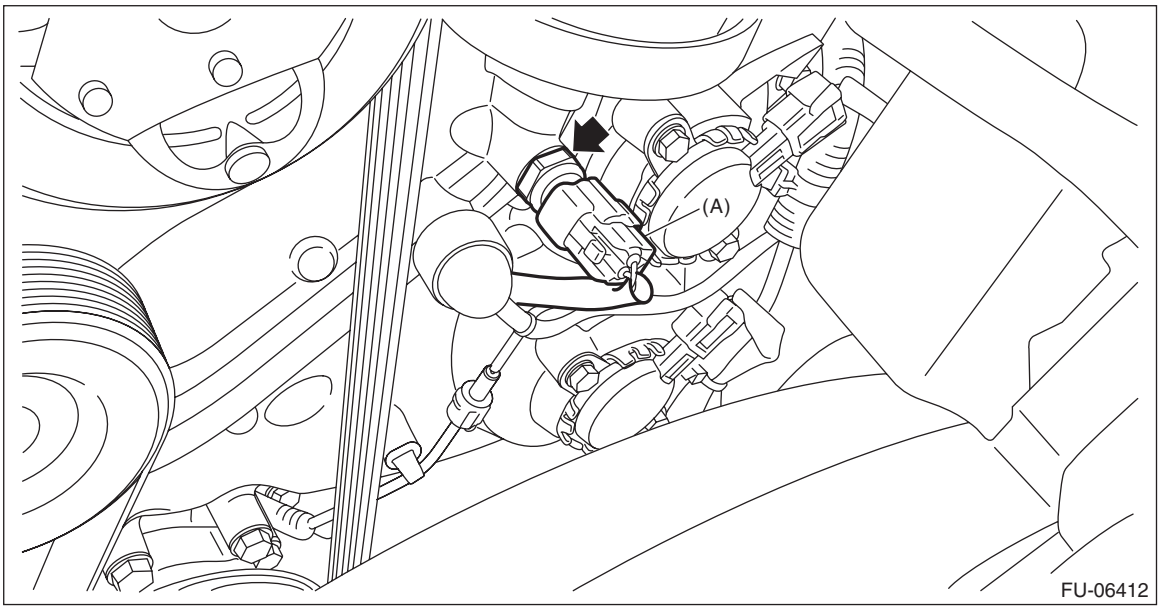
6. Engine Oil Temperature Sensor

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Disconnect the connector (A) from the engine oil temperature sensor, and remove the engine oil temperature sensor from the chain cover.



B: INSTALLATION

Install in the reverse order of removal.

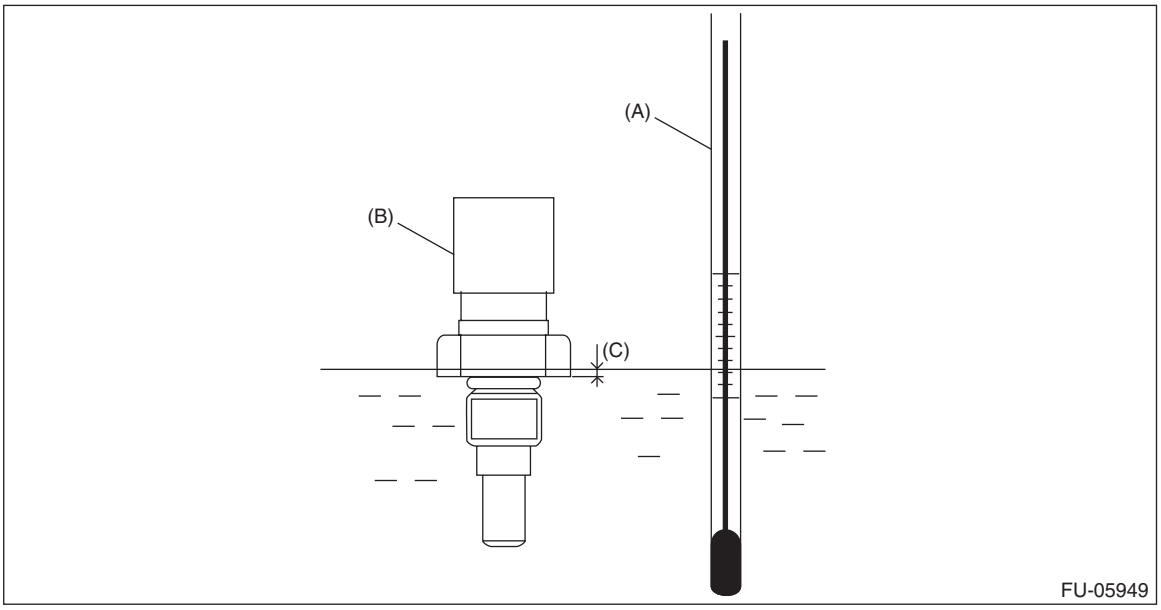
NOTE:
Use a new gasket.

Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)

C: INSPECTION

1) Check that the engine oil temperature sensor has no deformation, cracks or other damages.
2) Immerse the engine oil temperature sensor and a thermometer in water.

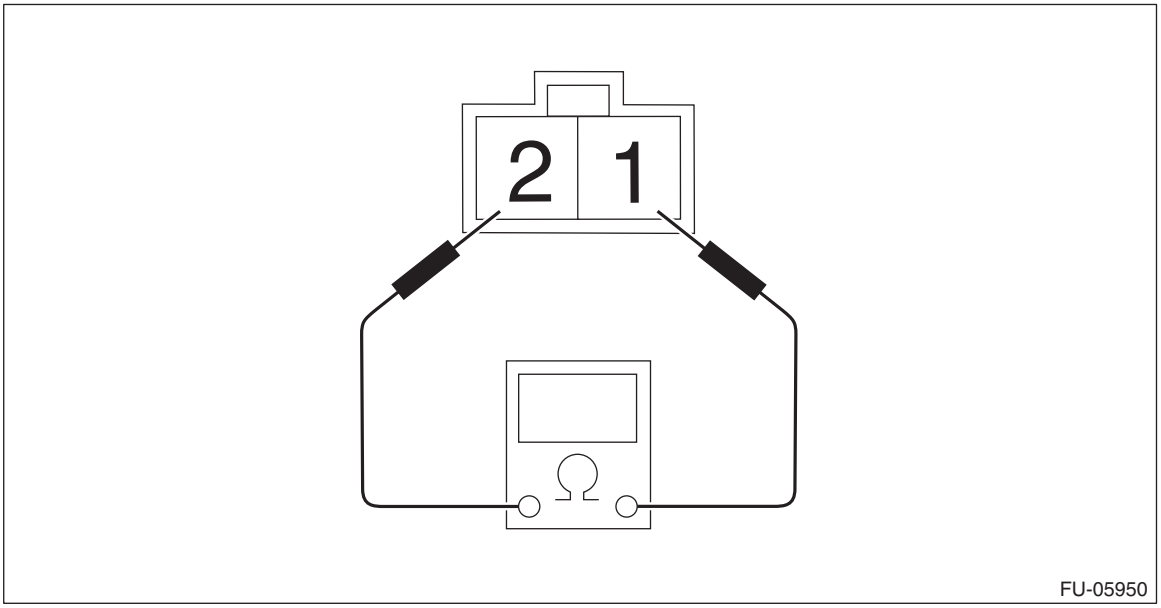
CAUTION:
Take care not to allow water to get into the engine oil temperature sensor connector. Completely remove any water inside.



(A) Thermometer
(B) Engine oil temperature sensor
(C) Hexagonal part height: To approx. $^{1}/_{3}$

3) Raise water temperature gradually, measure the resistance between the engine oil temperature sensor terminals when the temperature is 20°C (68°F) and 80°C (176°F).

NOTE:
Agitate the water for even temperature distribution.

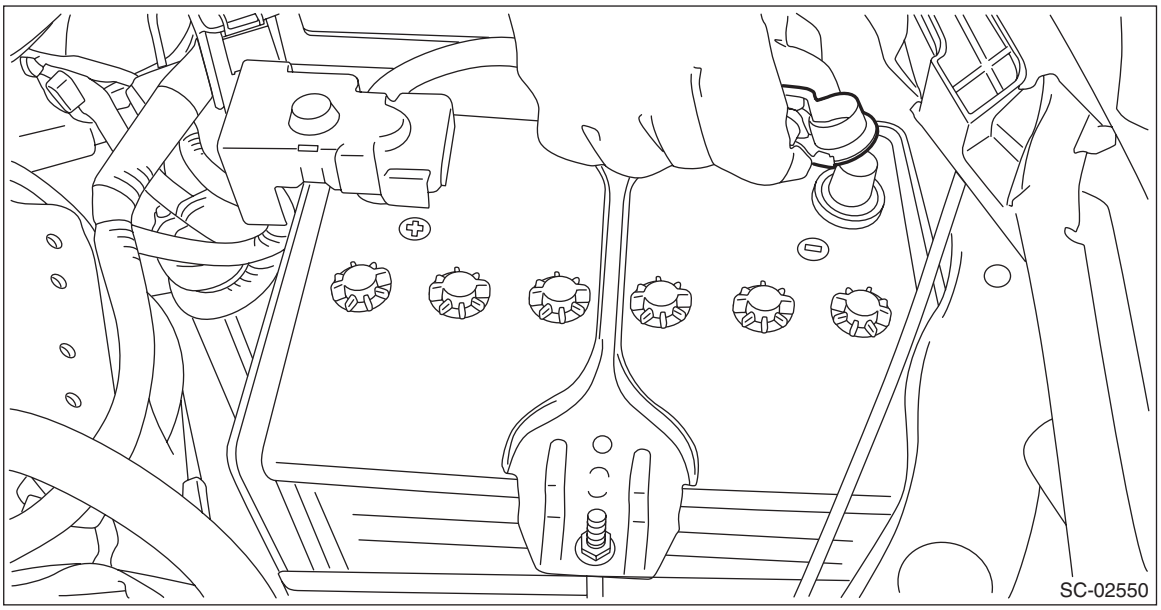


Water temperature	Terminal No.	Standard
20°C (68°F)	1 and 2	Approx. 2.45±0.2 kΩ
80°C (176°F)		Approx. 0.318±0.013 kΩ

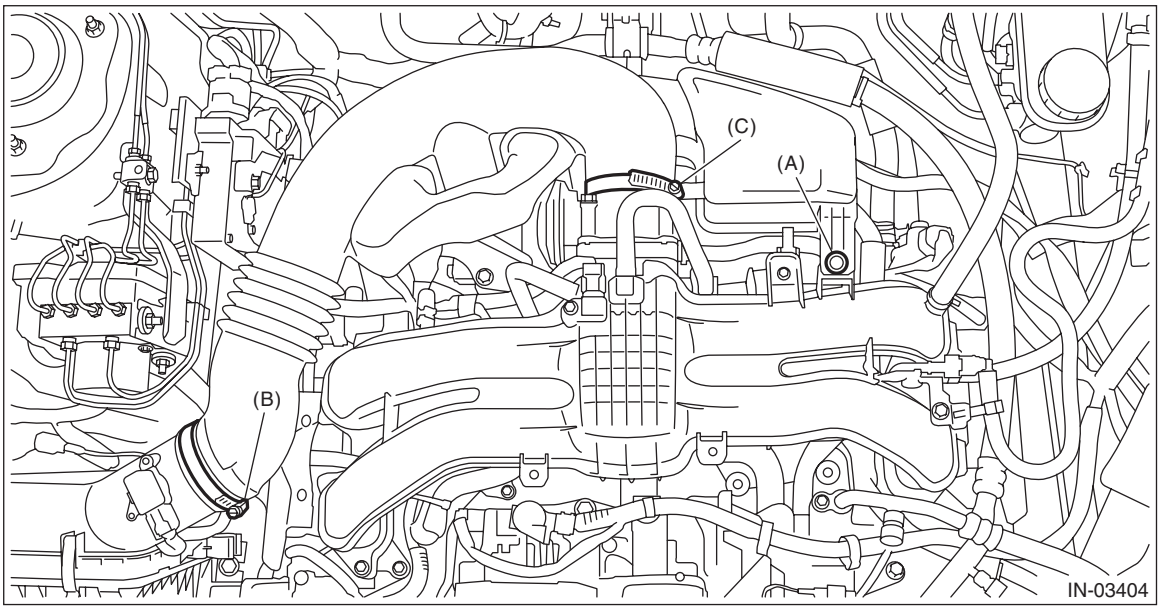
7. Crankshaft Position Sensor

A: REMOVAL

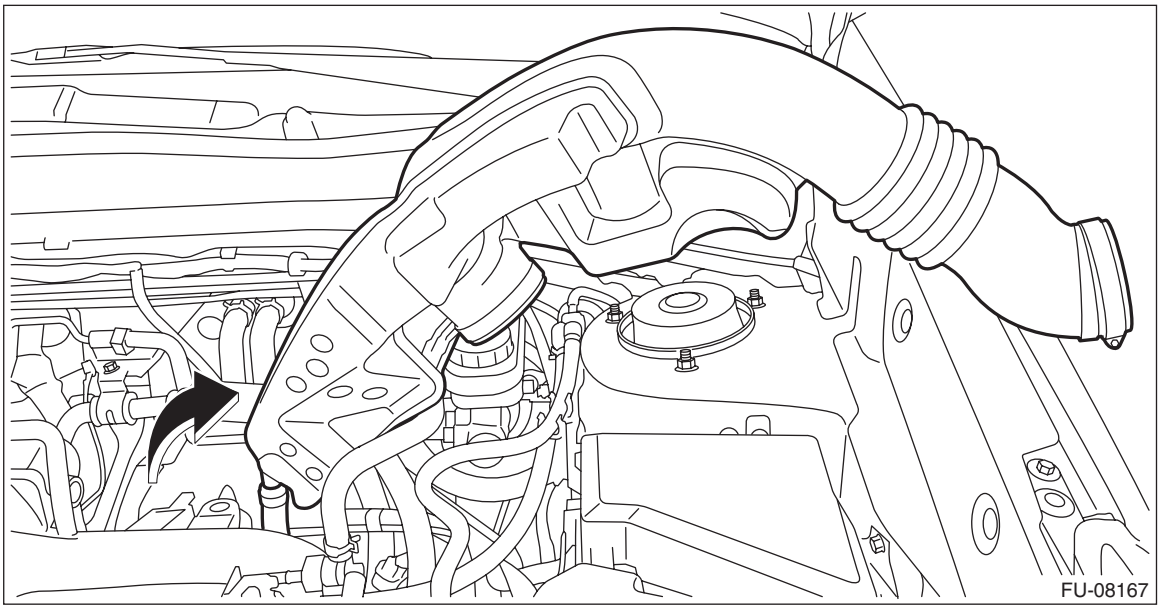
1) Disconnect the ground cable from battery.



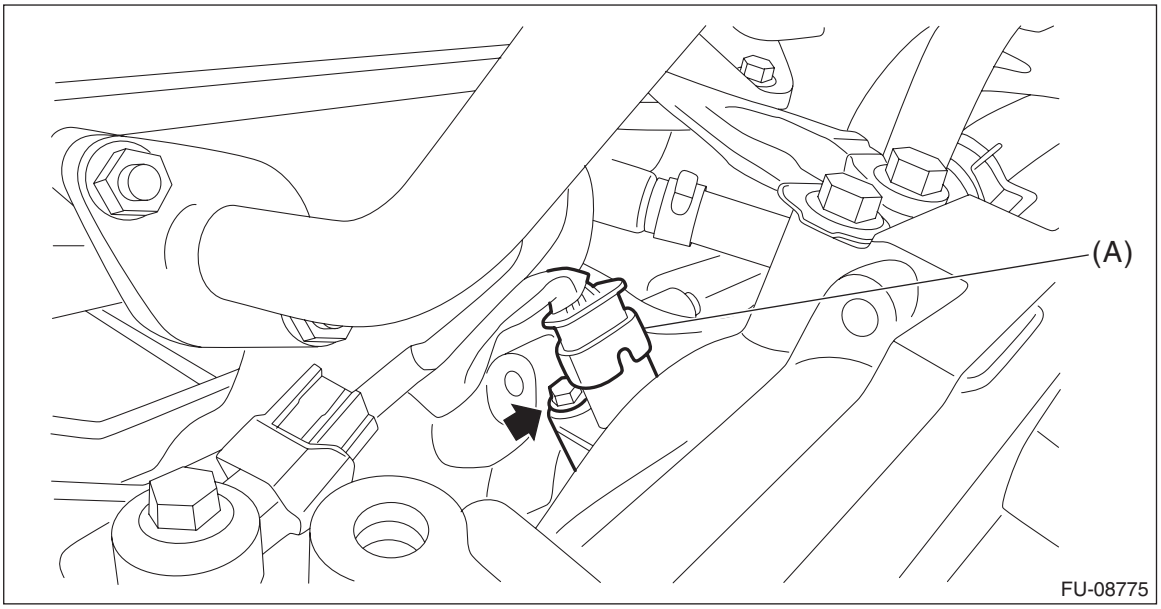
2) Remove the clip (A), and loosen the clamps (B) and (C) securing the air intake boot.



3) Remove the air intake boot from the air cleaner case (rear) and throttle body, and move it to the left side wheel apron.



4) Disconnect the connector (A) from the crankshaft position sensor, and remove the crankshaft position sensor from the cylinder block.



B: INSTALLATION

Install in the reverse order of removal.

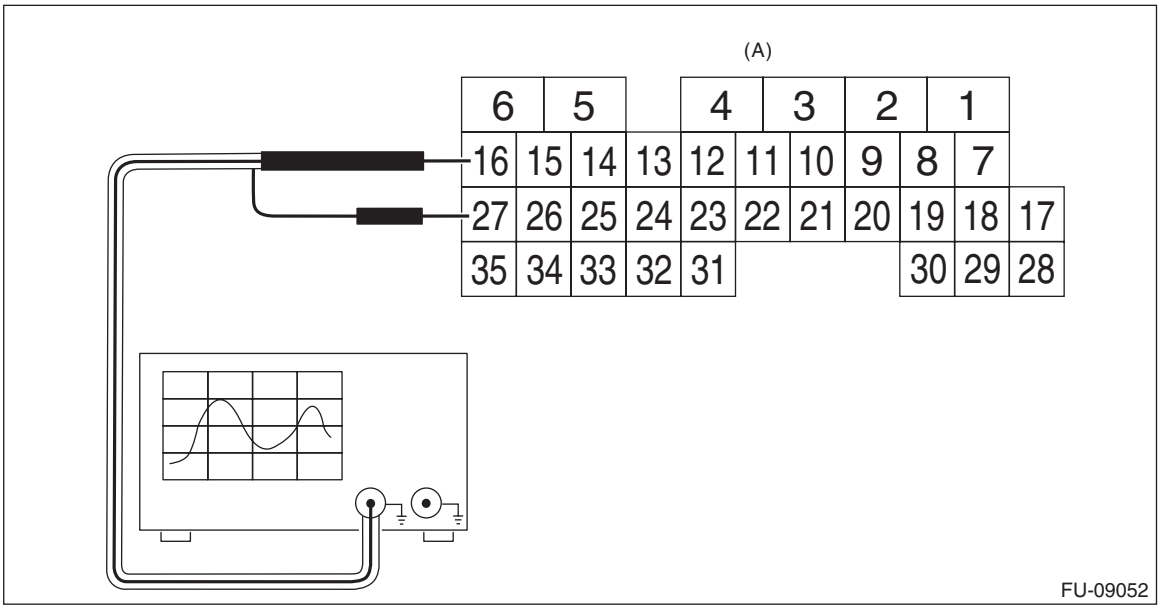
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

C: INSPECTION

1. CRANKSHAFT POSITION SENSOR (METHOD WITH OSCILLOSCOPE)

1) Prepare an oscilloscope.
2) Remove the glove box. <Ref. to EI-78, REMOVAL, Glove Box.>

3) Connect the probe to ECM connector.



(A) To ECM connector

Terminal No.	Probe
16	+
27	–

4) Start the engine and let it idle.
5) Check the waveforms and voltage.

NOTE:
For waveform and voltage, refer to “Engine Control Module (ECM) I/O Signal”. <Ref. to EN(H4DO w/o HEV)(diag)-19, ELECTRICAL SPECIFICATION, Engine Control Module (ECM) I/O Signal.>
6) After inspection, install the related parts in the reverse order of removal.

2. OTHER INSPECTIONS

Check that the crankshaft position sensor has no deformation, cracks or other damages.

8. Crankshaft Position Sensor Plate

A: REMOVAL

The crankshaft position sensor plate is tightened together with the drive plate or flywheel; therefore, refer to “Drive Plate” or “Flywheel” for removal procedure. <Ref. to CVT(TR580)-162, REMOVAL, Drive Plate.> <Ref. to CL-11, REMOVAL, Flywheel.>

B: INSTALLATION

The crankshaft position sensor plate is tightened together with the drive plate or flywheel; therefore, refer to “Drive Plate” or “Flywheel” for installation procedure. <Ref. to CVT(TR580)-163, INSTALLATION, Drive Plate.> <Ref. to CL-11, INSTALLATION, Flywheel.>

C: INSPECTION

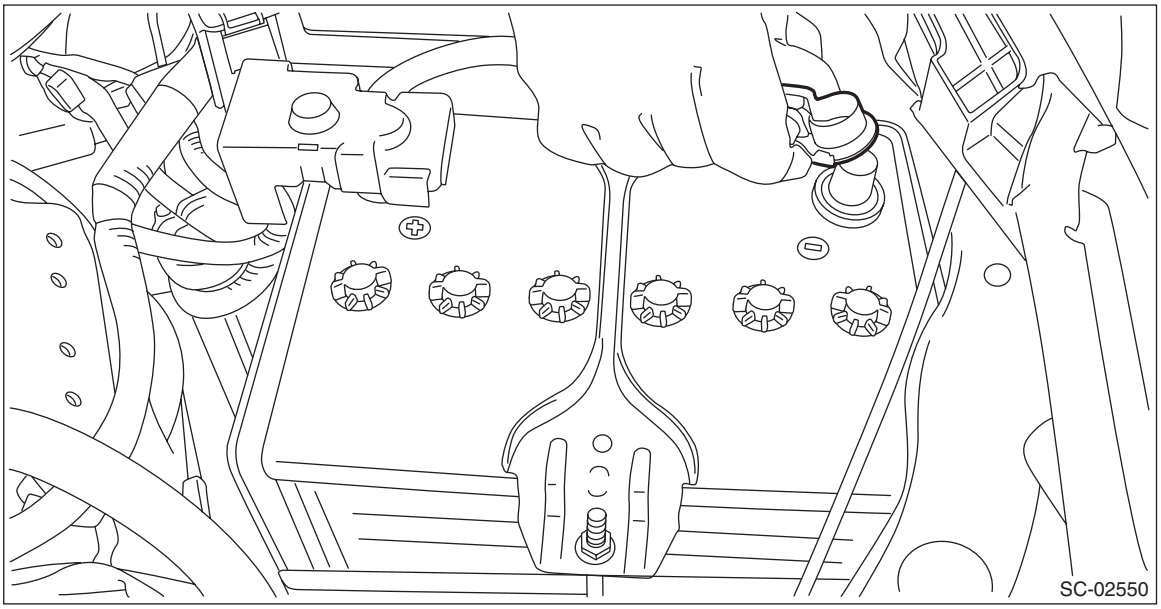
Check that the crankshaft position sensor plate has no deformation, cracks or other damages.

9. Camshaft Position Sensor

A: REMOVAL

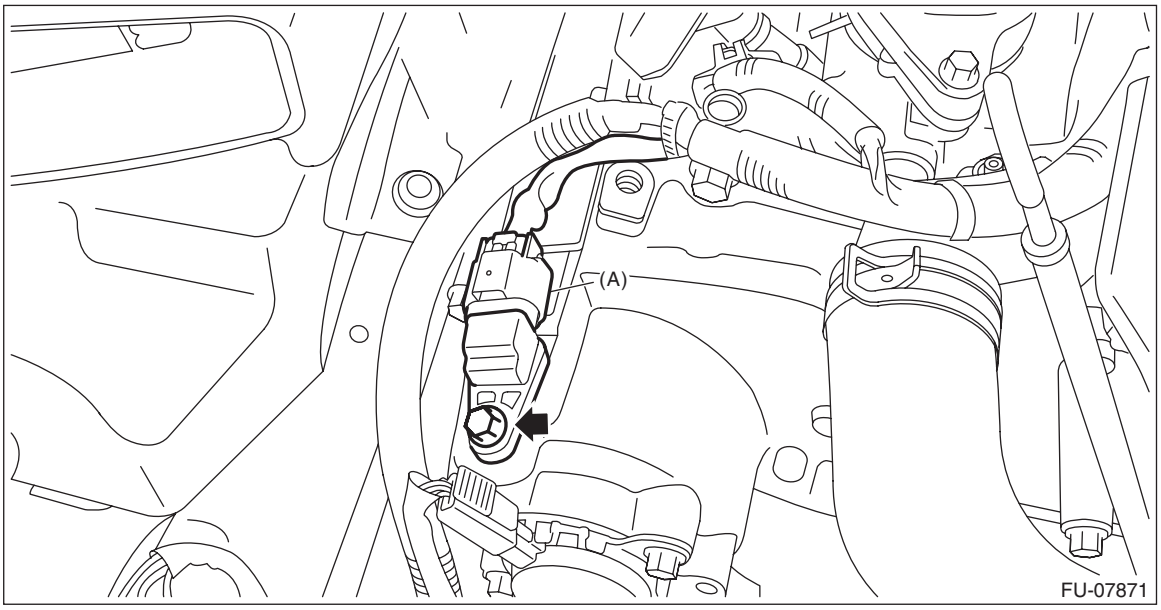
1. INTAKE SIDE

1) Disconnect the ground cable from battery.

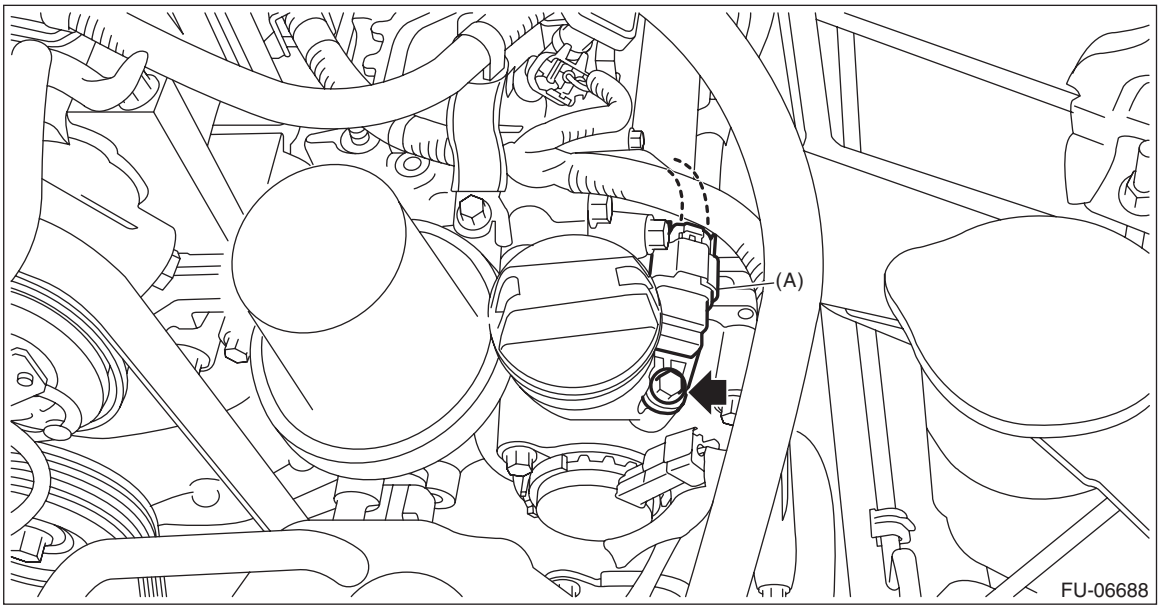


2) Remove the air intake duct. (RH side only) <Ref. to IN(H4DO(w/o HEV))-13, REMOVAL, Air Intake Duct.>
3) Disconnect the connector (A) from the camshaft position sensor, and remove the camshaft position sensor from the chain cover.

- RH side

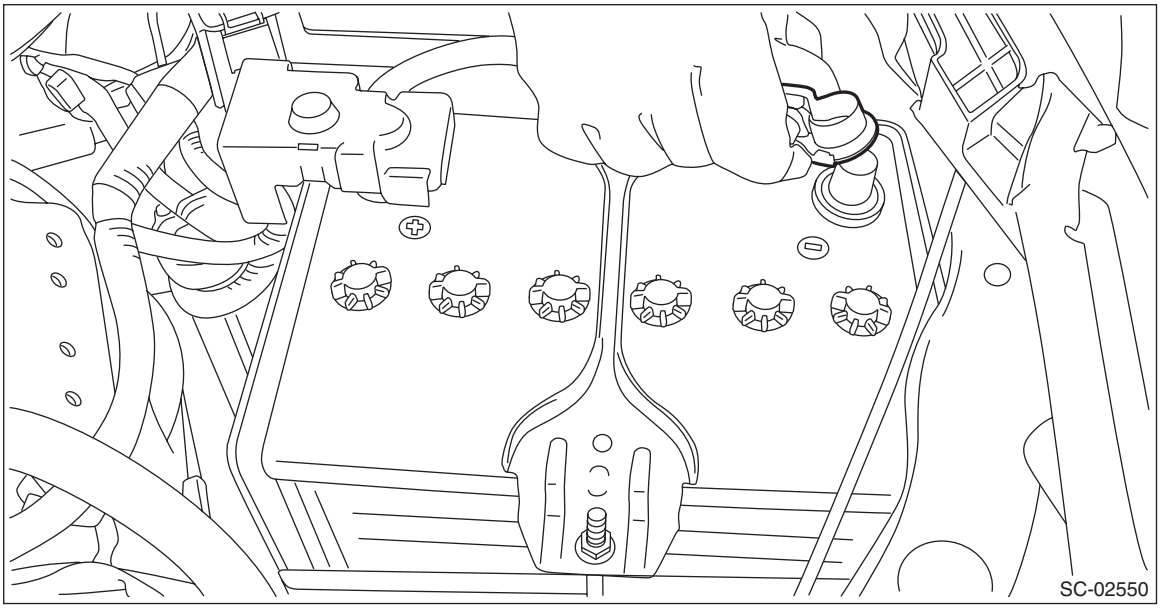


- LH side



2. EXHAUST SIDE

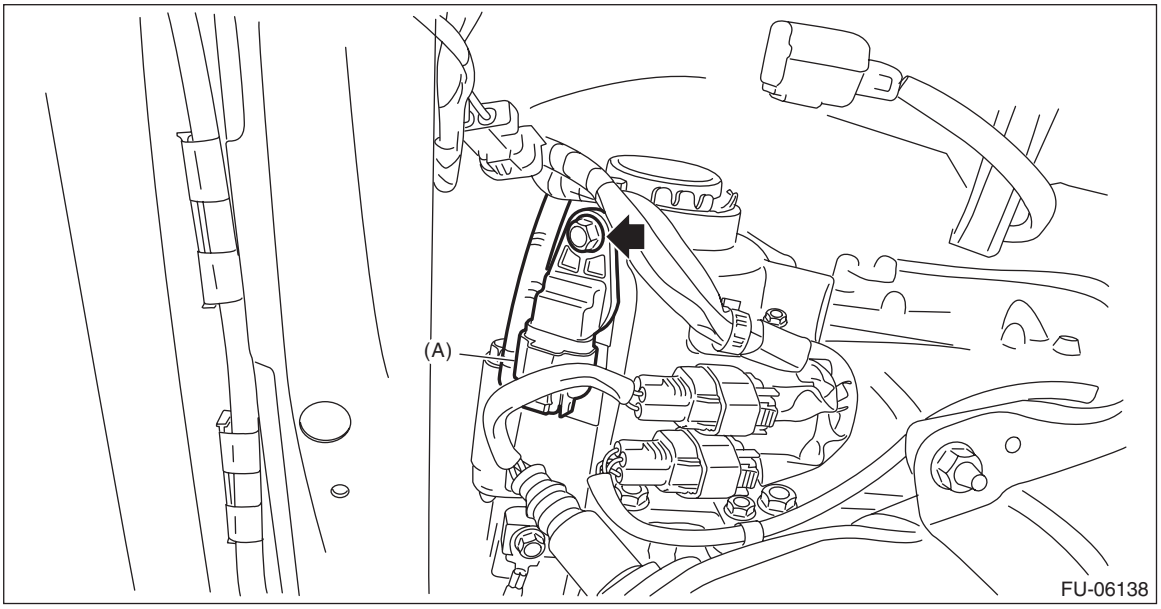
1) Disconnect the ground cable from battery.



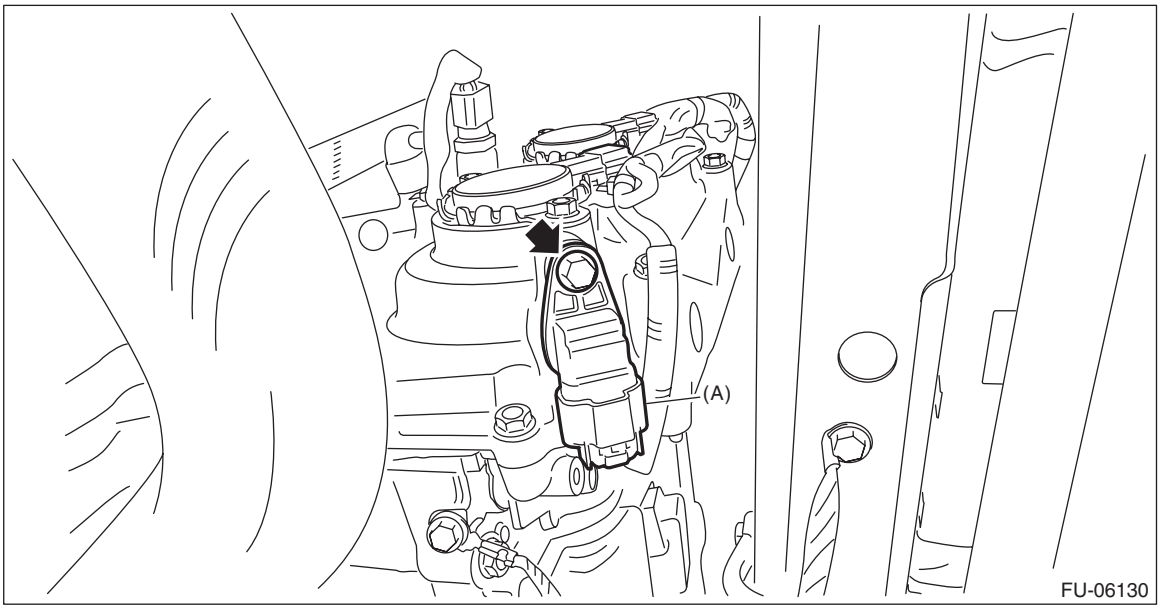
2) Remove the under cover. <Ref. to EI-32, REMOVAL, Front Under Cover.>

3) Disconnect the connector (A) from the camshaft position sensor, and remove the camshaft position sensor from the chain cover.

- RH side



- LH side



B: INSTALLATION

Install in the reverse order of removal.

NOTE:
- Use new O-rings.
- Apply engine oil to O-ring.

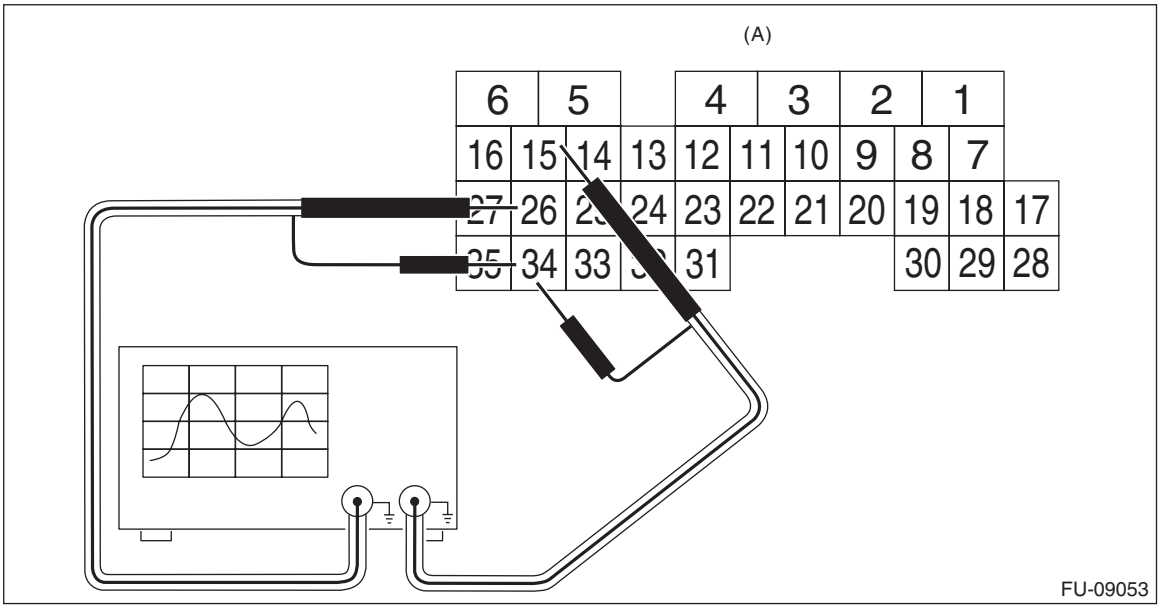
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

C: INSPECTION

1. CAMSHAFT POSITION SENSOR (METHOD WITH OSCILLOSCOPE)

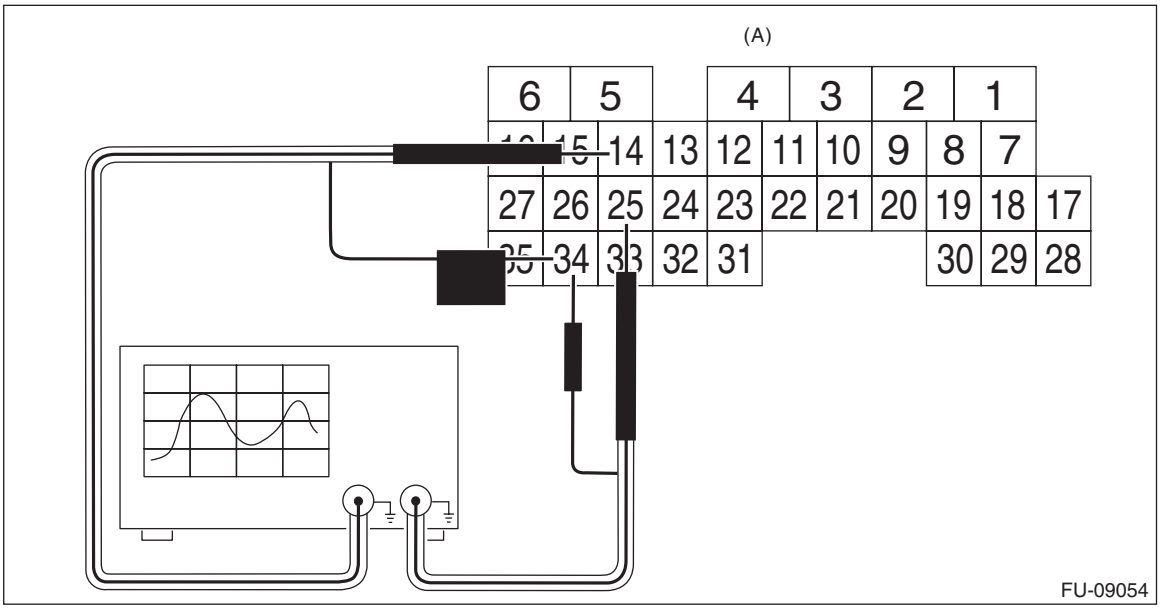
1) Prepare an oscilloscope.
2) Remove the glove box. <Ref. to EI-78, REMOVAL, Glove Box.>
3) Connect the probe to ECM connector.

- Intake camshaft position sensor



(A) To ECM connector

- Exhaust camshaft position sensor



(A) To ECM connector

Camshaft position sensor		Terminal No.	Probe
Intake	RH	26	+
	LH	15	+
Exhaust	RH	14	+
	LH	25	+
RH and LH		34	–

4) Start the engine and let it idle.
5) Check the waveforms and voltage.

NOTE:
For waveform and voltage, refer to “Engine Control Module (ECM) I/O Signal”. <Ref. to EN(H4DO w/o HEV)(diag)-19, ELECTRICAL SPECIFICATION, Engine Control Module (ECM) I/O Signal.>
6) After inspection, install the related parts in the reverse order of removal.

2. OTHER INSPECTIONS

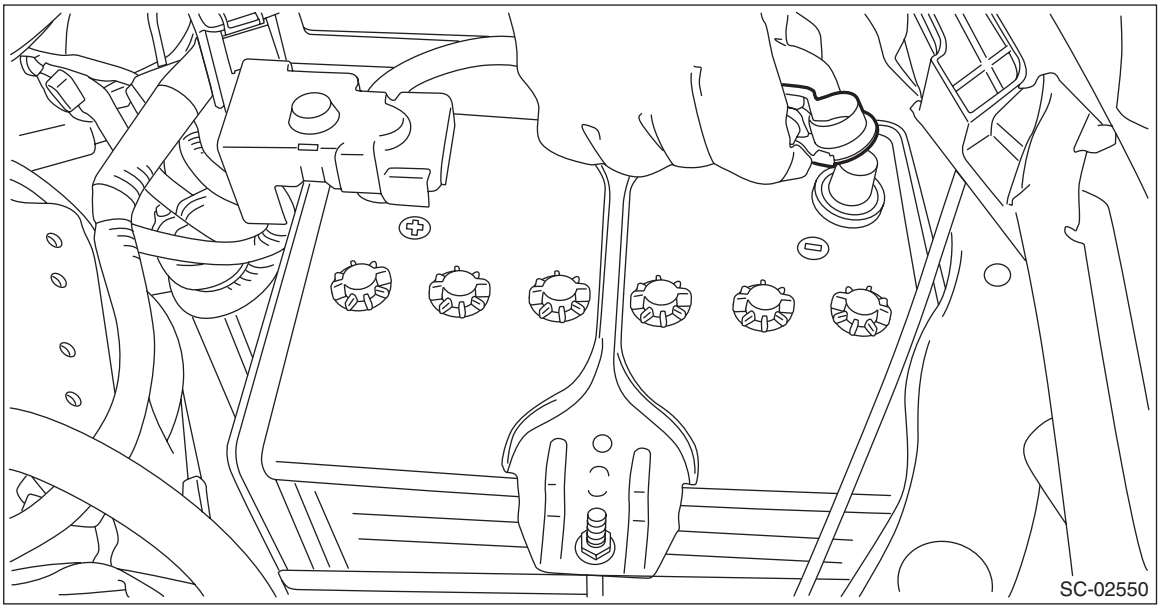
Check that the camshaft position sensor has no deformation, cracks or other damages.

10.Oil Control Solenoid

A: REMOVAL

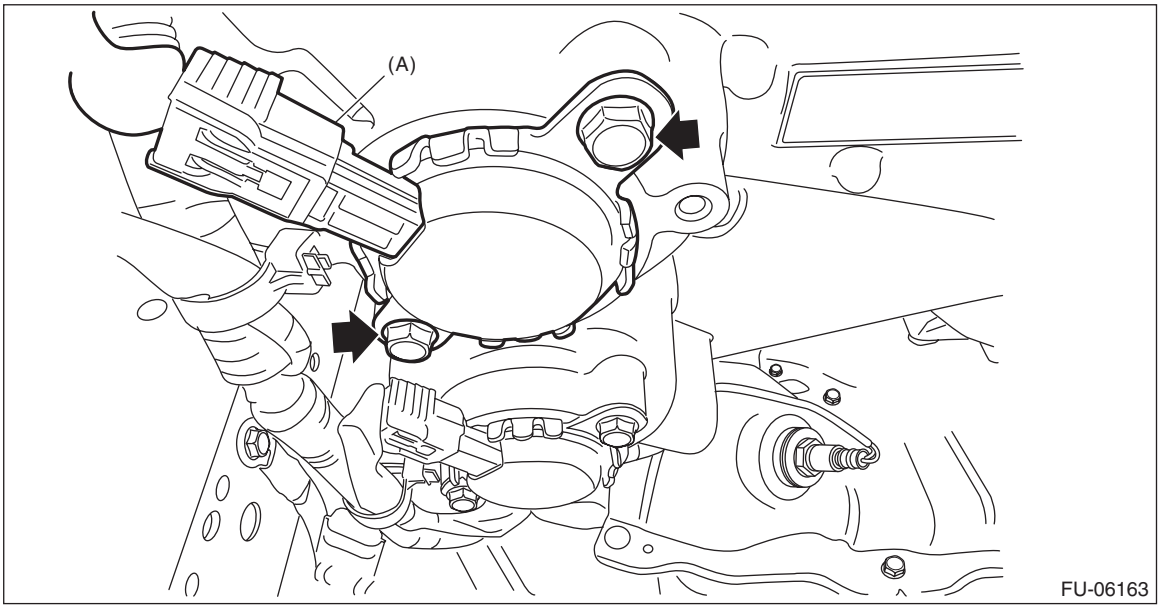
1. INTAKE SIDE

1) Disconnect the ground cable from battery.

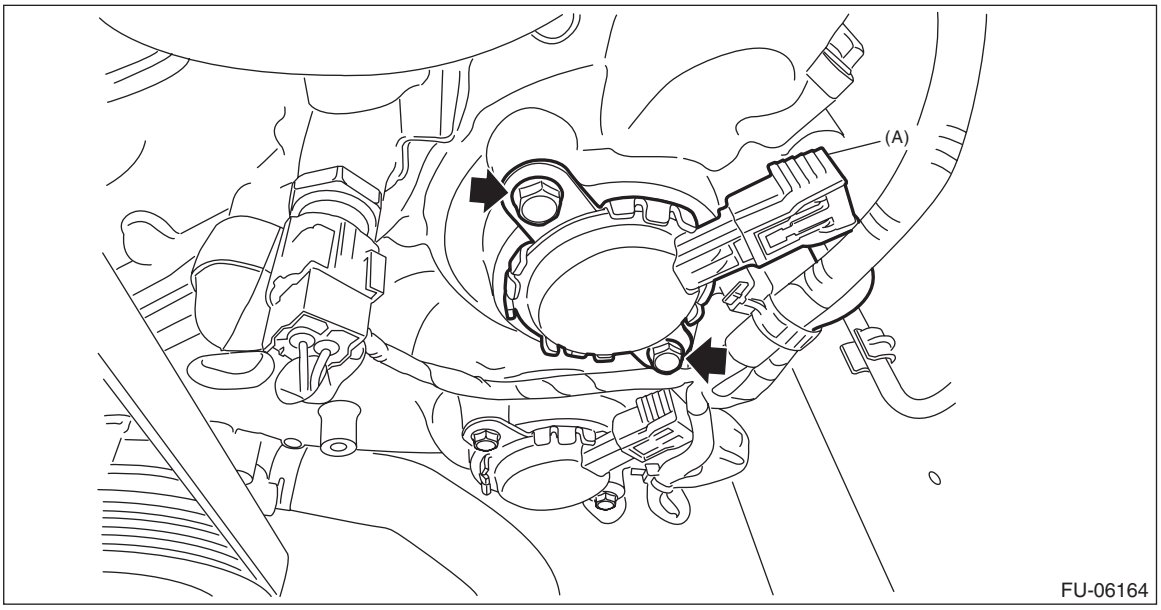


2) Remove the air intake duct. (RH side only) <Ref. to IN(H4DO(w/o HEV))-13, REMOVAL, Air Intake Duct.>
3) Remove the reservoir tank. (LH side only) <Ref. to CO(H4DO(w/o HEV))-97, REMOVAL, Reservoir Tank.>
4) Disconnect the connector (A) from the oil control solenoid, and remove the oil control solenoid from the chain cover.

- RH side

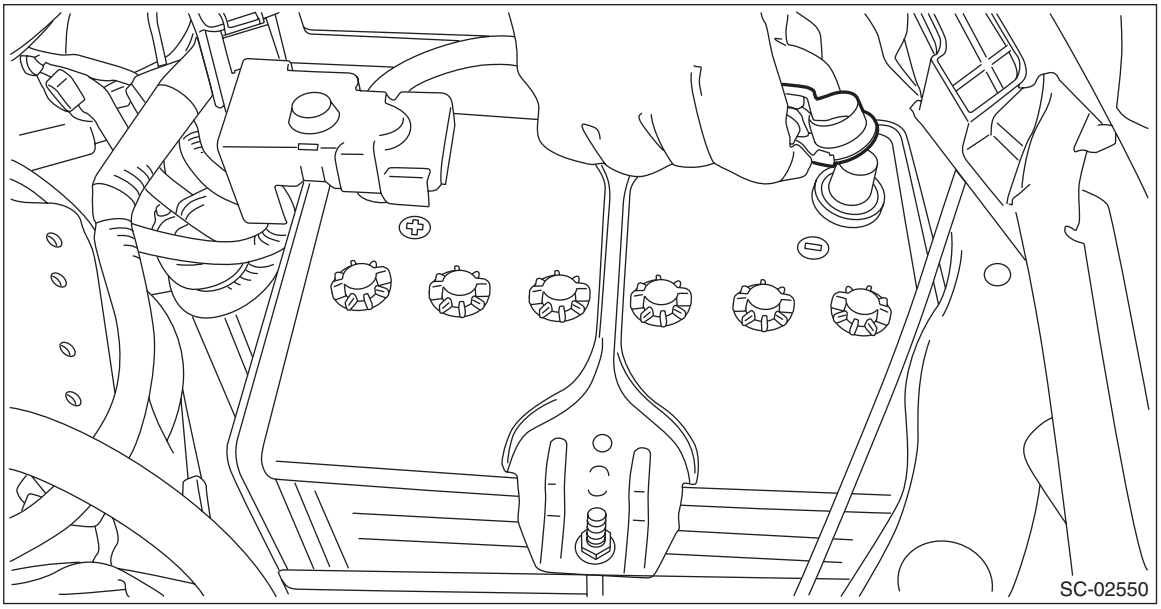


- LH side



2. EXHAUST SIDE

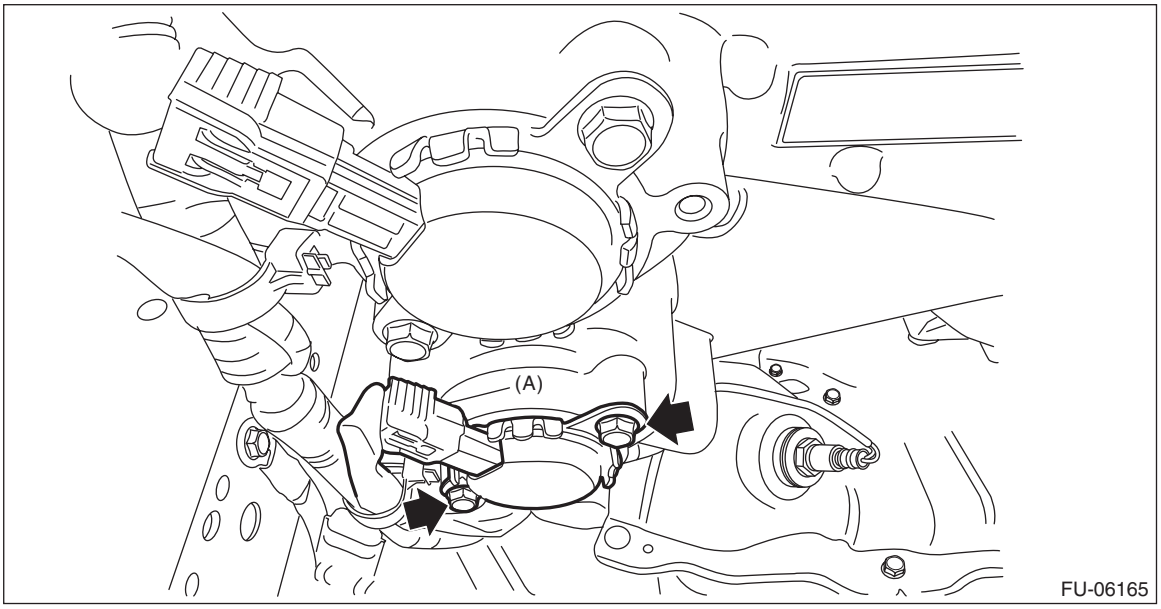
1) Disconnect the ground cable from battery.



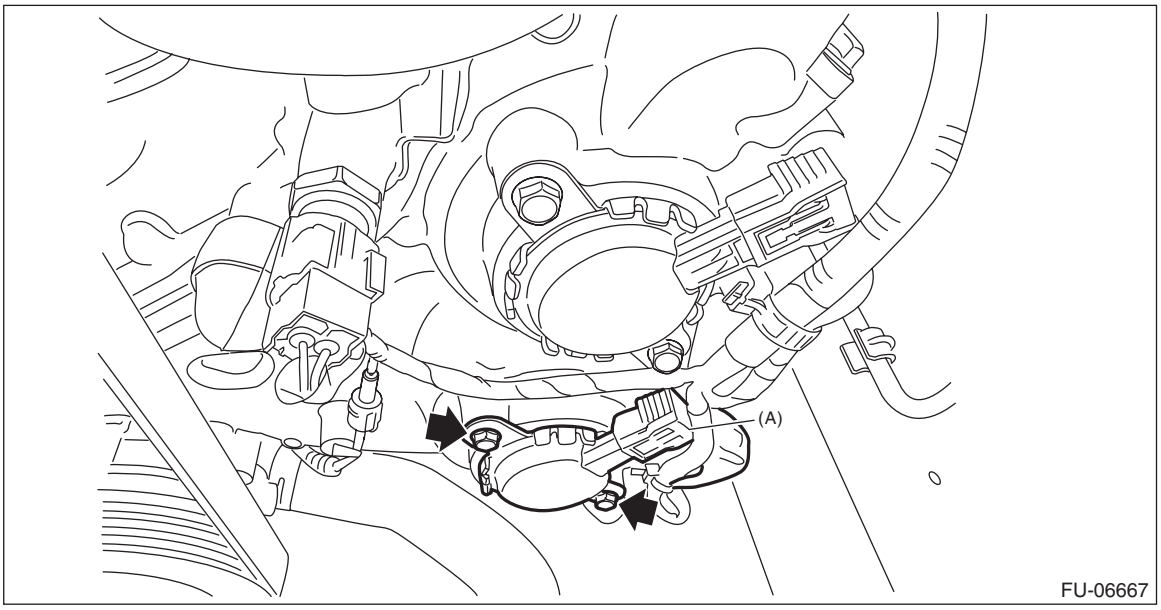
2) Remove the air intake duct. (RH side only) <Ref. to IN(H4DO(w/o HEV))-13, REMOVAL, Air Intake Duct.>
3) Remove the reservoir tank. (LH side only) <Ref. to CO(H4DO(w/o HEV))-97, REMOVAL, Reservoir Tank.>

4) Disconnect the connector (A) from the oil control solenoid, and remove the oil control solenoid from the chain cover.

- RH side



- LH side



B: INSTALLATION

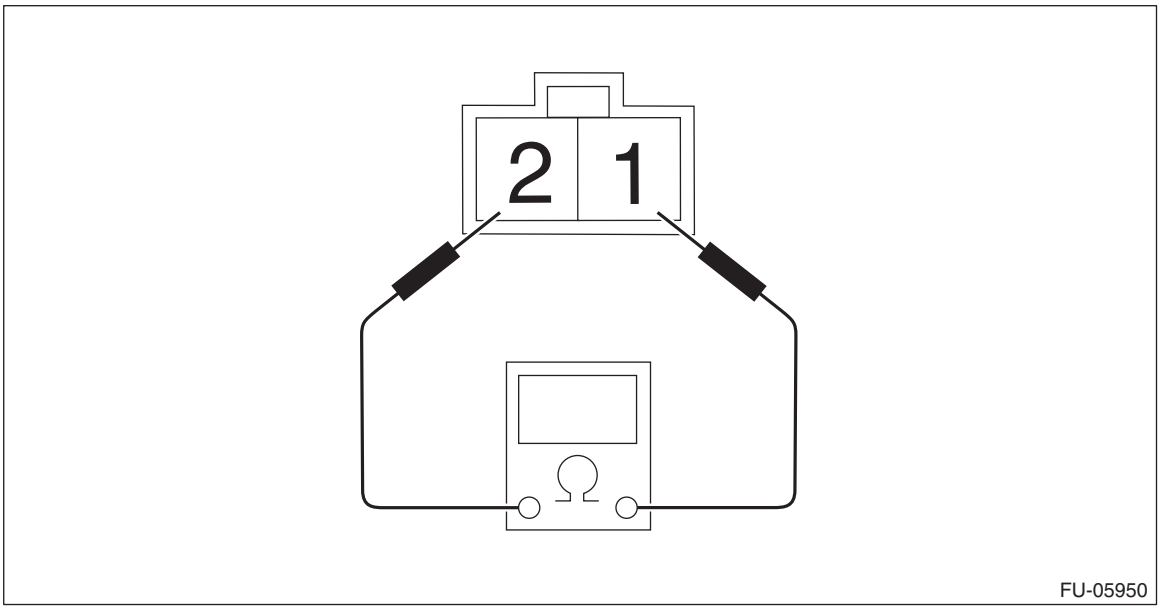
Install in the reverse order of removal.

NOTE:
- Use new O-rings.
- Apply engine oil to O-ring.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

C: INSPECTION

1) Check that the oil control solenoid has no deformation, cracks or other damages.
2) Measure the resistance between the oil control solenoid terminals.

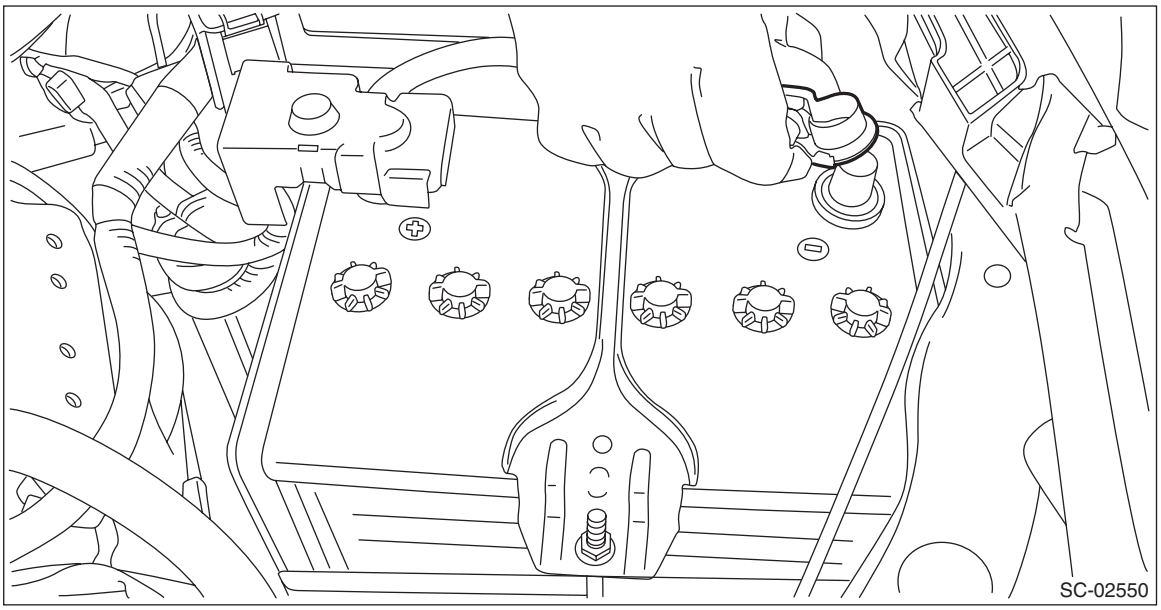


Terminal No.	Standard
1 and 2	7.25±0.4 Ω (when 20°C (68°F))

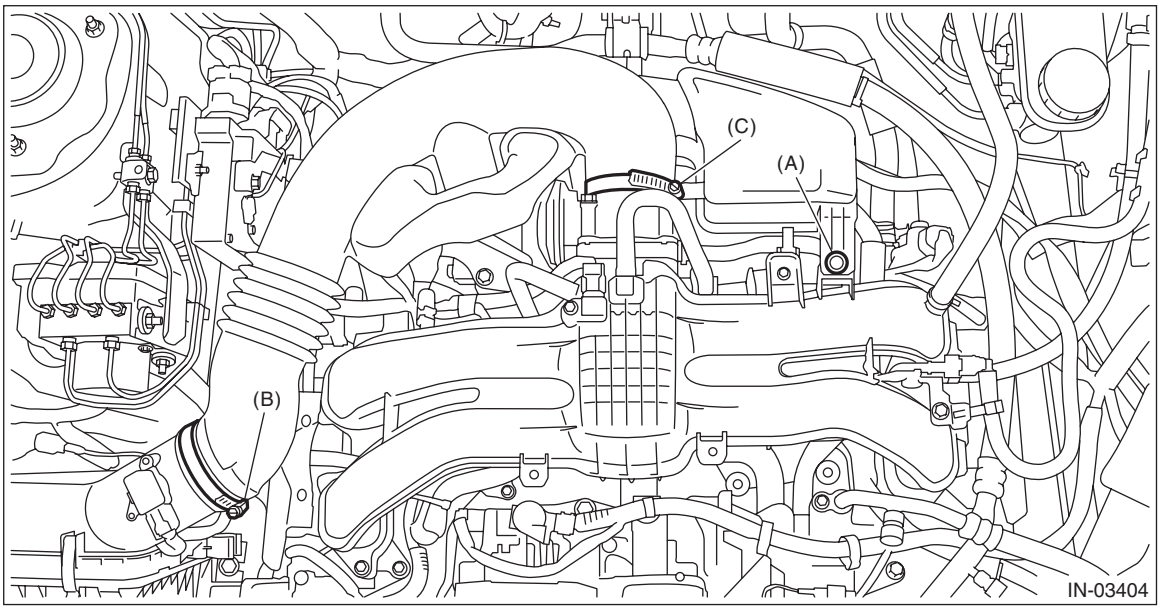
11.Knock Sensor

A: REMOVAL

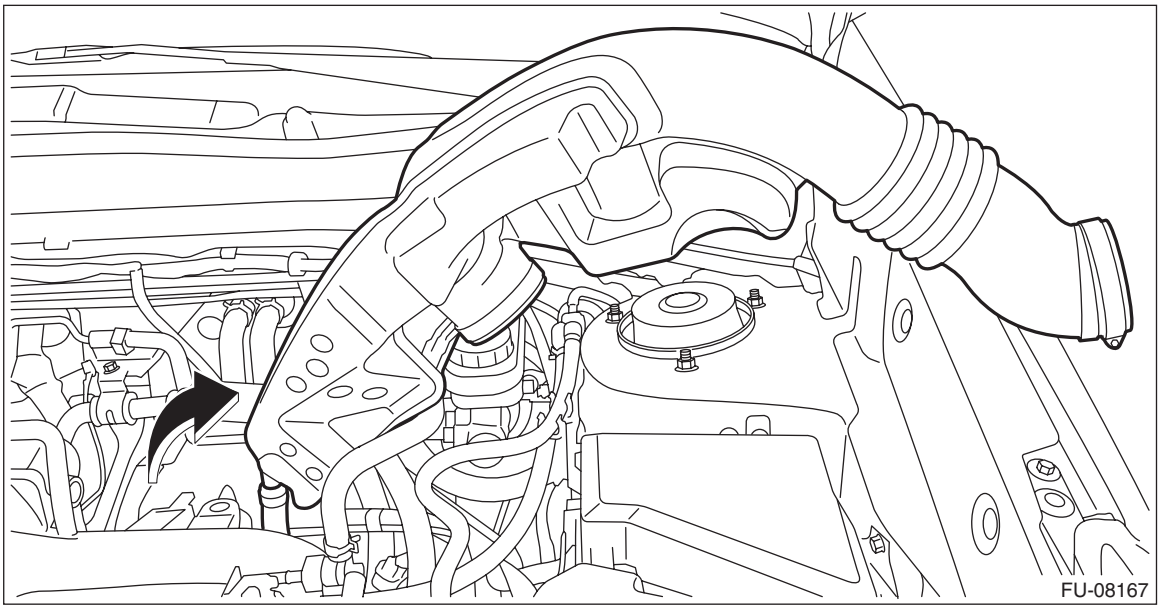
1) Disconnect the ground cable from battery.



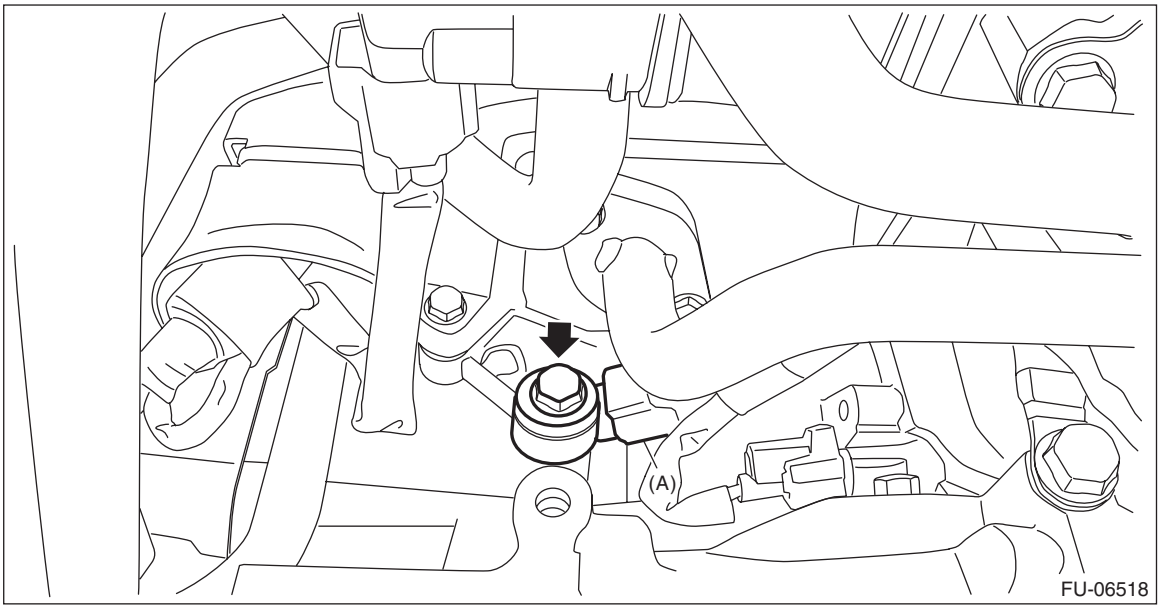
2) Remove the clip (A), and loosen the clamps (B) and (C) securing the air intake boot.



3) Remove the air intake boot from the air cleaner case (rear) and throttle body, and move it to the left side wheel apron.



4) Disconnect the connector (A) from the knock sensor, and remove the knock sensor from the cylinder block.

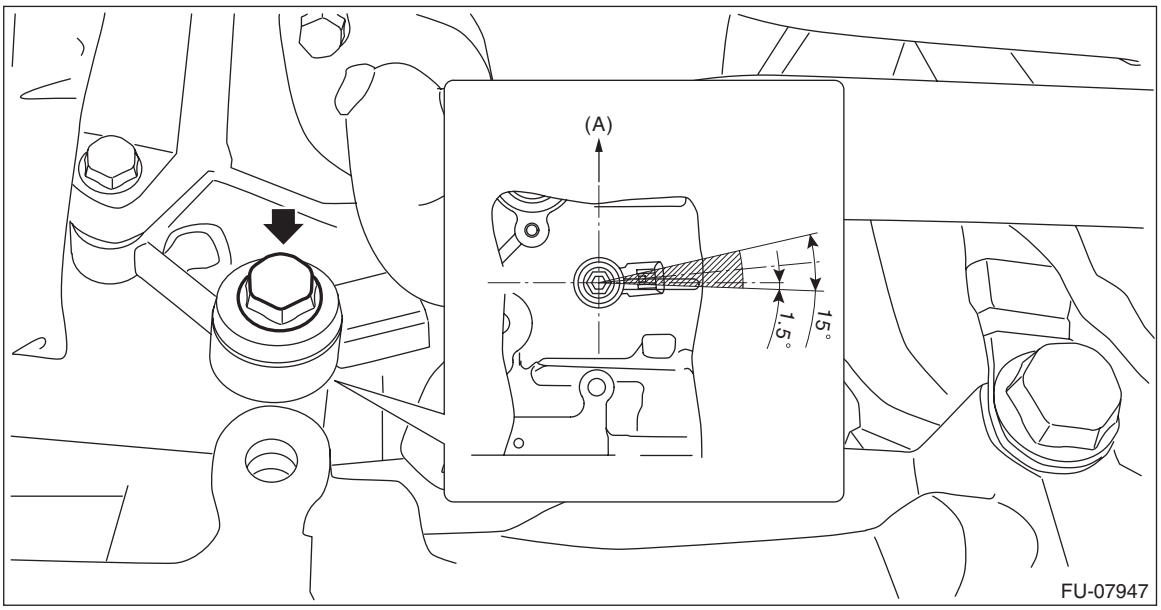


B: INSTALLATION

1) Install the knock sensor to the cylinder block.

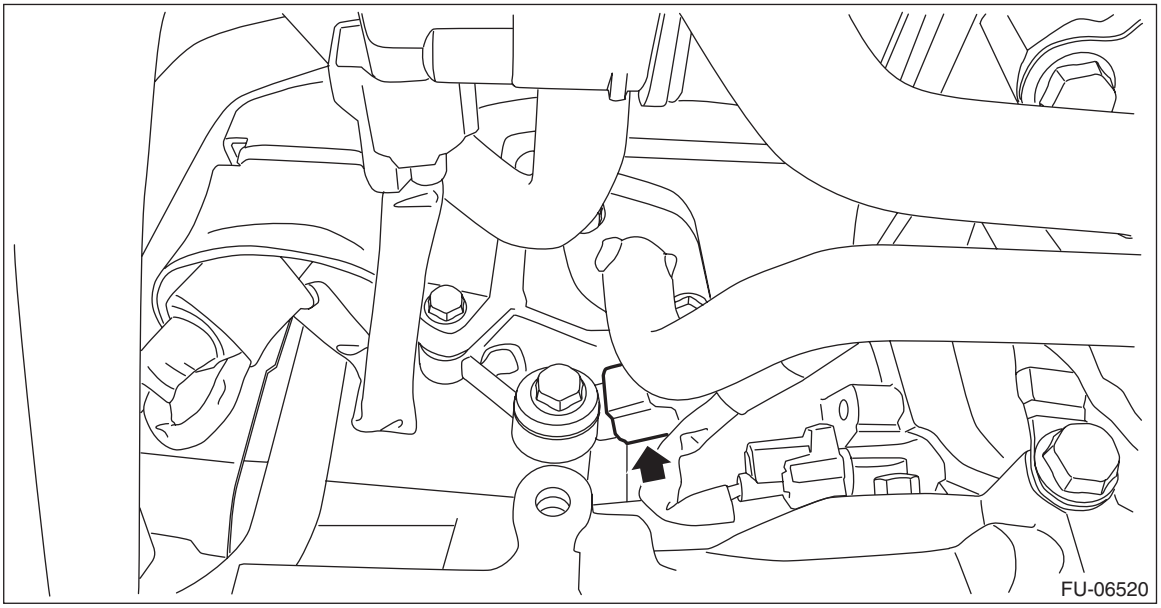
NOTE:
The knock sensor should be installed so that the center of the connector is positioned at a 76.5 — 91.5° angle relative to the front of engine.

Tightening torque:
24 N·m (2.4 kgf-m, 17.7 ft-lb)



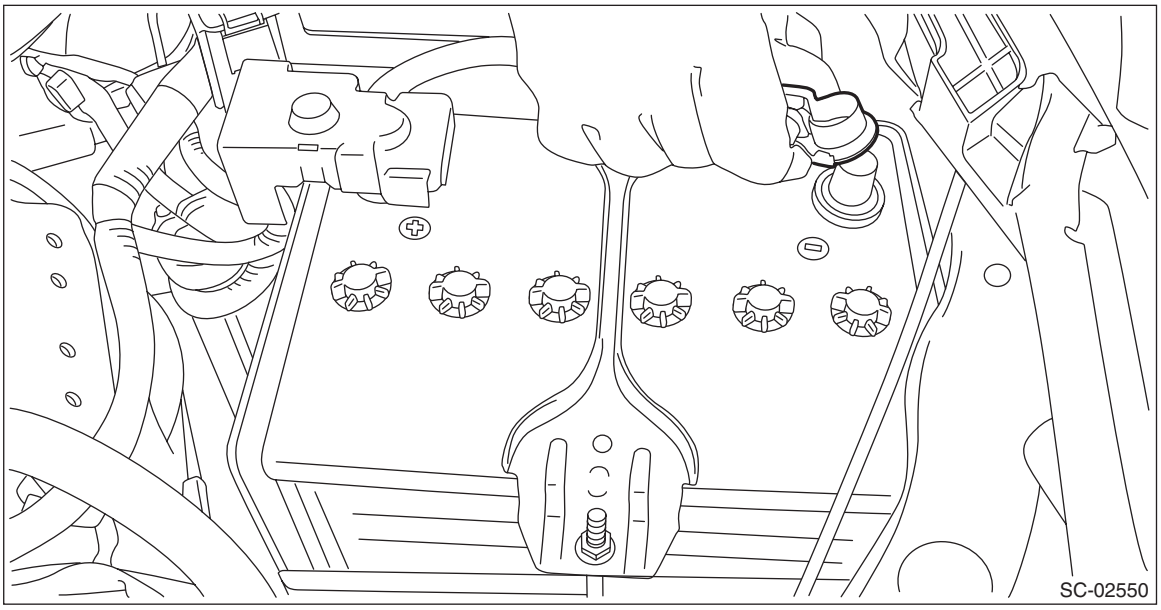
(A) Front of engine

2) Connect the connector to the knock sensor.



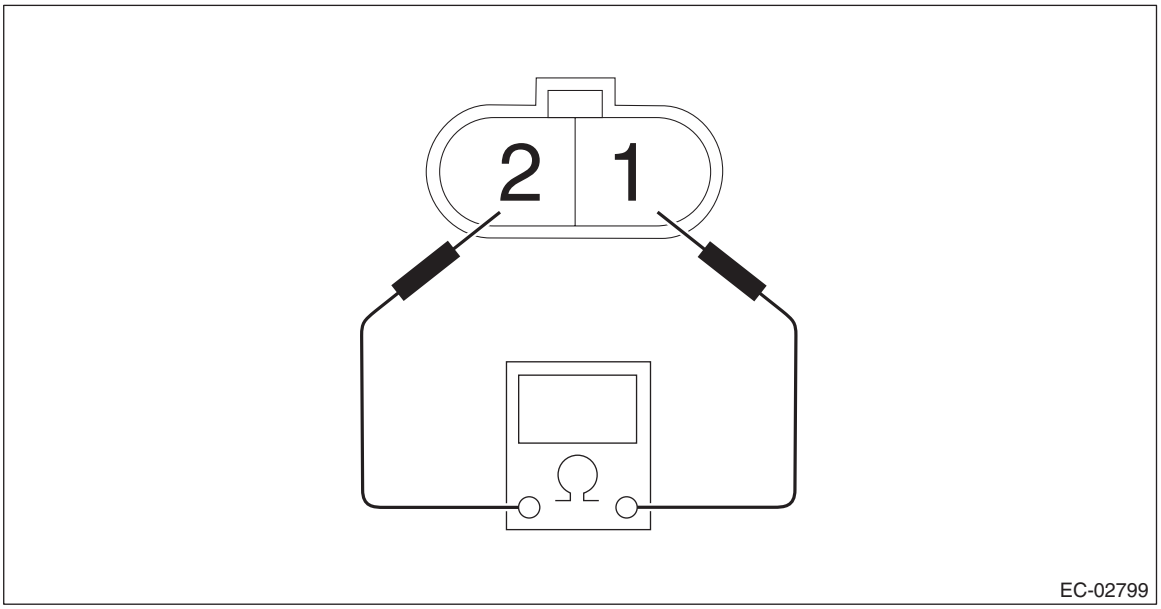
3) Install the air intake boot. <Ref. to IN(H4DO(w/o HEV))-12, INSTALLATION, Air Intake Boot.>

4) Connect the battery ground terminal.



C: INSPECTION

1) Check that the knock sensor has no deformation, cracks or other damages.
2) Measure the resistance between knock sensor terminals.



Terminal No.	Standard
1 and 2	560±28 kΩ

12.Throttle Position Sensor

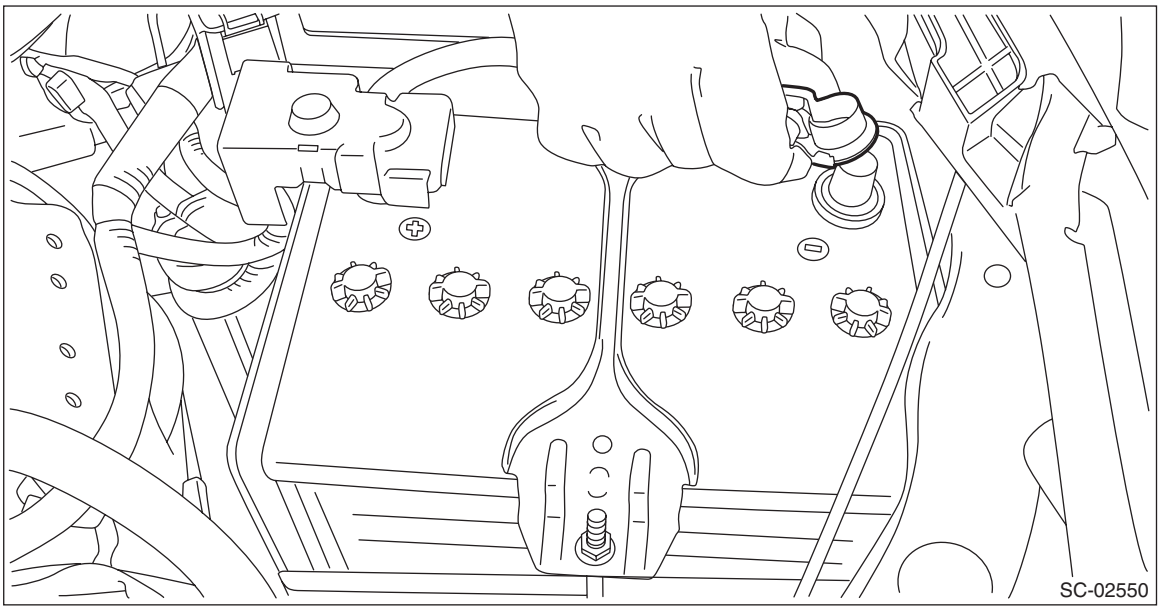
A: SPECIFICATION

Throttle body is a non-disassembled part, so do not remove the throttle position sensor from throttle body. Refer to “Throttle Body” for removal and installation procedure. <Ref. to FU(H4DO(w/o HEV))-14, REMOVAL, Throttle Body.> <Ref. to FU(H4DO(w/o HEV))-16, INSTALLATION, Throttle Body.>

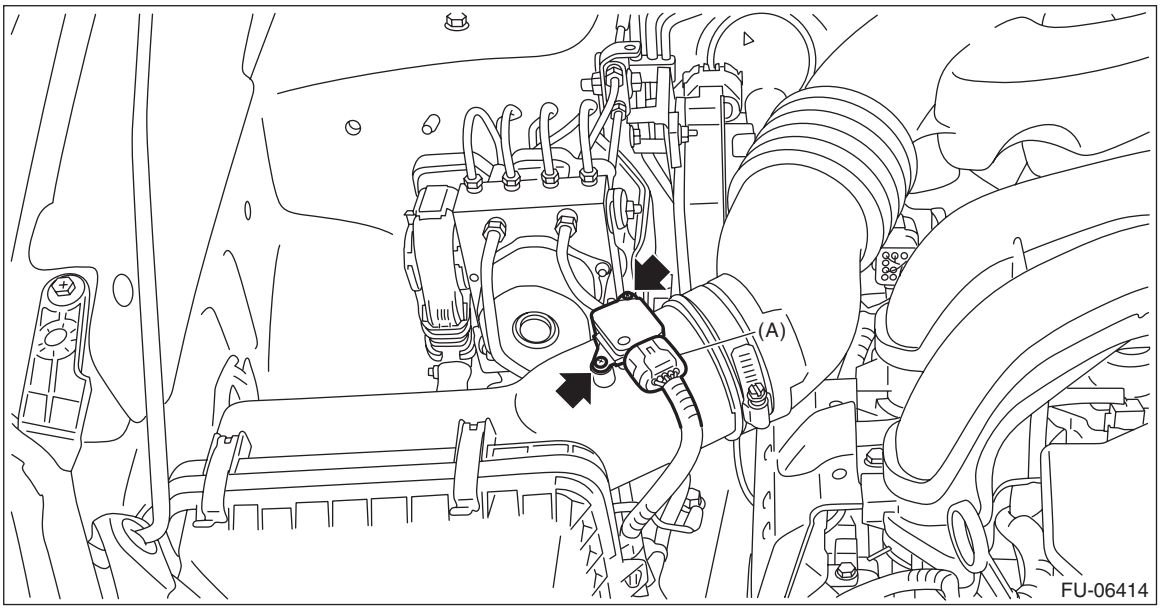
13.Mass Air Flow and Intake Air Temperature Sensor

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Disconnect the connector (A) from the mass air flow and intake air temperature sensor, and remove the mass air flow and intake air temperature sensor.



B: INSTALLATION

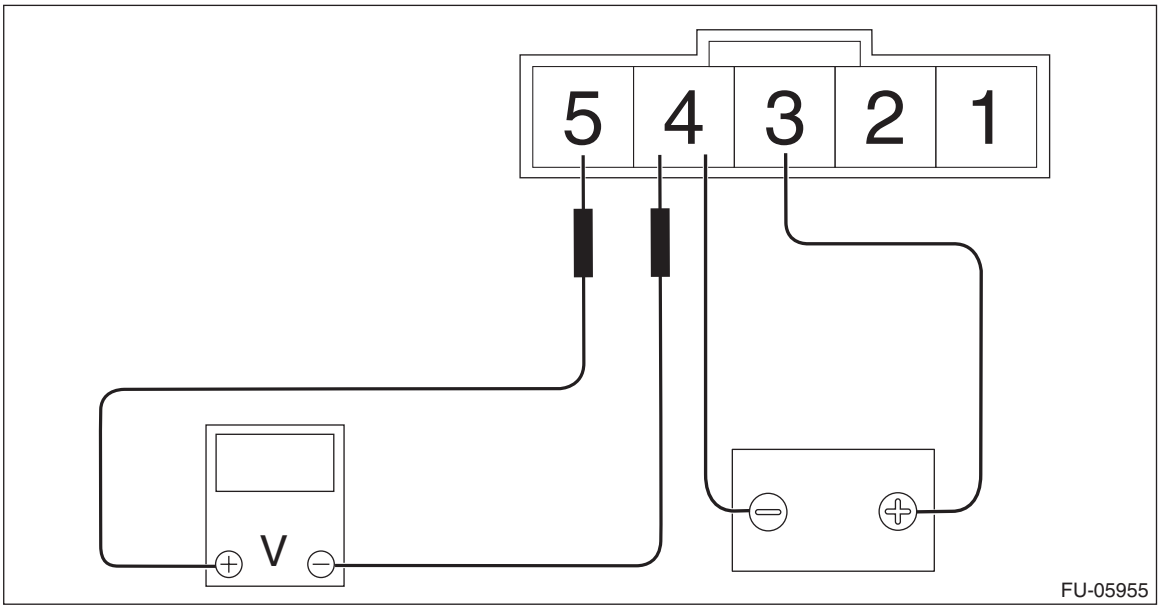
Install in the reverse order of removal.

Tightening torque:
1 N·m (0.1 kgf-m, 0.7 ft-lb)

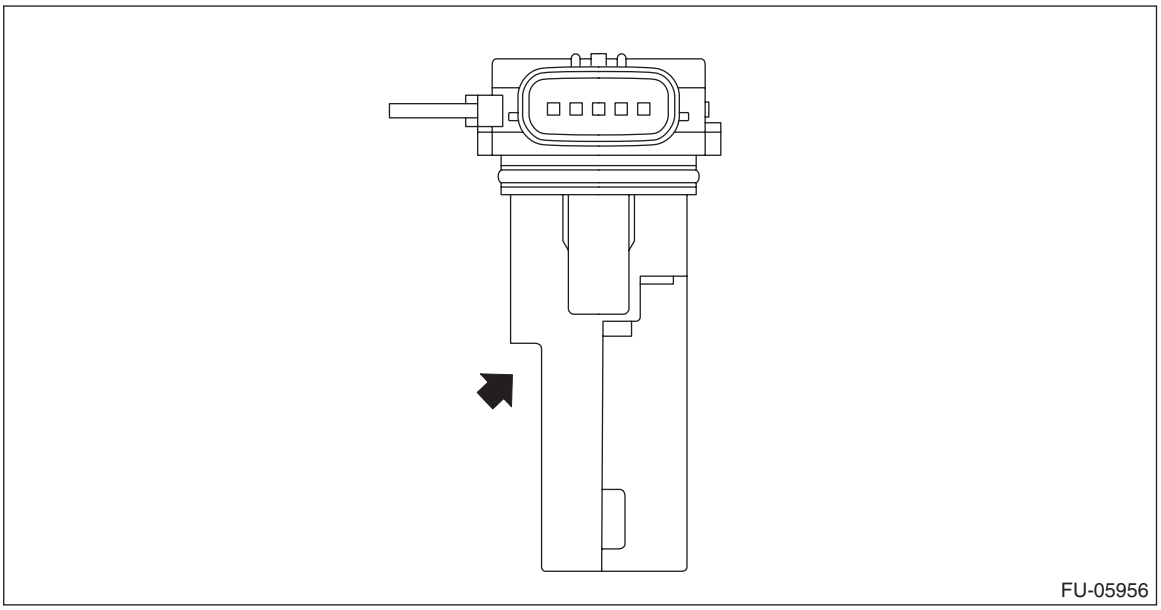
C: INSPECTION

1. CHECK THE MASS AIR FLOW SENSOR UNIT

1) Connect the battery positive terminal to terminal No. 3 and the battery ground terminal to terminal No. 4, the circuit tester positive terminal to terminal No. 5 and the circuit tester ground terminal to terminal No. 4.

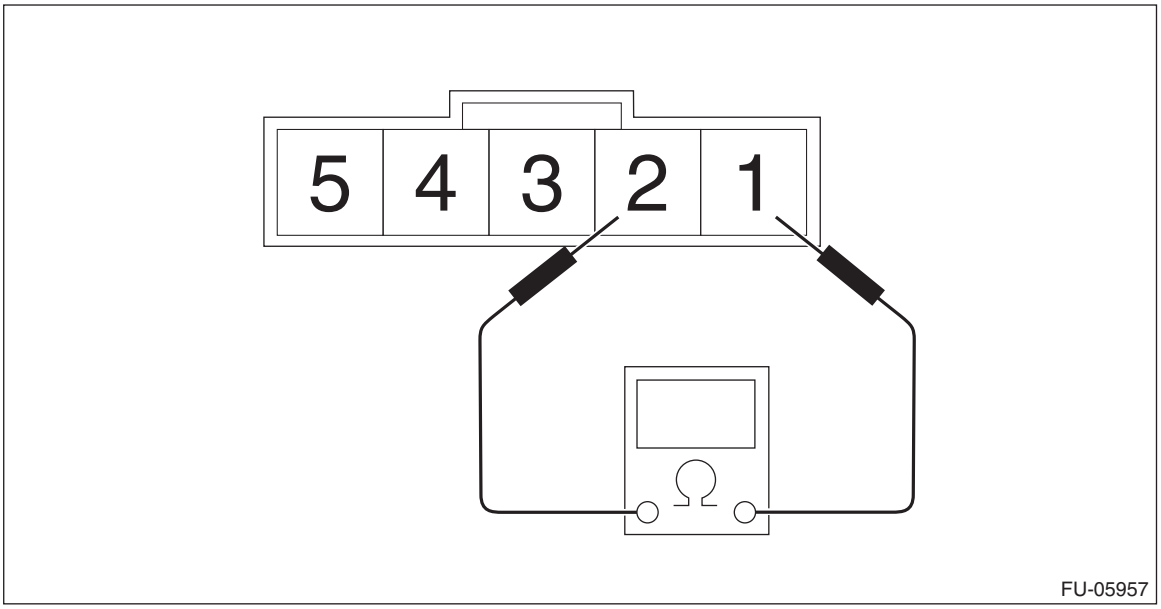


2) Check the voltage changes when air is blown to the mass air flow sensor unit in arrow direction.



2. CHECK THE INTAKE AIR TEMPERATURE SENSOR UNIT

Measure the resistance between intake air temperature sensor terminals.



Temperature	Terminal No.	Standard
–20°C (–4°F)	1 and 2	16.0±2.4 kΩ
20°C (68°F)		2.45±0.24 kΩ
60°C (140°F)		0.58±0.087 kΩ

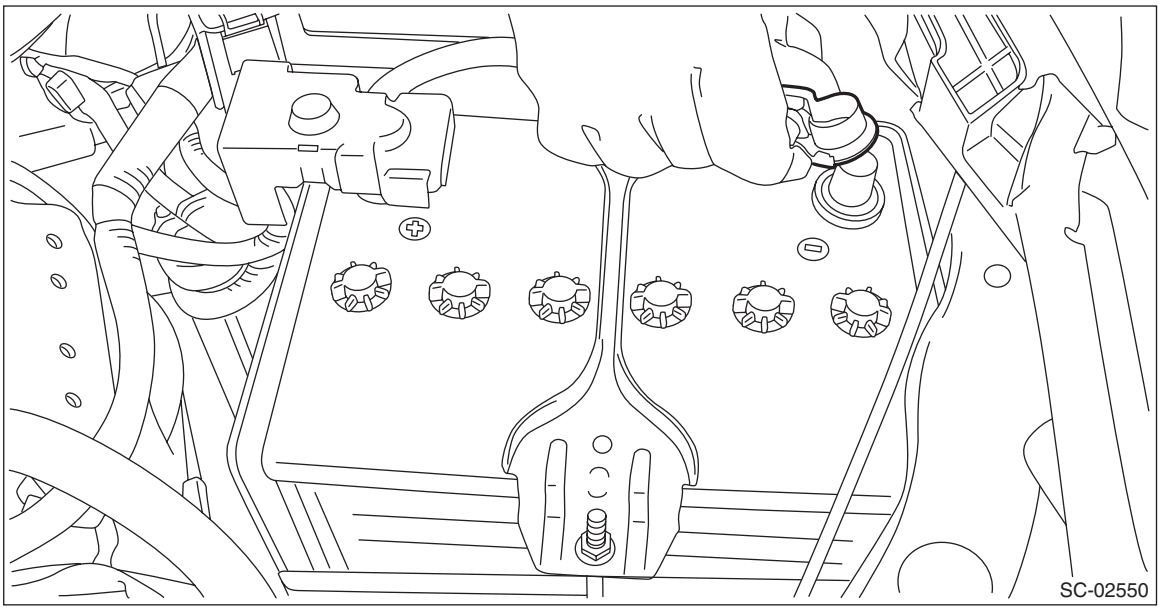
3. OTHER INSPECTIONS

1) Check that the mass air flow and intake air temperature sensor has no deformation, cracks or other damages.
2) Check that the mass air flow and intake air temperature sensor has no dirt.

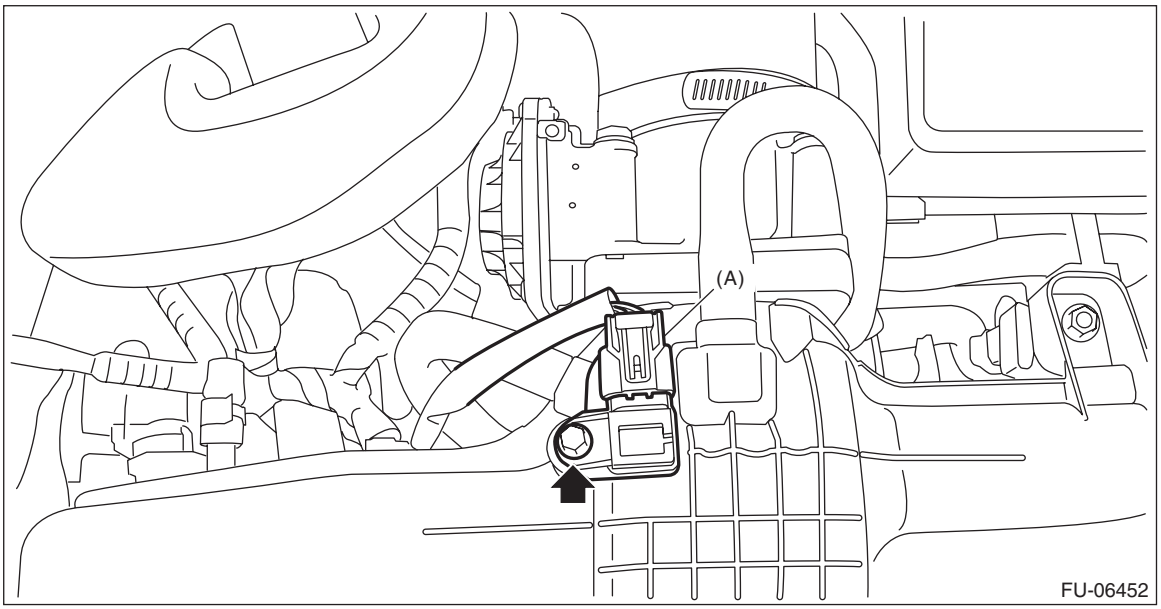
14.Manifold Absolute Pressure Sensor

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Disconnect the connector (A) from the manifold absolute pressure sensor, and remove the manifold absolute pressure sensor from intake manifold.



B: INSTALLATION

Install in the reverse order of removal.

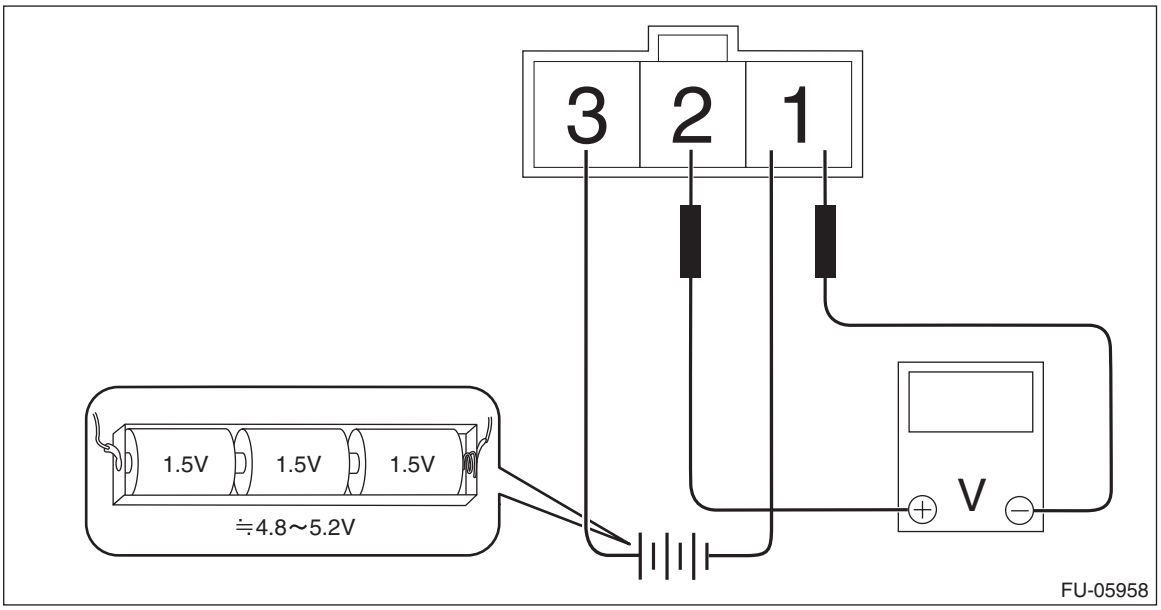
NOTE:
Use new O-rings.

Tightening torque:
3.4 N·m (0.3 kgf-m, 2.5 ft-lb)

C: INSPECTION

1) Check that the manifold absolute pressure sensor has no deformation, cracks or other damages.
2) Connect dry-cell battery positive terminal to terminal No. 3 and dry-cell battery ground terminal to terminal No. 1, circuit tester positive terminal to terminal No. 2 and the circuit tester negative terminal to terminal No. 1.

NOTE:
- Use new dry-cell batteries.
- Using circuit tester, check the voltage of a single dry-cell battery is 1.6 V or more. And also check the voltage of three batteries in series is between 4.8 V and 5.2 V.
- For power supply, 5 V DC voltage source can also be used.

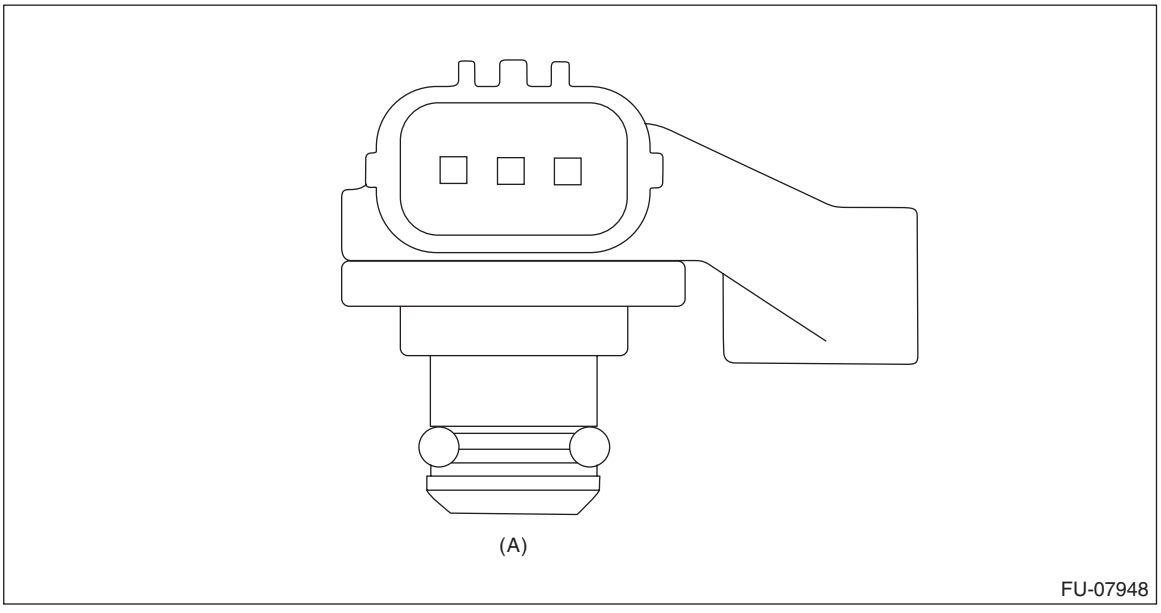


3) Check the voltage at a normal atmospheric pressure.

NOTE:
The atmospheric pressure at higher altitude is lower than normal. Therefore, the voltage is lower than the standard value.

Terminal No.	Standard
2 (+) and 1 (–)	Approx. 4.2 V (when 25°C (77°F))

4) Connect the Mighty Vac to the pressure port (A) of manifold absolute pressure sensor.



5) Check the voltage when generating vacuum using Mighty Vac.

CAUTION:
Do not apply vacuum of less than –88 kPa (–0.9 kg/cm^2, –12.8 psi). Doing so may damage the manifold absolute pressure sensor.

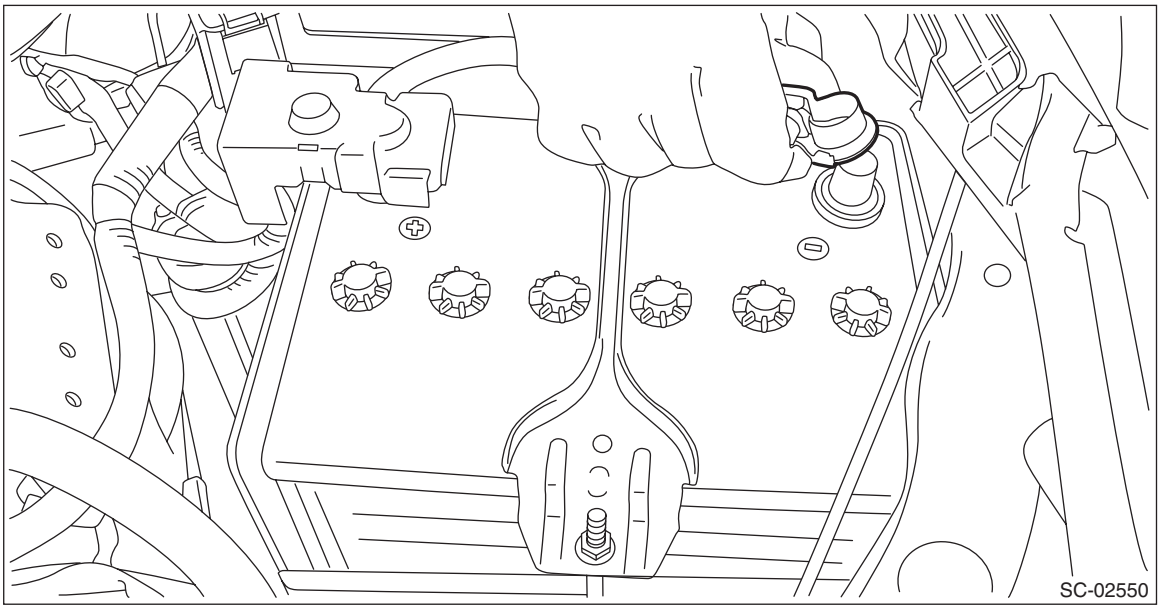
NOTE:
When vacuum occurs at the pressure port of manifold absolute pressure sensor, the voltage will drop from the value as in step 3).

Pressure	Terminal No.	Standard
–88 kPa (–0.9 kg/cm^2, –12.8 psi)	2 (+) and 1 (–)	Approx. 1 V (when 25°C (77°F))

15.Fuel Injector

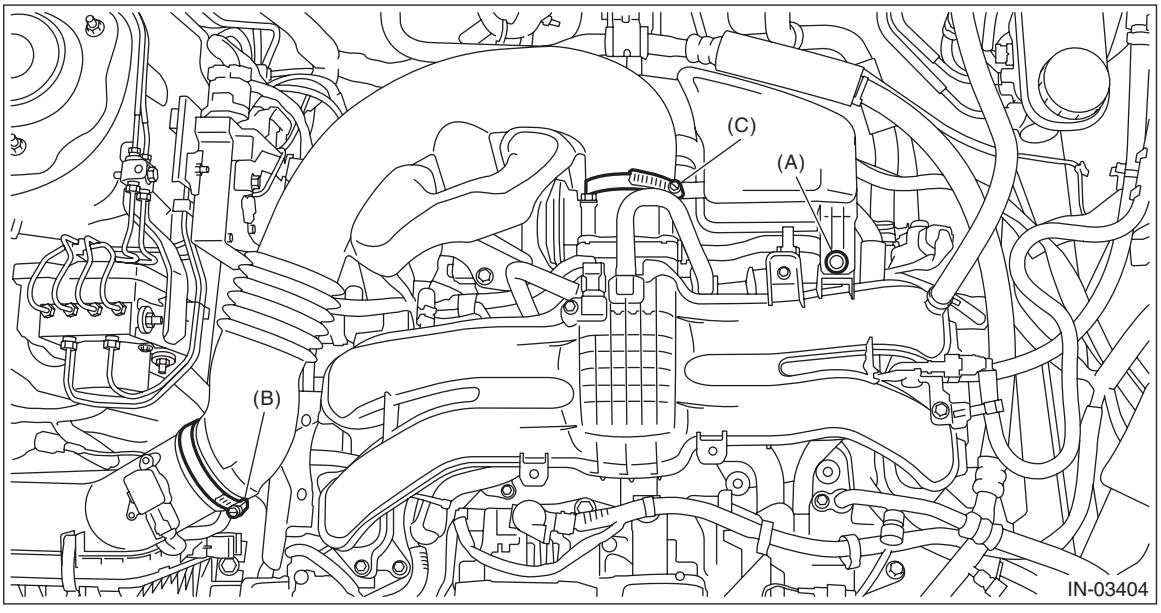
A: REMOVAL

1) Release the fuel pressure. <Ref. to FU(H4DO(w/o HEV))-109, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Disconnect the ground cable from battery.

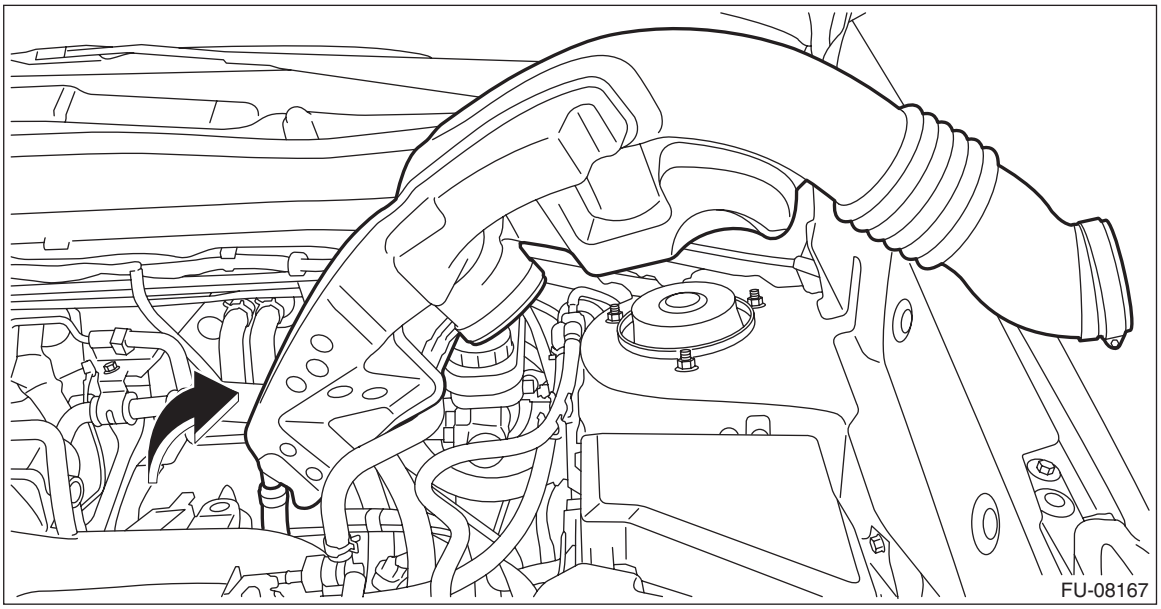


3) Open the fuel filler lid and remove the fuel filler cap.

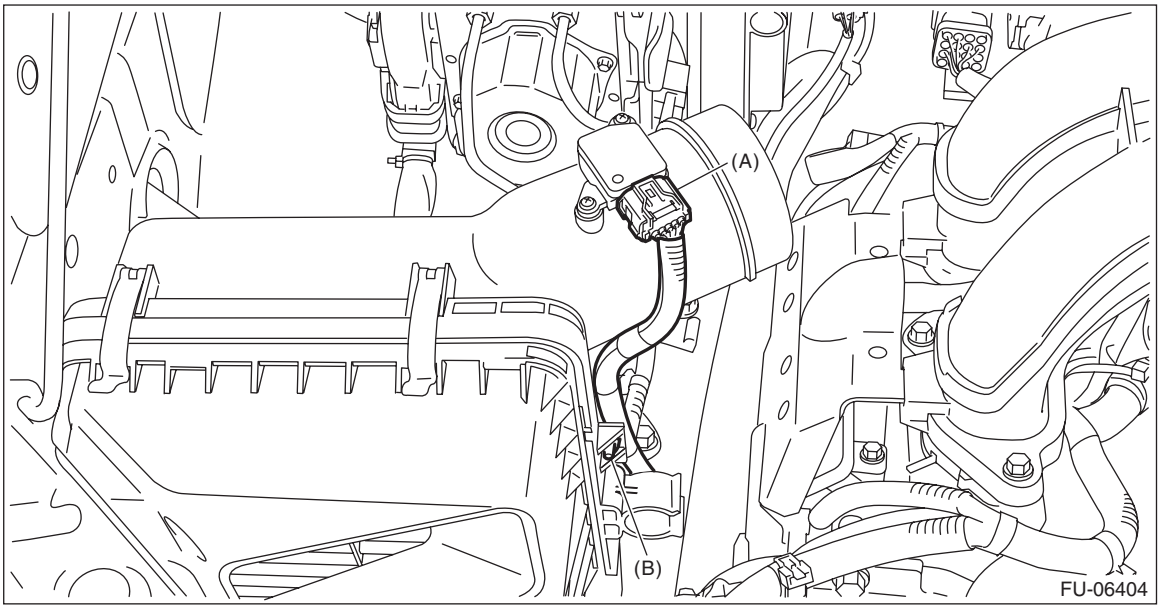
NOTE:
This operation is required to release the inner pressure of the fuel tank.
4) Remove the clip (A), and loosen the clamps (B) and (C) securing the air intake boot. (RH side only)



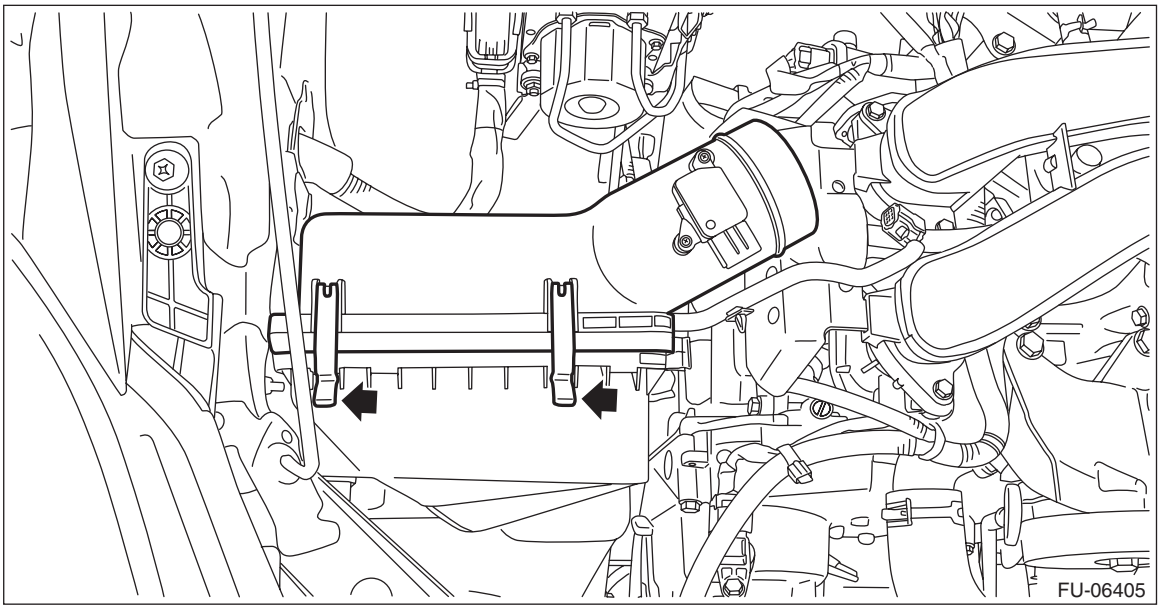
5) Remove the air intake boot from the air cleaner case (rear) and throttle body, and move it to the left side wheel apron. (RH side only)



6) Disconnect the connector (A) from the mass air flow and intake air temperature sensor, and remove the clip (B) which holds the mass air flow and intake air temperature sensor harness. (RH side only)

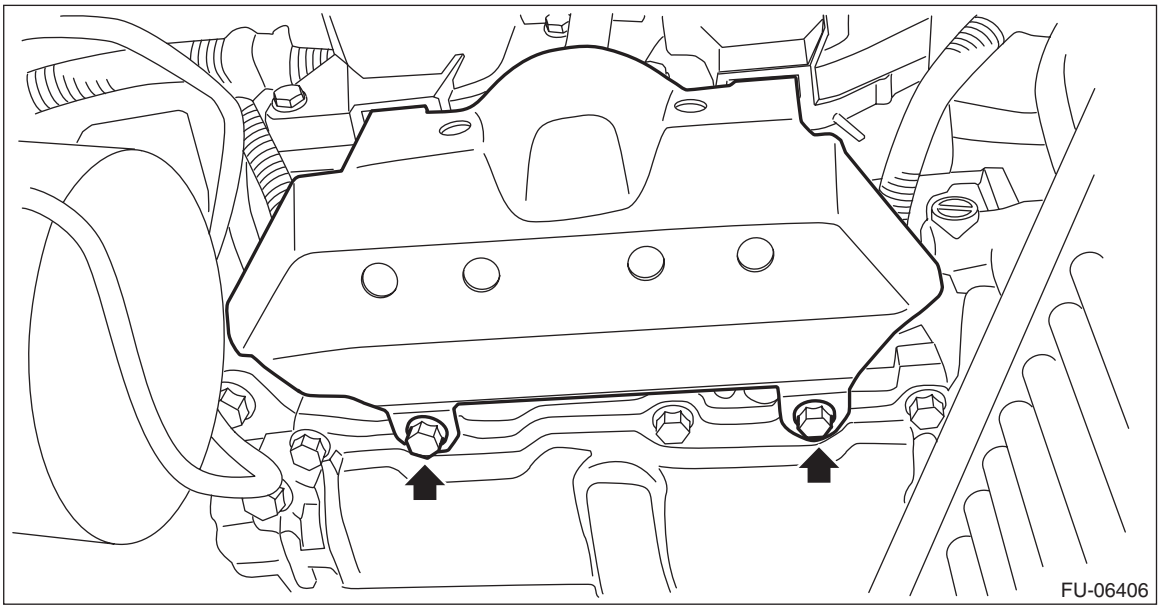


7) Remove the air cleaner case (rear). (RH side only)

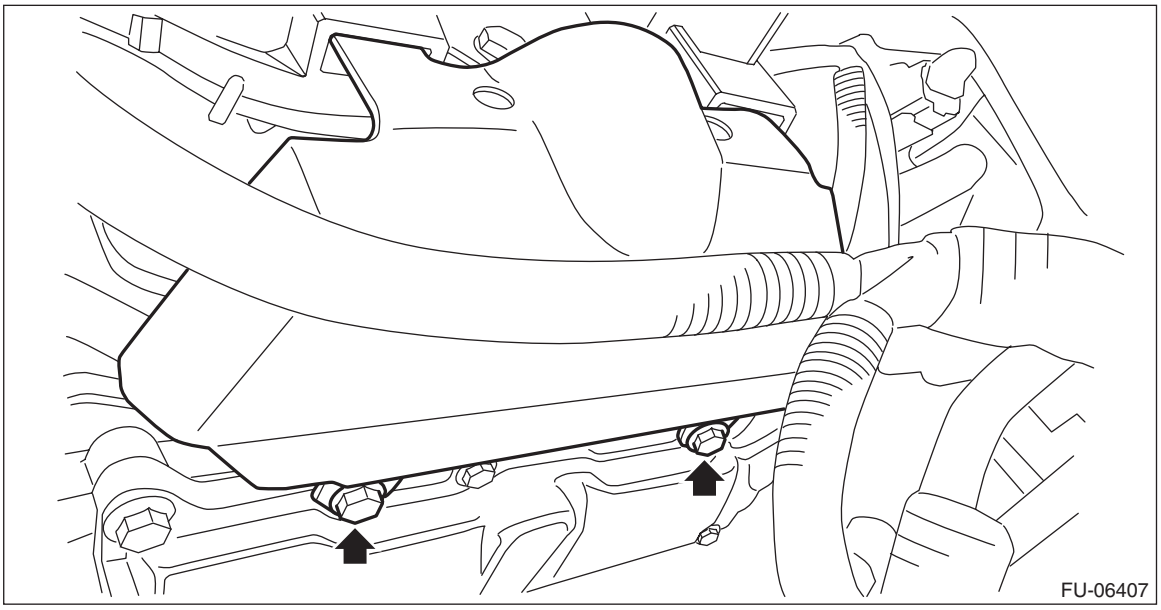


8) Remove the intake manifold protector.

- RH side



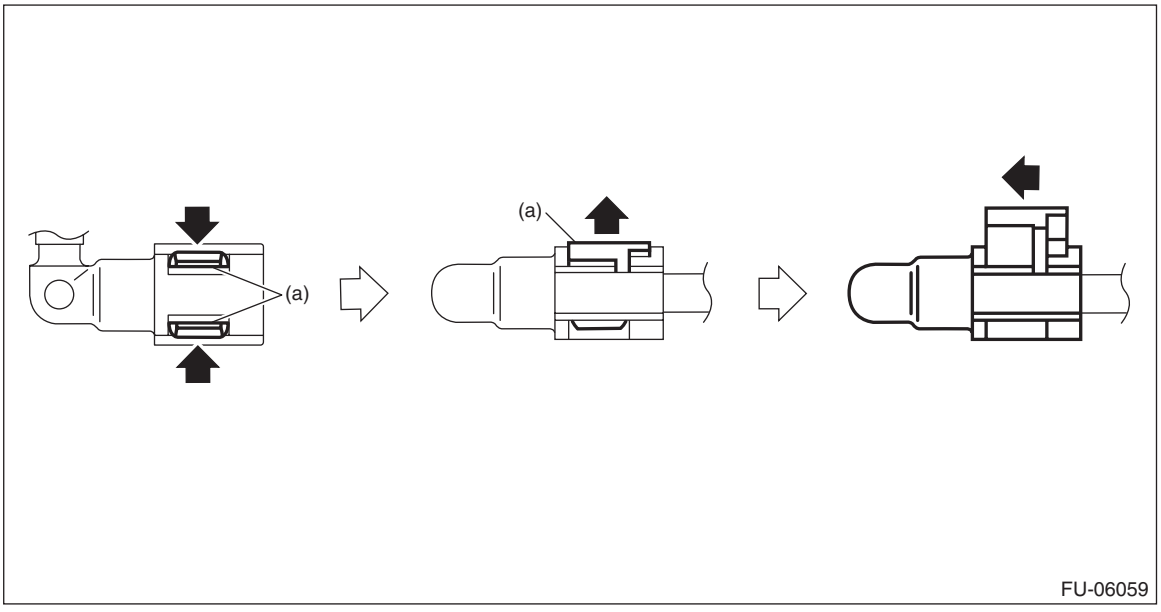
- LH side



9) Disconnect the connectors (A) from fuel injector.
10) Disconnect the quick connector (B) of the fuel delivery pipe from the fuel pipe.

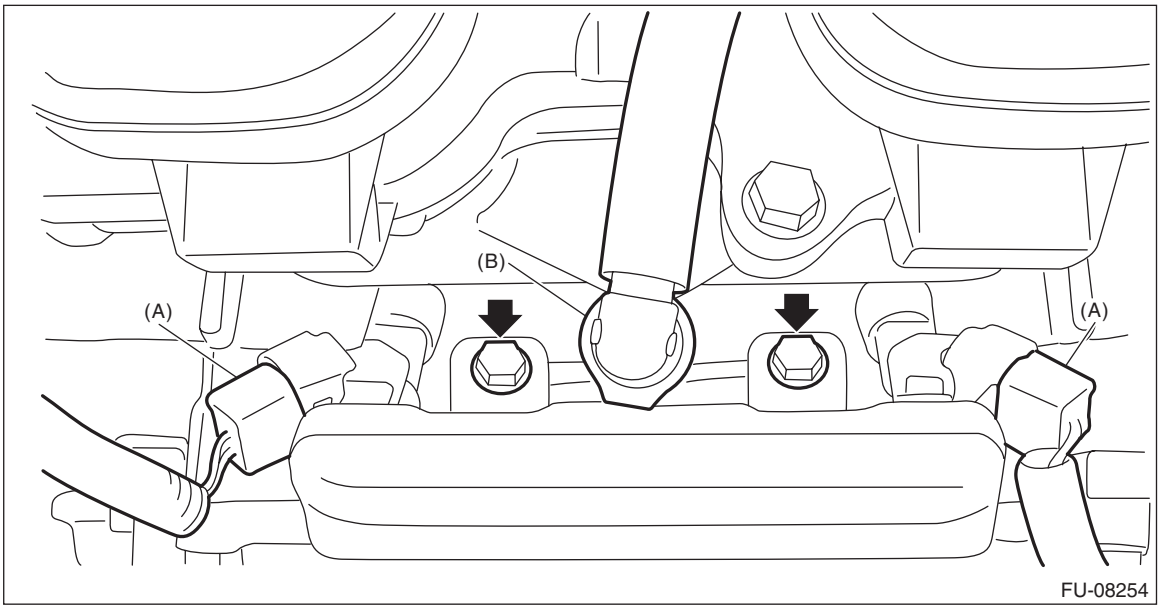
CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from the pipes using a container or cloth.**

NOTE:
Disconnect the quick connector as shown in the figure.

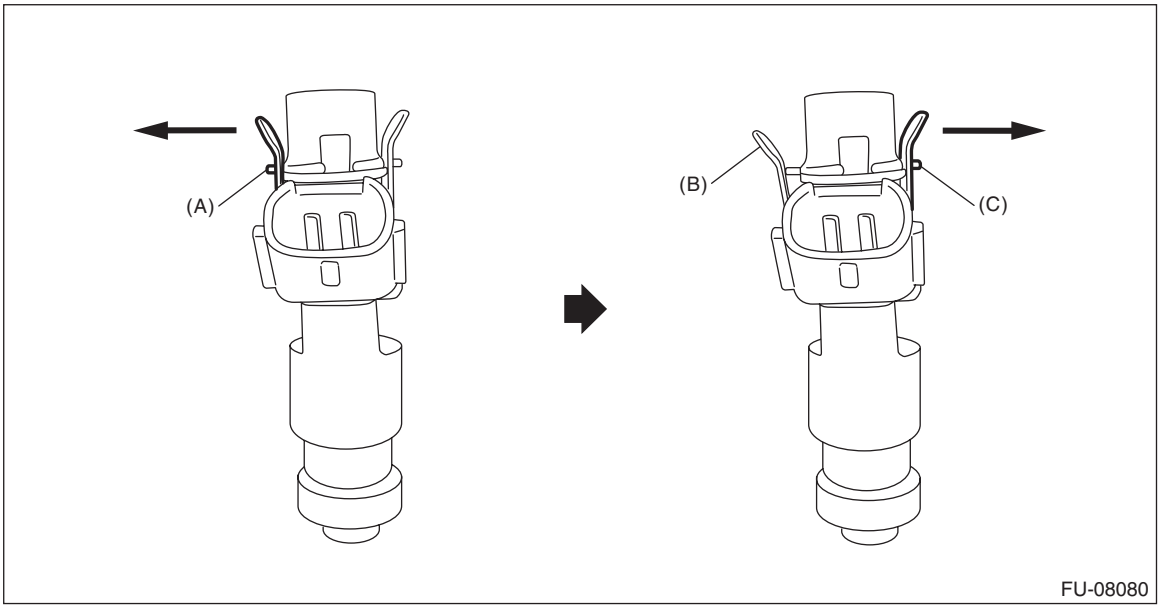


(a) Slider

11) Remove the bolts which hold fuel pipe onto the cam carrier, and remove the fuel pipe together with the fuel injector.



12) Remove the fuel injector from the fuel pipe.
(1) Remove the fuel injector holder from one side of flange section (A) of the fuel pipe.
(2) While holding one side of fuel injector holder (B) you removed in step (1) by finger, remove the other side of fuel injector holder from the flange section (C) of the fuel pipe.

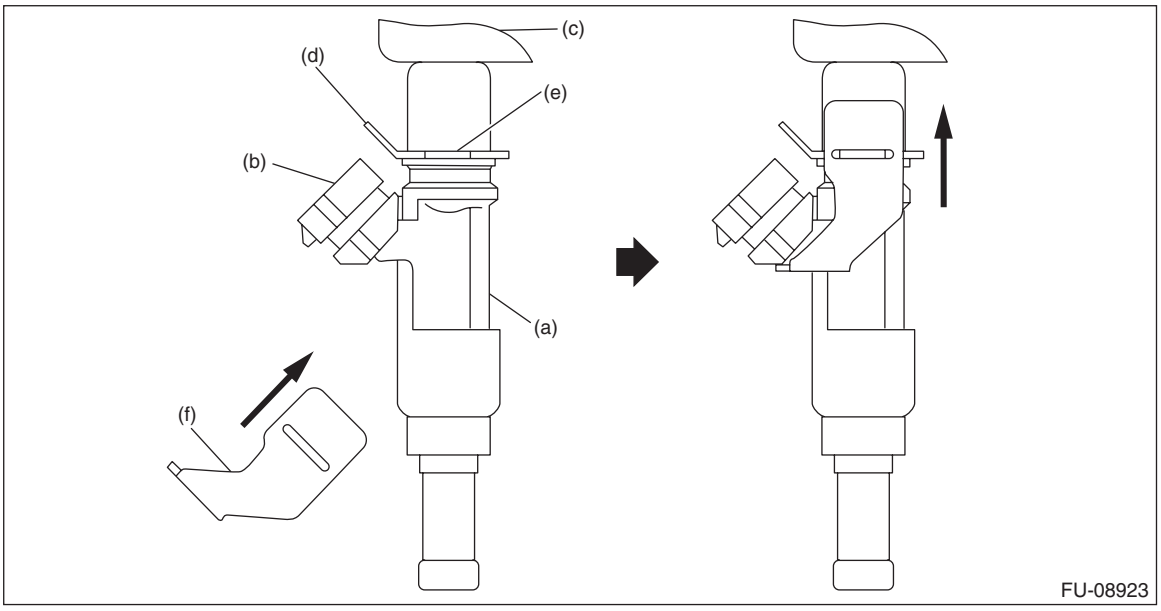


(3) Remove the fuel injector holder from the fuel pipe and fuel injector, and remove the fuel injector from the fuel pipe.
(4) Remove the fuel injector on the LH side in the same manner.

B: INSTALLATION

Install in the reverse order of removal.

NOTE:
- Use new fuel injector holder, O-rings, rubbers and seal rings.
- Install the fuel injector so that the connector joint faces the connector rotation stopper side of the fuel pipe.
- Securely put the flange section of fuel pipe into the groove of fuel injector holder.

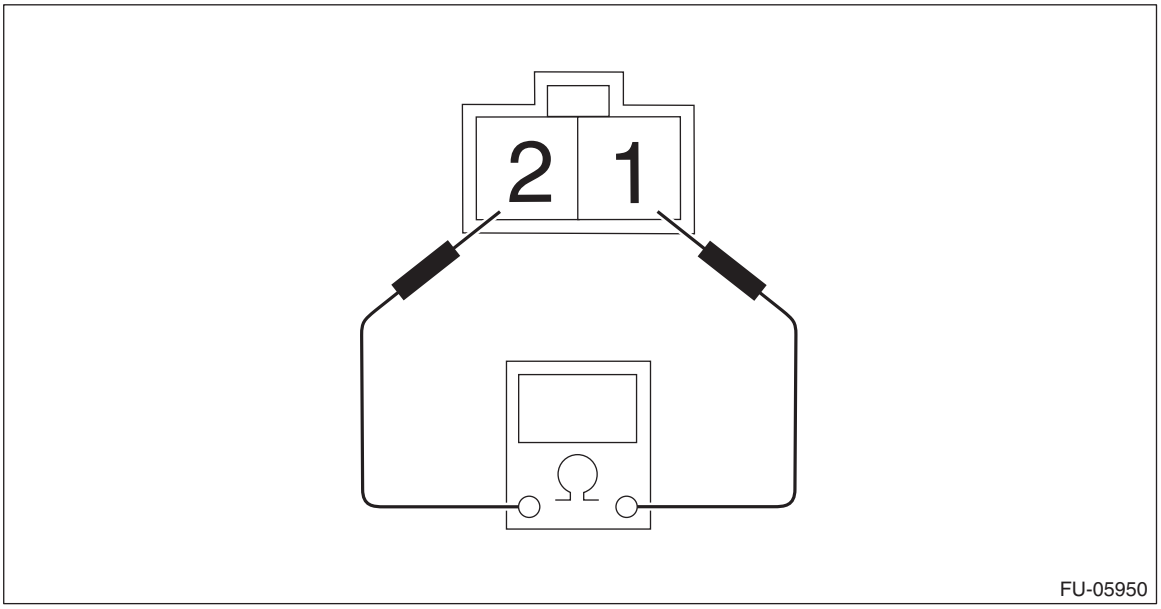


(a)	Fuel injector	(b)	Connector joint	(c)	Fuel pipe
(d)	Connector rotation stopper	(e)	Flange section	(f)	Fuel injector holder

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

C: INSPECTION

1) Check that the fuel injector has no deformation, cracks or other damages.
2) Measure the resistance between fuel injector terminals.

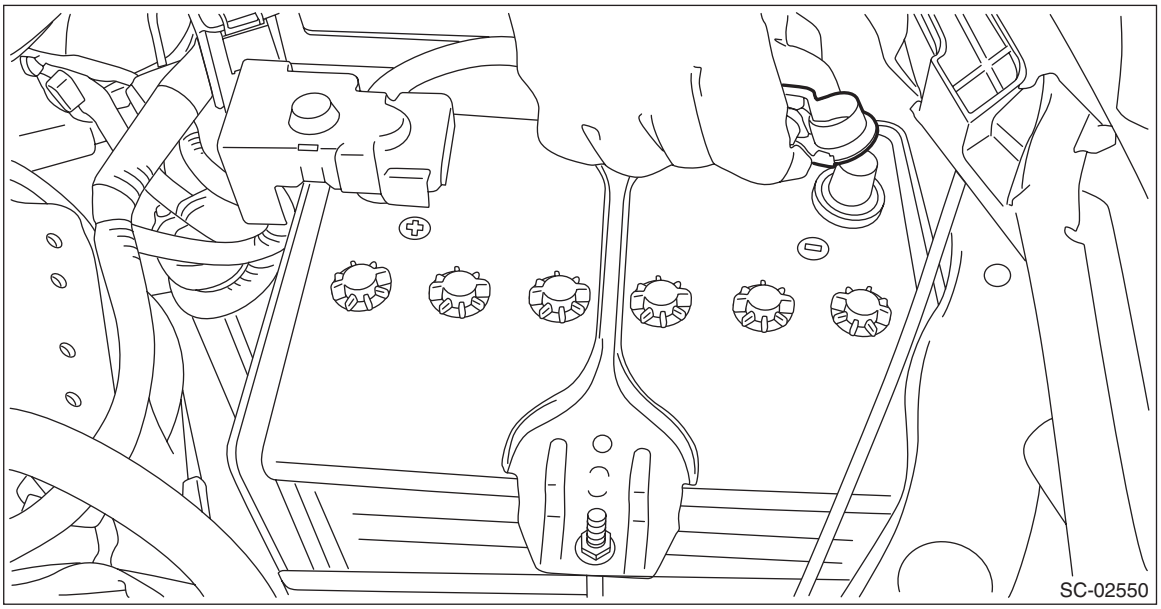


Terminal No.	Standard
1 and 2	Approx. 12.0 Ω (when 20°C (68°F))

16.Tumble Generator Valve Assembly

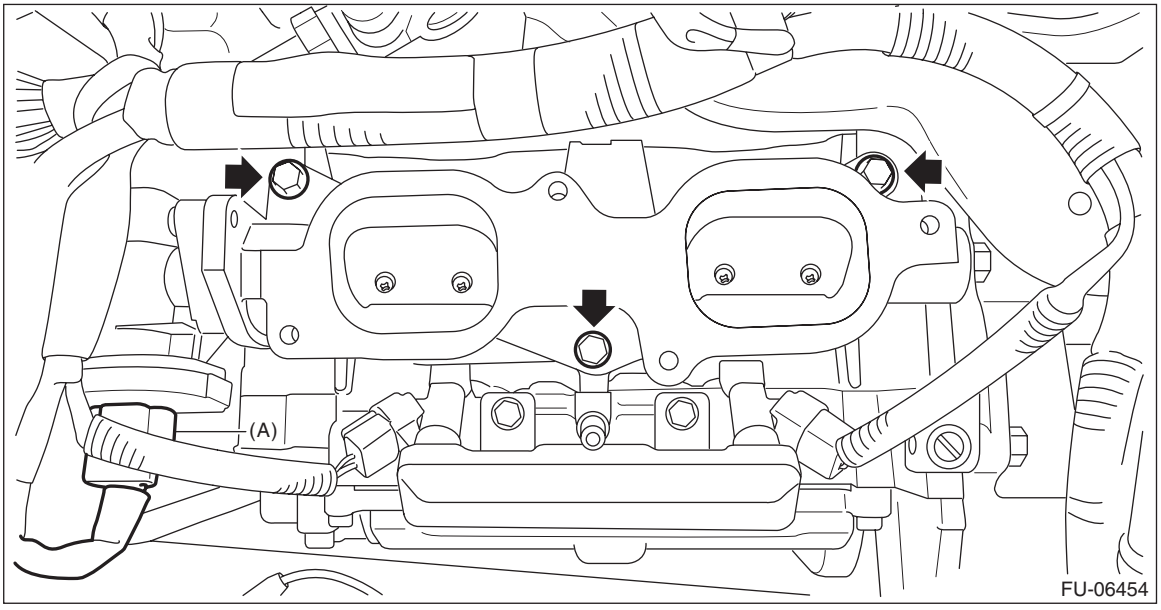
A: REMOVAL

1) Release the fuel pressure. <Ref. to FU(H4DO(w/o HEV))-109, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Disconnect the ground cable from battery.

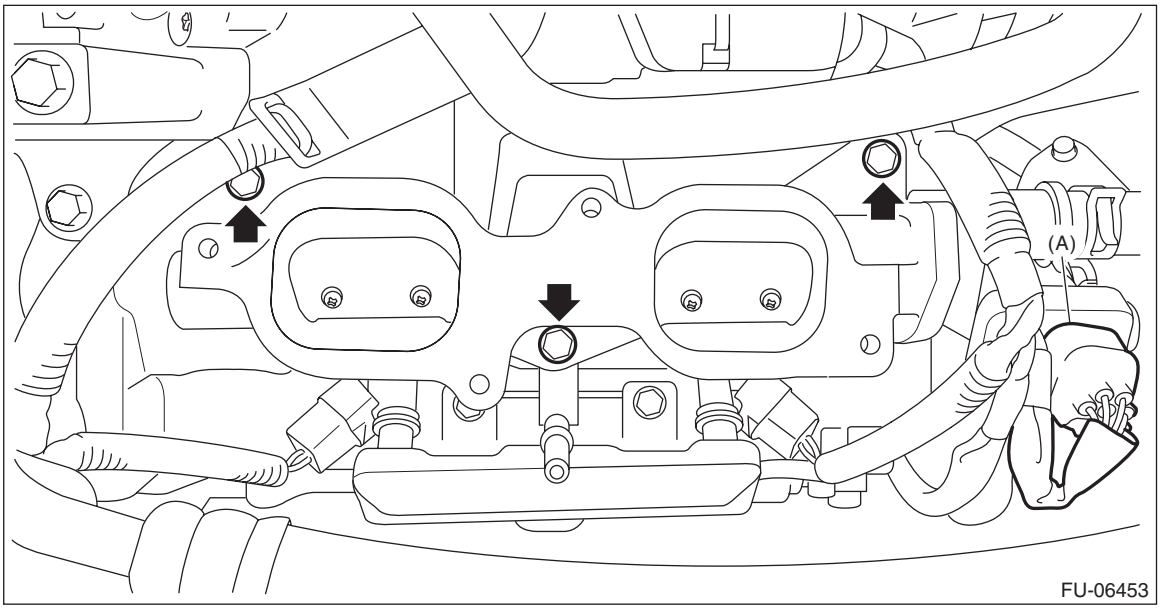


3) Open the fuel filler lid and remove the fuel filler cap.
4) Remove the intake manifold. <Ref. to FU(H4DO(w/o HEV))-19, REMOVAL, Intake Manifold.>
5) Disconnect the connector (A) from the tumble generator valve assembly.
6) Remove the tumble generator valve assembly from the cylinder head.

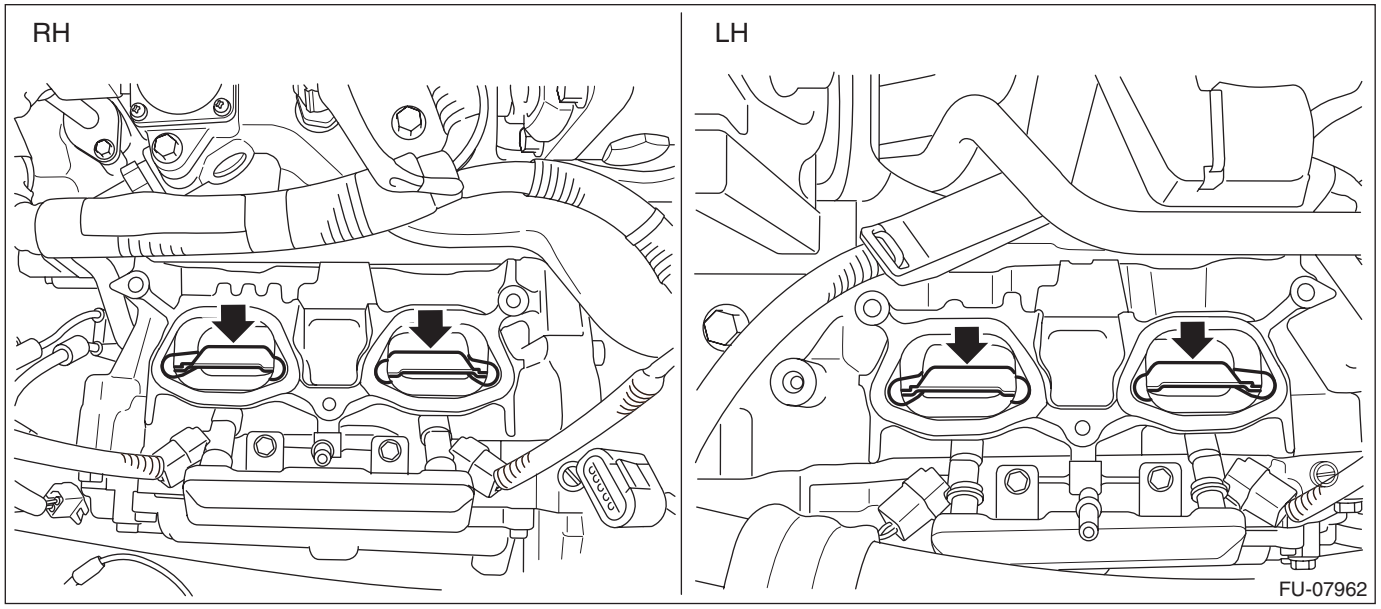
- RH side



- LH side



7) Remove the cylinder head plate from cylinder head.



B: INSTALLATION

Install in the reverse order of removal.

NOTE:
Use a new gasket.

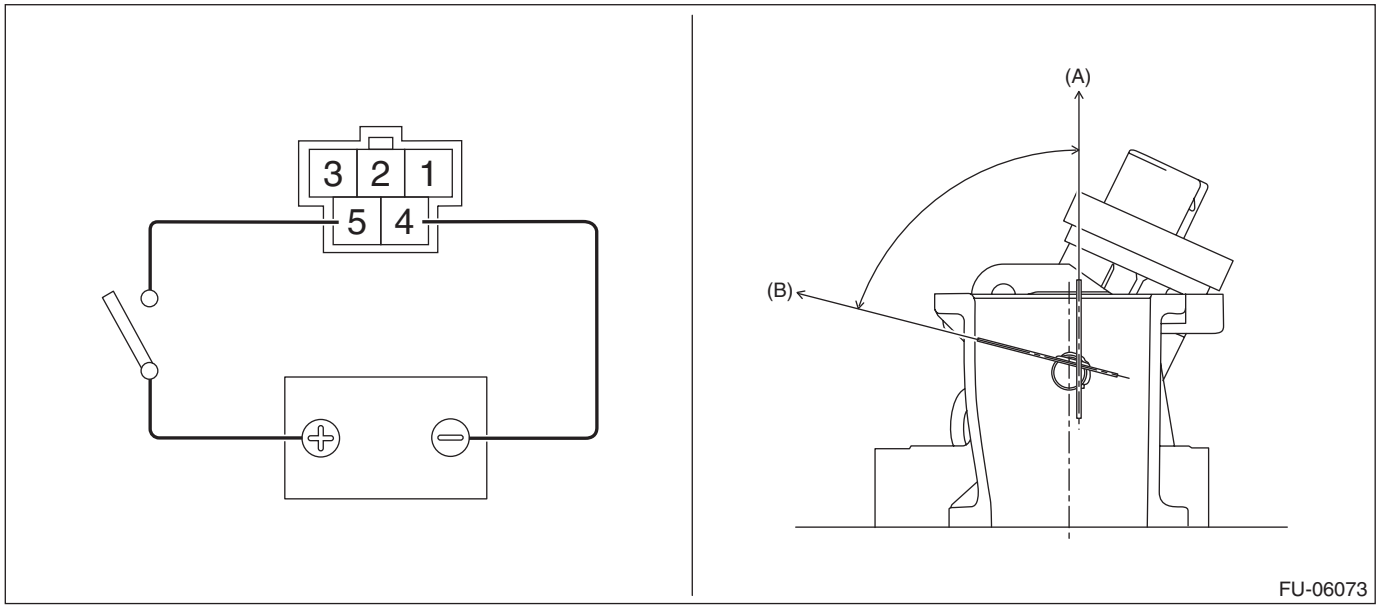
Tightening torque:
25 N·m (2.5 kgf-m, 18.4 ft-lb)

C: INSPECTION

1. CHECK MOTOR

1) Connect the battery positive terminal to terminal No. 5 and the battery ground terminal to terminal No. 4, and check that the valve is fully opened on LH side and the valve is fully closed on RH side.

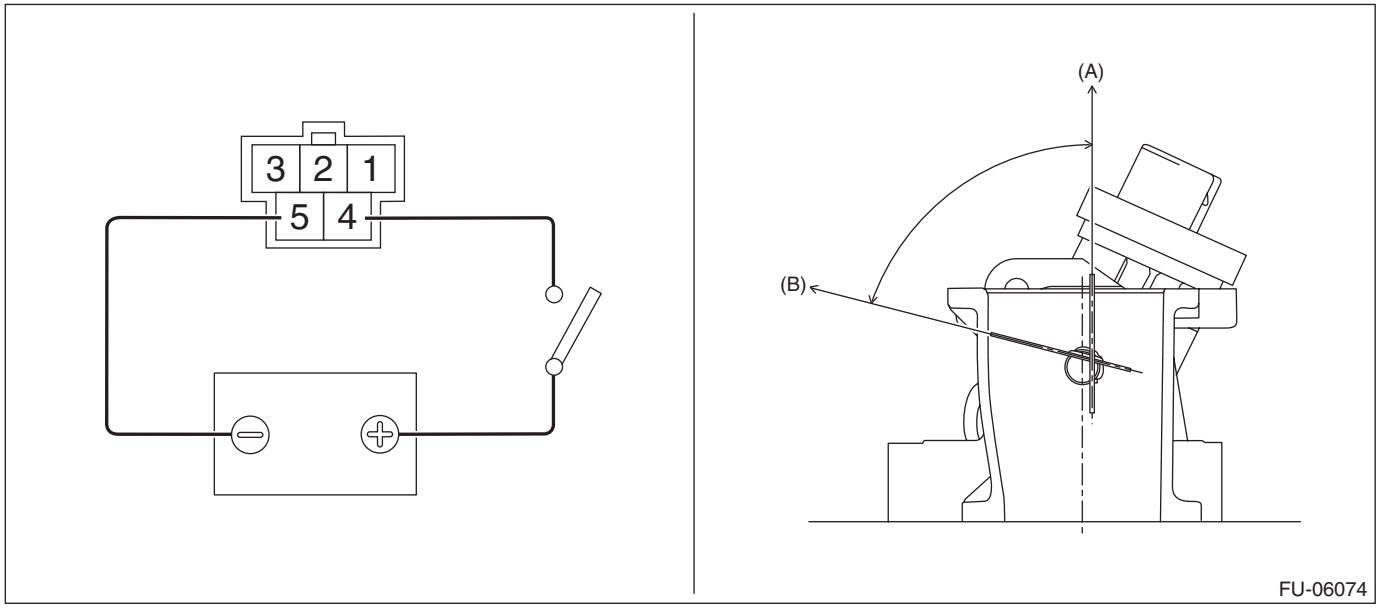
CAUTION:
Do not power the motor for more than 10 seconds.



(A) Full open (B) Full closed

2) Connect the battery positive terminal to terminal No. 4 and the battery ground terminal to terminal No. 5, and check that the valve is fully closed on LH side and the valve is fully opened on RH side.

CAUTION:
Do not power the motor for more than 10 seconds.



(A) Full open (B) Full closed

2. CHECK SENSORS

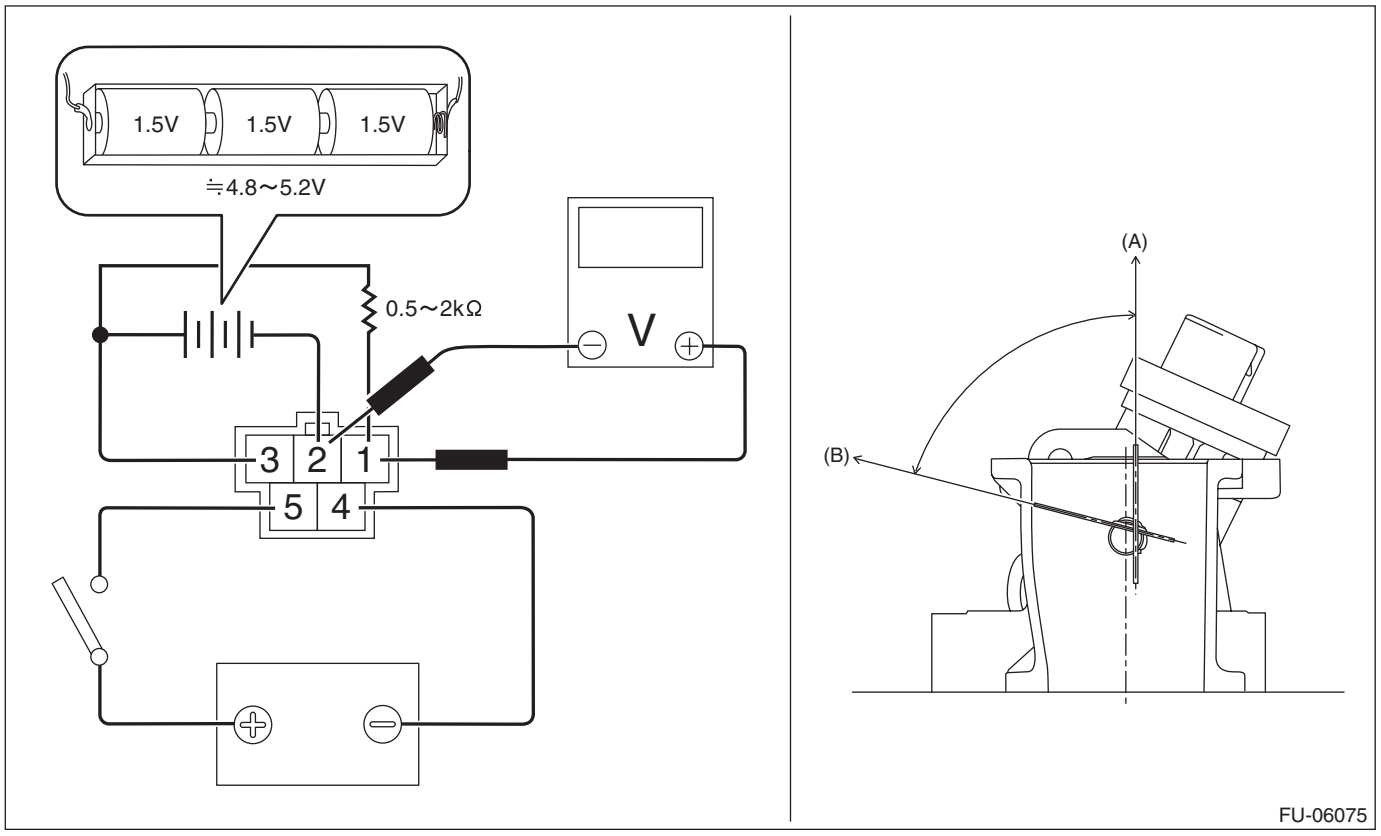
1) Connect dry-cell battery positive terminal to terminal No. 3 and dry-cell battery ground terminal to terminal No. 2, and connect the resistance (0.5 — 2 kΩ) between dry-cell battery positive terminal and terminal No. 1.

NOTE:
- Use new dry-cell batteries.
- Using circuit tester, check the voltage of a single dry-cell battery is 1.6 V or more. And also check the voltage of three batteries in series is between 4.8 V and 5.2 V.
- For power supply, 5 V DC voltage source can also be used.

2) Connect the circuit tester positive terminal to terminal No. 1, and the circuit tester negative terminal to terminal No. 2.

3) Connect the battery positive terminal to terminal No. 5 and the battery ground terminal to terminal No. 4, and measure the voltages with the valve fully opened on LH side and with the valve fully closed on RH side.

CAUTION:
Do not power the motor for more than 10 seconds.



(A) Full open (B) Full closed

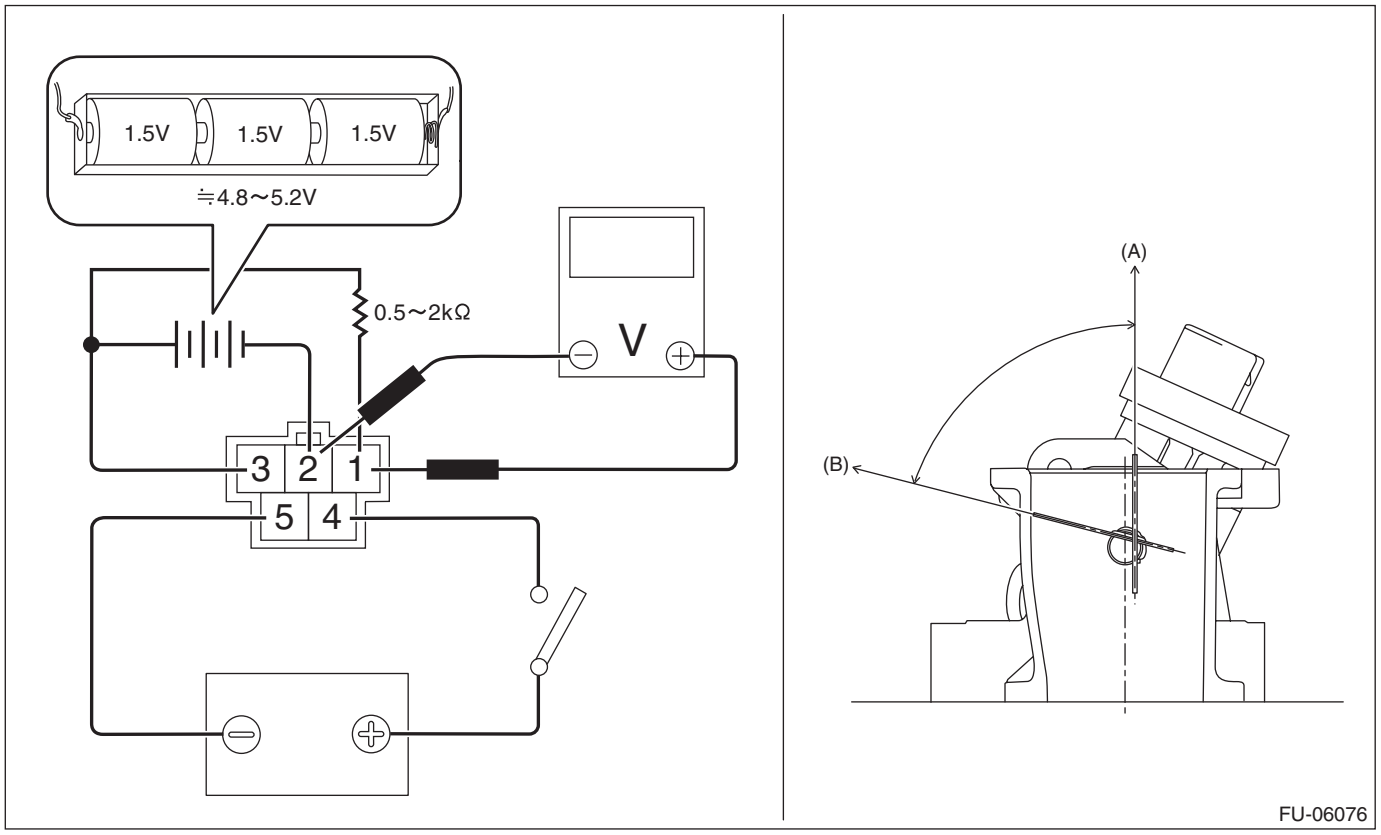
Terminal No.	Standard
1 (+) and 2 (–)	LH side: Approx. 5 V (when 25°C (77°F)) RH side: Approx. 0 — 0.5 V (when 25°C (77°F))

4) Connect dry-cell battery positive terminal to terminal No. 3 and dry-cell battery ground terminal to terminal No. 2, and connect the resistance (0.5 — 2 kΩ) between dry-cell battery positive terminal and terminal No. 1.

NOTE:
- Use new dry-cell batteries.
- Using circuit tester, check the voltage of a single dry-cell battery is 1.6 V or more. And also check the voltage of three batteries in series is between 4.8 V and 5.2 V.
- For power supply, 5 V DC voltage source can also be used.

5) Connect the circuit tester positive terminal to terminal No. 1, and the circuit tester negative terminal to terminal No. 2.
6) Connect the battery positive terminal to terminal No. 4 and the battery ground terminal to terminal No. 5, and measure the voltages with the valve fully closed on LH side and with the valve fully opened on RH side.

CAUTION:
Do not power the motor for more than 10 seconds.



(A) Full open (B) Full closed

Terminal No.	Standard
1 (+) and 2 (–)	LH side: Approx. 0 — 0.5 V (when 25°C (77°F)) RH side: Approx. 5 V (when 25°C (77°F))

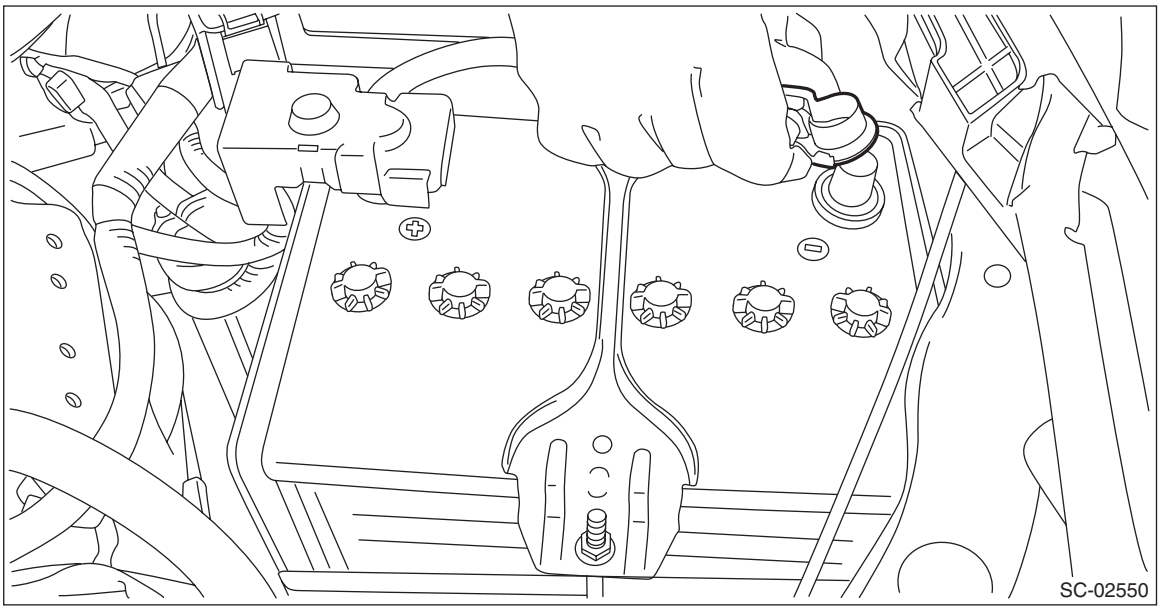
3. OTHER INSPECTIONS

1) Check that the tumble generator valve assembly has no deformation, cracks or other damages.
2) Check tumble generator valve assembly for contamination or clogging.

17.Tumble Generator Valve Actuator

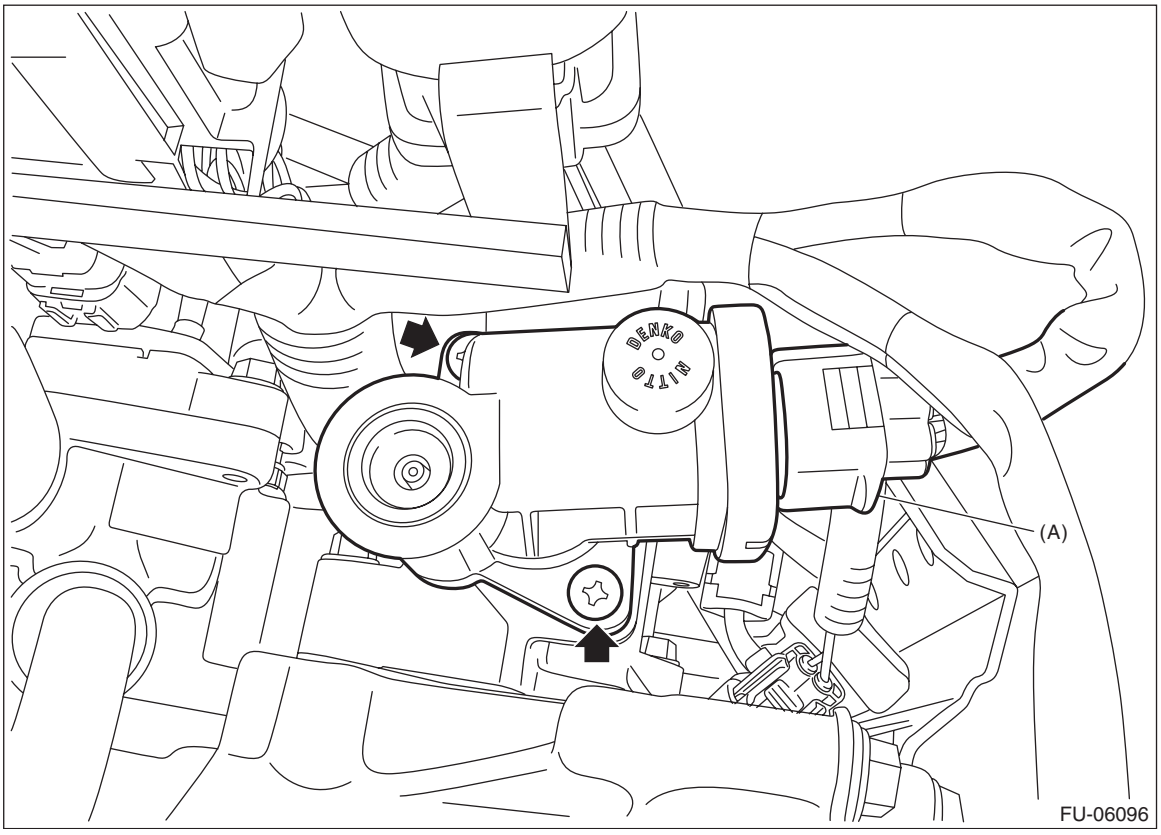
A: REMOVAL

1) Disconnect the ground cable from battery.

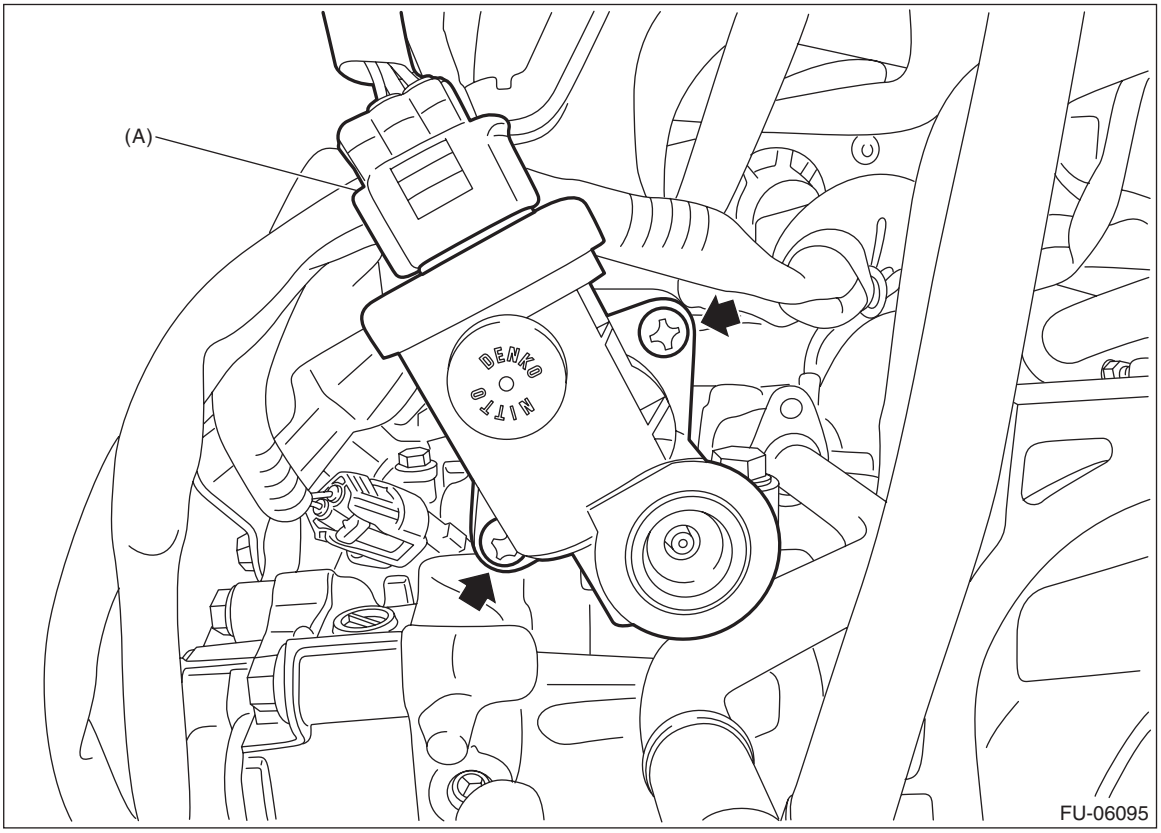


2) Disconnect the connector (A) from tumble generator valve assembly, and remove the tumble generator valve actuator.

- RH side



- LH side



B: INSTALLATION

Install in the reverse order of removal.

NOTE:
Use a new gasket.

Tightening torque:
6 N·m (0.6 kgf-m, 4.4 ft-lb)

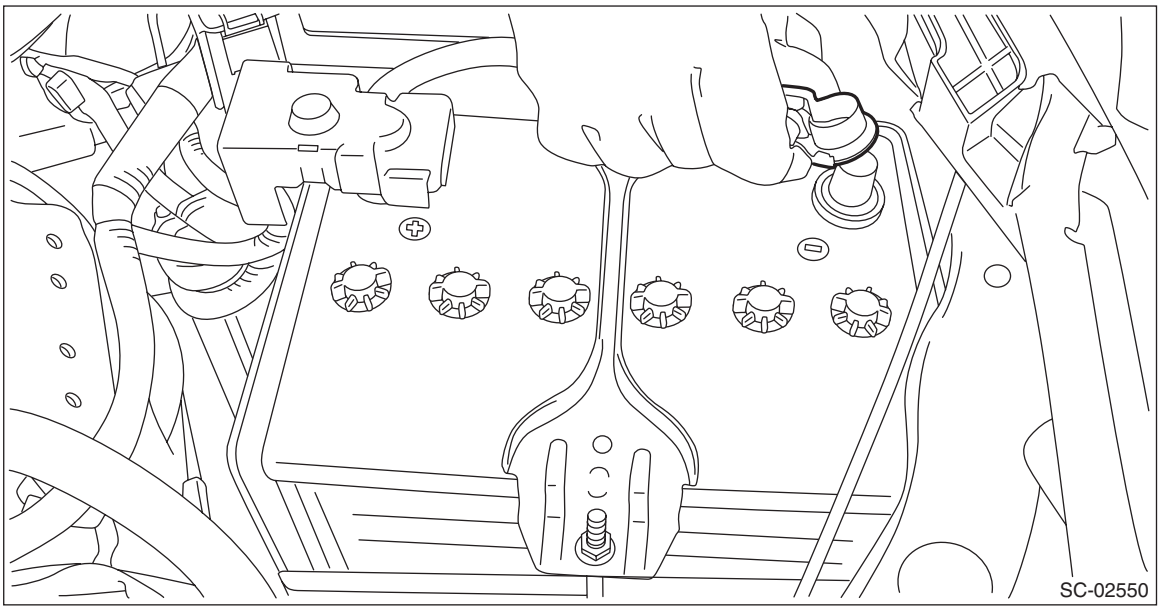
C: INSPECTION

1) Check that the tumble generator valve actuator has no deformation, cracks or other damages.
2) Check tumble generator valve actuator for contamination or clogging.

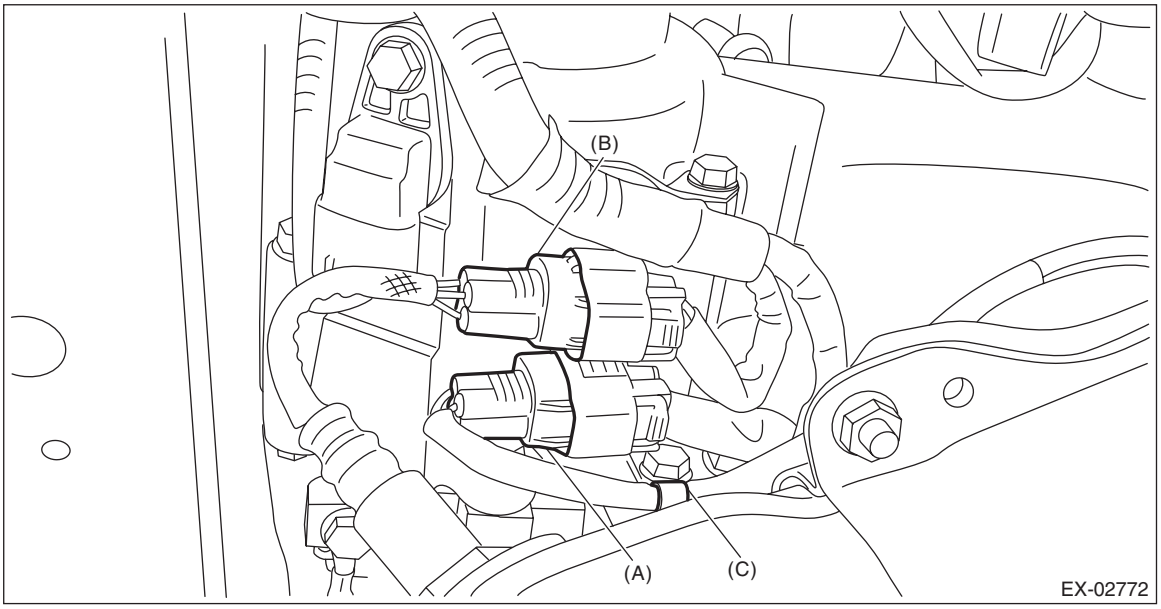
18.Front Oxygen (A/F) Sensor

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Remove the radiator sub fan and fan motor assembly. <Ref. to CO(H4DO(w/o HEV))-93, REMOVAL, Radiator Sub Fan and Fan Motor.>
3) Lift up the vehicle.
4) Remove the under cover. <Ref. to EI-32, REMOVAL, Front Under Cover.>
5) Disconnect the front oxygen (A/F) sensor connector, and remove the clip holding the front oxygen (A/F) sensor harness.

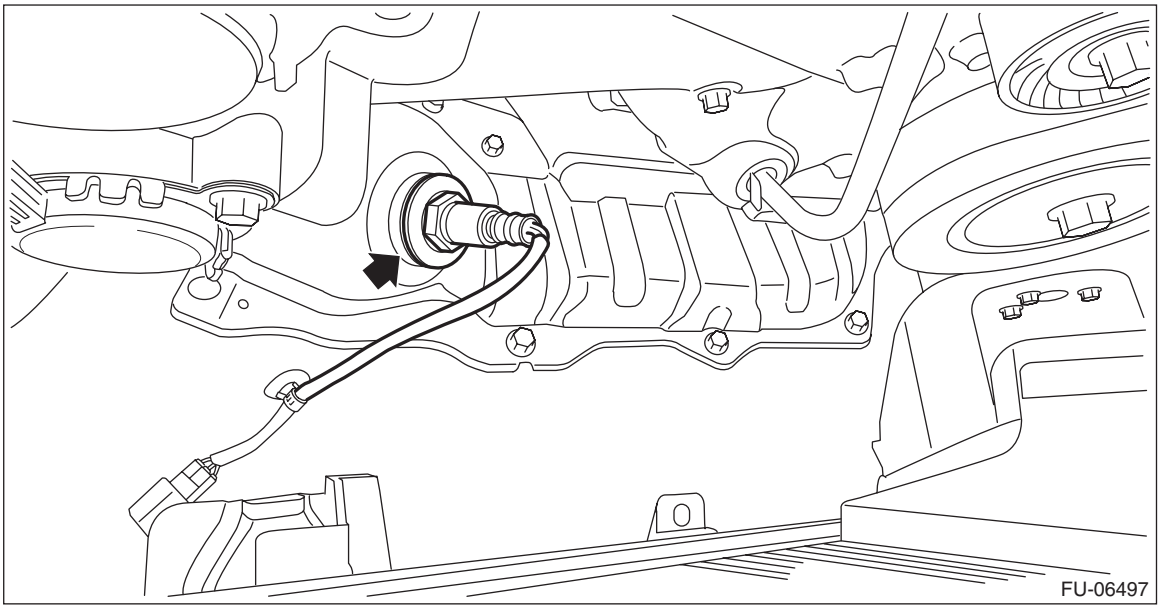


(A) Front oxygen (A/F) sensor connector
(B) Rear oxygen sensor connector
(C) Clip

6) Lower the vehicle.
7) Apply spray-type lubricant to the threaded portion of front oxygen (A/F) sensor, and leave it for one minute or more.

8) Remove the front oxygen (A/F) sensor.

CAUTION:
When removing the front oxygen (A/F) sensor, wait until exhaust pipe cools, otherwise it will damage the exhaust pipe.



B: INSTALLATION

CAUTION:
If lubricant is spilt over the exhaust pipe, wipe it off with cloth to avoid emission of smoke or causing a fire.

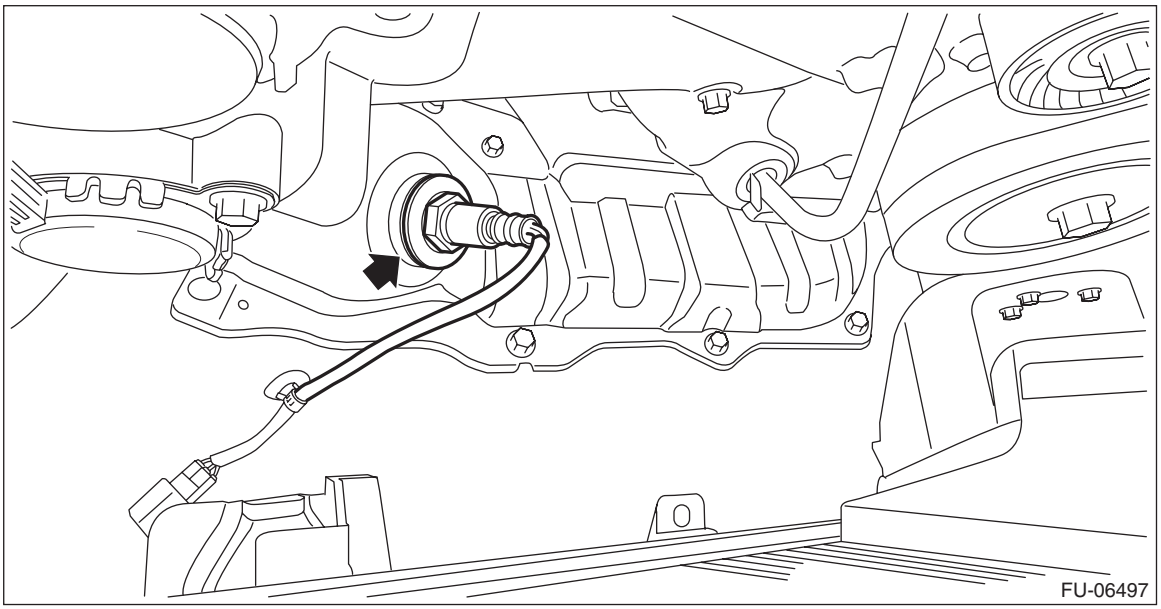
1) Before installing front oxygen (A/F) sensor, apply anti-seize compound only to the threaded portion of front oxygen (A/F) sensor to make the next removal easier.

CAUTION:
Never apply anti-seize compound to the protector of front oxygen (A/F) sensor.

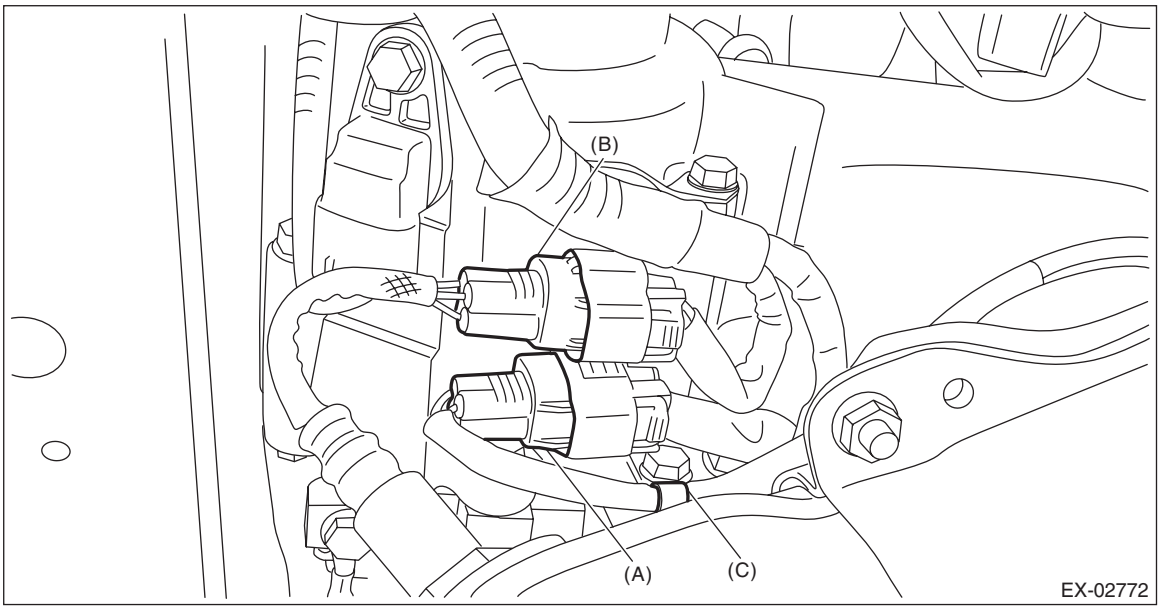
Anti-seize compound:
NEVER-SEEZ NSN, JET LUBE SS-30 or equivalent

2) Install the front oxygen (A/F) sensor.

Tightening torque:
21 N·m (2.1 kgf-m, 15.5 ft-lb)



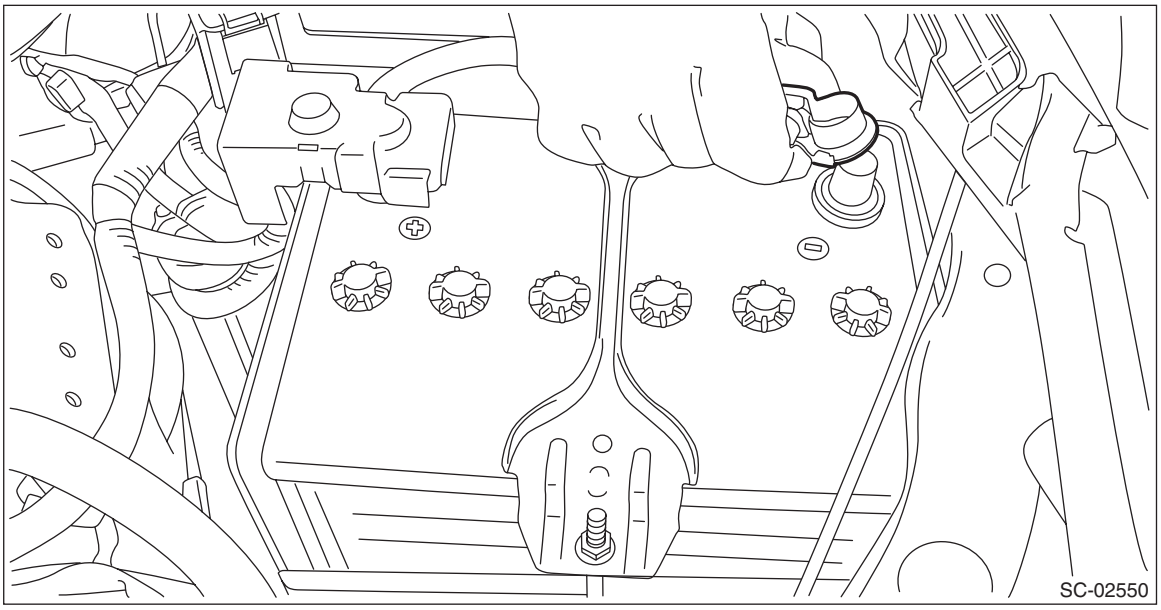
3) Lift up the vehicle.
4) Connect the front oxygen (A/F) sensor connector, and secure the front oxygen (A/F) sensor harness by using the clip.



(A) Front oxygen (A/F) sensor connector
(B) Rear oxygen sensor connector
(C) Clip

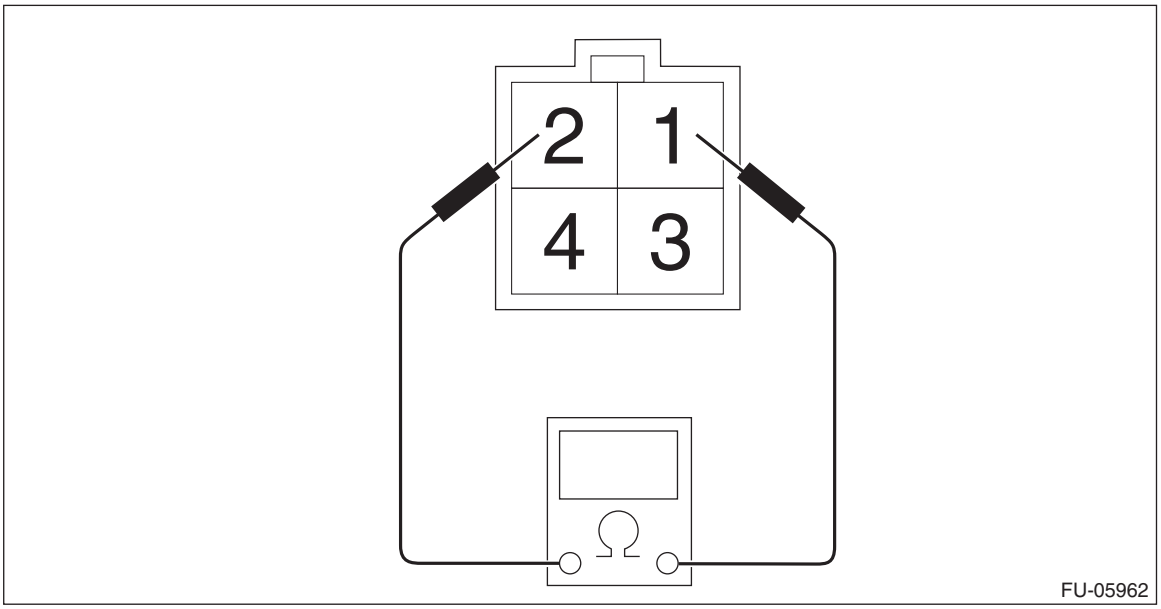
5) Install the under cover. <Ref. to EI-32, INSTALLATION, Front Under Cover.>
6) Lower the vehicle.
7) Install the radiator sub fan and fan motor assembly. <Ref. to CO(H4DO(w/o HEV))-94, INSTALLATION, Radiator Sub Fan and Fan Motor.>

8) Connect the battery ground terminal.



C: INSPECTION

1) Check that the front oxygen (A/F) sensor has no deformation, cracks or other damages.
2) Measure the resistance between front oxygen (A/F) sensor terminals.

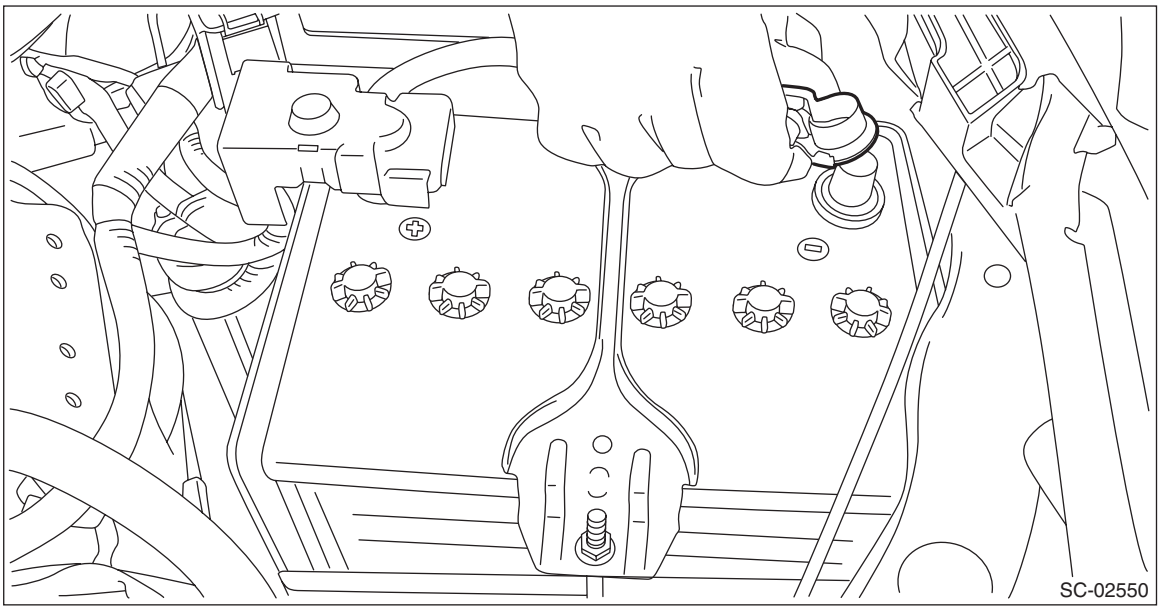


Terminal No.	Standard
1 and 2	$2.0^{+0.42}_{-0.2}$ Ω (when 20°C (68°F))

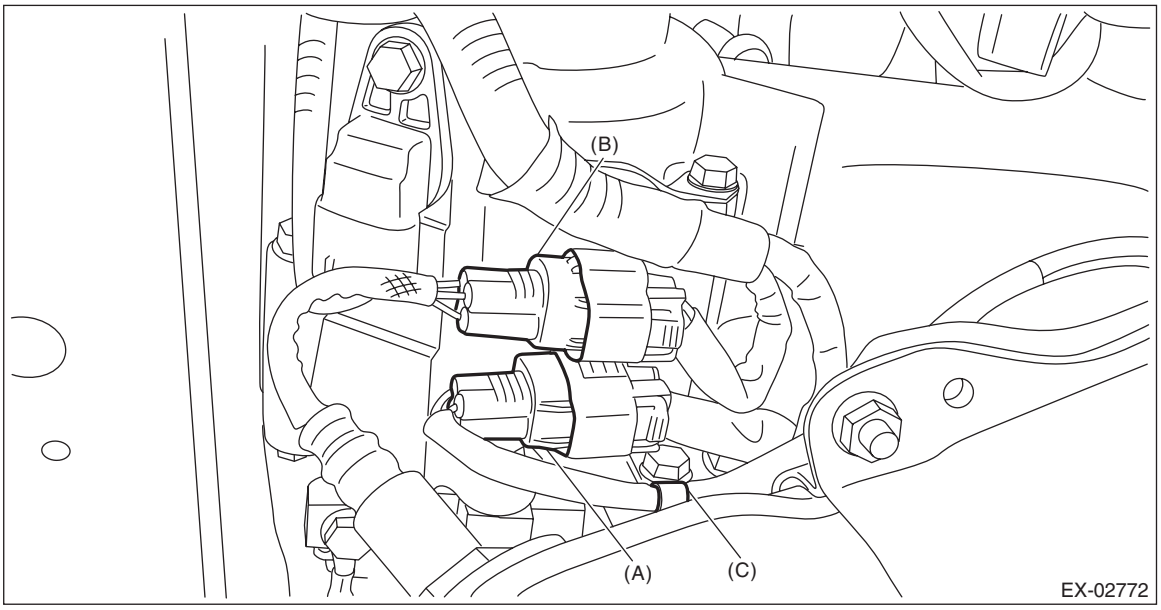
19.Rear Oxygen Sensor

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-32, REMOVAL, Front Under Cover.>
4) Disconnect the rear oxygen sensor connector.

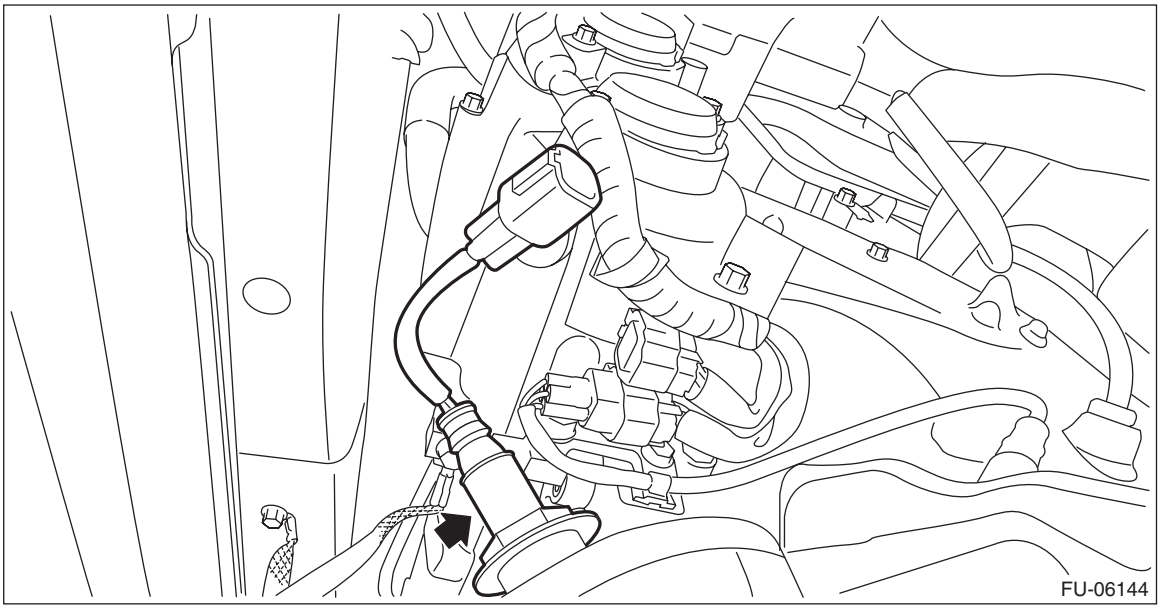


(A) Front oxygen (A/F) sensor connector
(B) Rear oxygen sensor connector
(C) Clip

5) Apply spray-type lubricant to the threaded portion of rear oxygen sensor, and leave it for one minute or more.

6) Remove the rear oxygen sensor.

CAUTION:
When removing the rear oxygen sensor, wait until exhaust pipe cools, otherwise it will damage the exhaust pipe.



B: INSTALLATION

CAUTION:
If lubricant is spilt over the exhaust pipe, wipe it off with cloth to avoid emission of smoke or causing a fire.

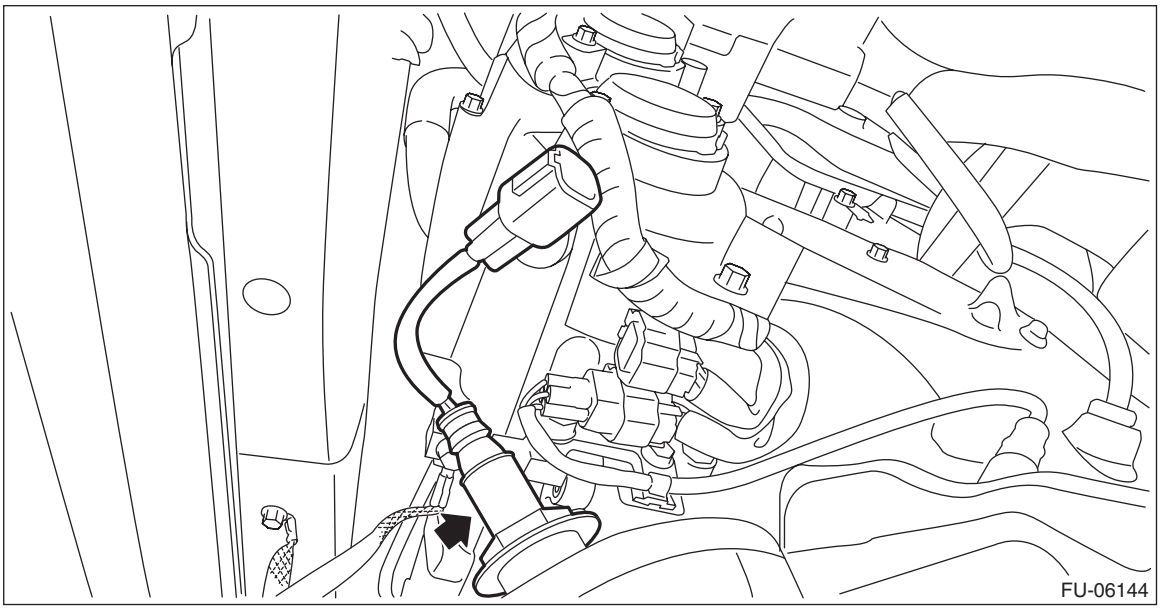
1) Before installing rear oxygen sensor, apply the anti-seize compound only to the threaded portion of rear oxygen sensor to make the next removal easier.

CAUTION:
Never apply anti-seize compound to the protector of rear oxygen sensor.

Anti-seize compound:
NEVER-SEEZ NSN, JET LUBE SS-30 or equivalent

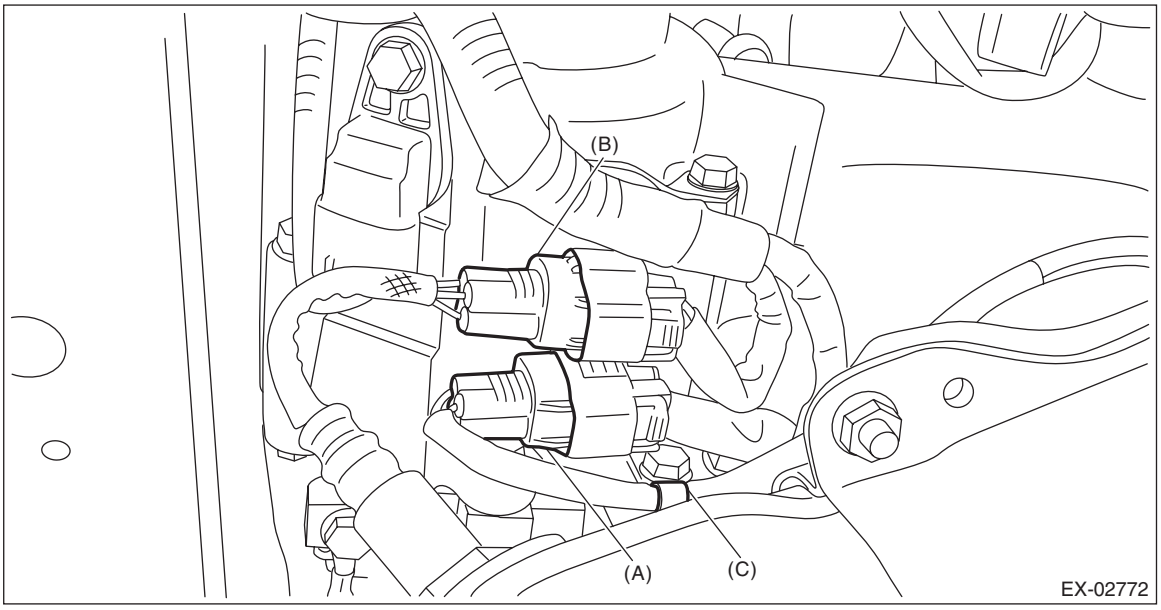
2) Install the rear oxygen sensor.

Tightening torque:
21 N·m (2.1 kgf-m, 15.5 ft-lb)



3) Connect the rear oxygen sensor connector.

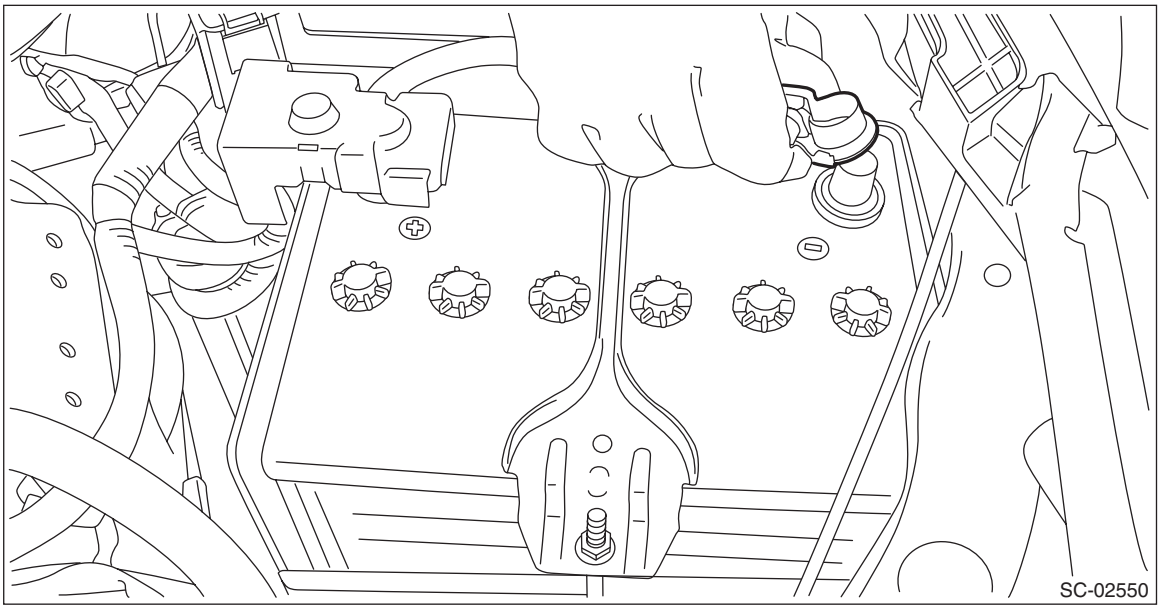
NOTE:
Be careful not to allow the rear oxygen sensor harness to interfere with the sensor unit and the front oxygen (A/F) sensor harness.



(A) Front oxygen (A/F) sensor connector
(B) Rear oxygen sensor connector
(C) Clip

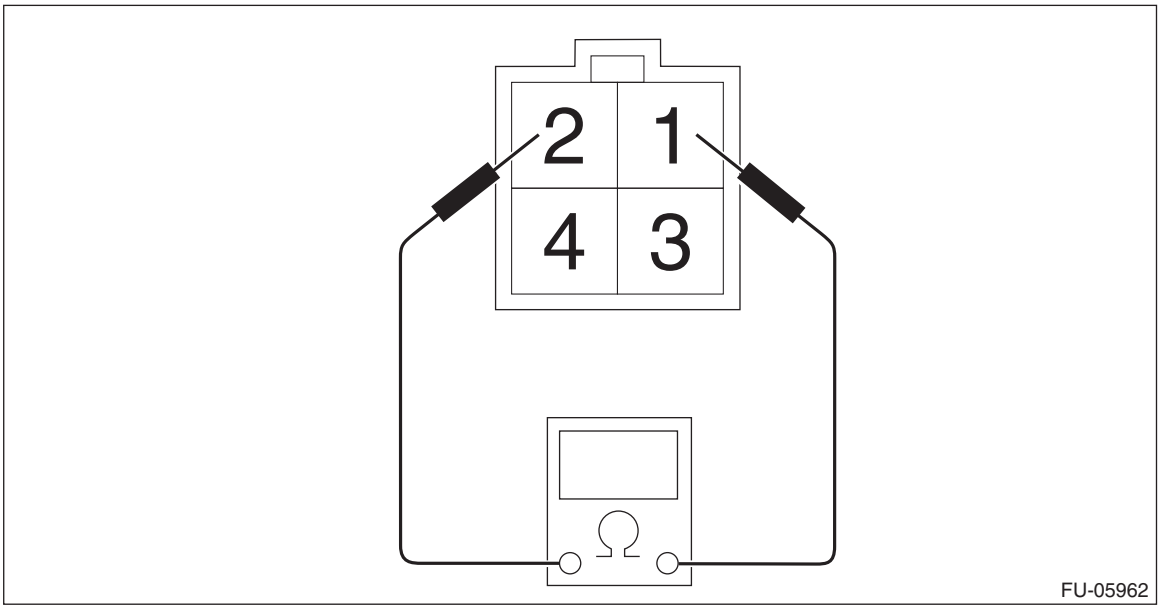
4) Install the under cover. <Ref. to EI-32, INSTALLATION, Front Under Cover.>
5) Lower the vehicle.

6) Connect the battery ground terminal.



C: INSPECTION

1) Check that the rear oxygen sensor has no deformation, cracks or other damages.
2) Measure the resistance between rear oxygen sensor terminals.

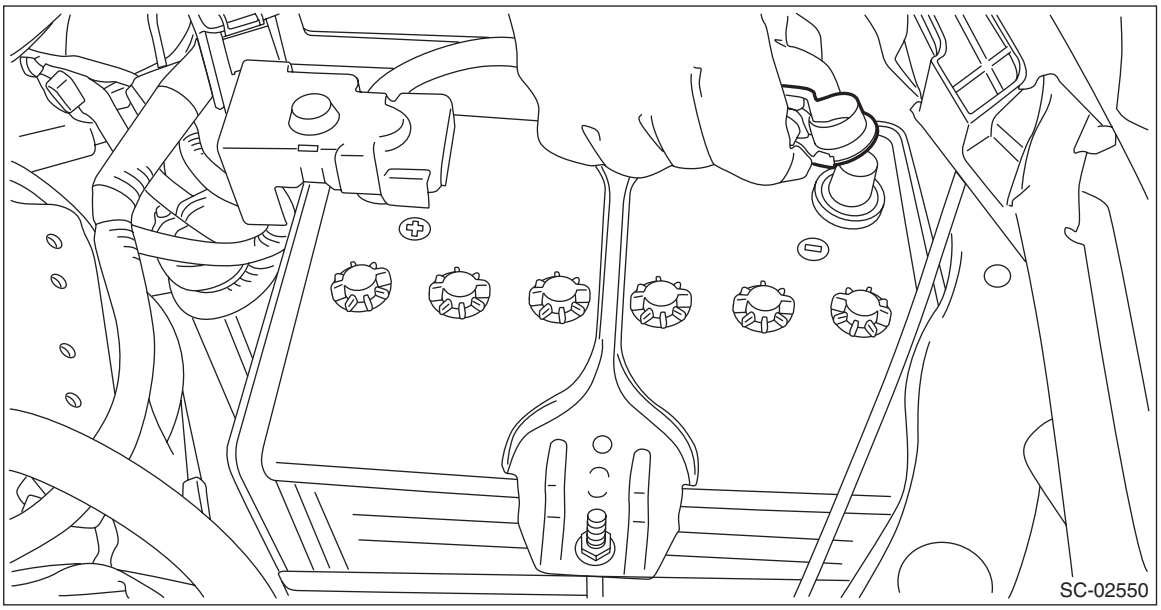


Terminal No.	Standard
1 and 2	$5.6^{+1.7}_{-0.6}$ Ω (when 20°C (68°F))

20.Engine Control Module (ECM)

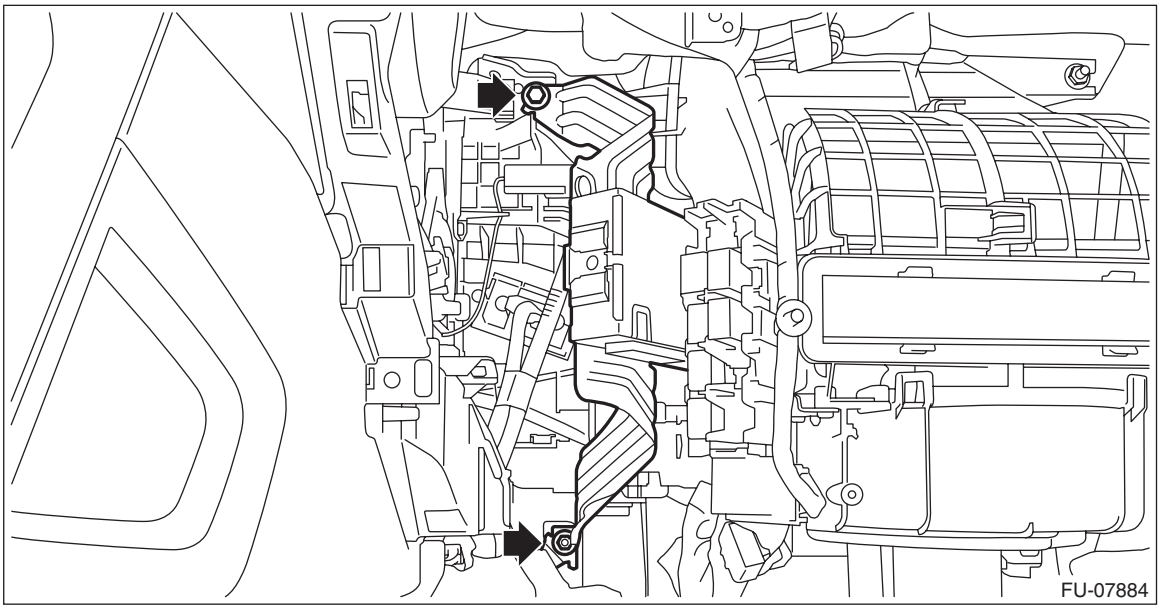
A: REMOVAL

1) Disconnect the ground cable from battery.



2) Remove the glove box. <Ref. to EI-78, REMOVAL, Glove Box.>
3) Disconnect the connector from ECM.

4) Remove the bolts and nuts, and remove the ECM.



B: INSTALLATION

Install in the reverse order of removal.

CAUTION:

- **When the ECM of model with immobilizer has been replaced, be sure to perform the registration of immobilizer system. (Refer to the "REGISTRATION MANUAL FOR IMMOBILIZER".)**
- **If replacing ECM or the bracket, replace both parts with new parts at a time.**
- **After installing the bracket to ECM, do not separate the bracket.**
- **If the bracket has been installed to ECM in the wrong direction, replace both parts to new parts.**

NOTE:
When replacing the ECM, be careful not to use the wrong spec. ECM to avoid any damage on the fuel injection system.

Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

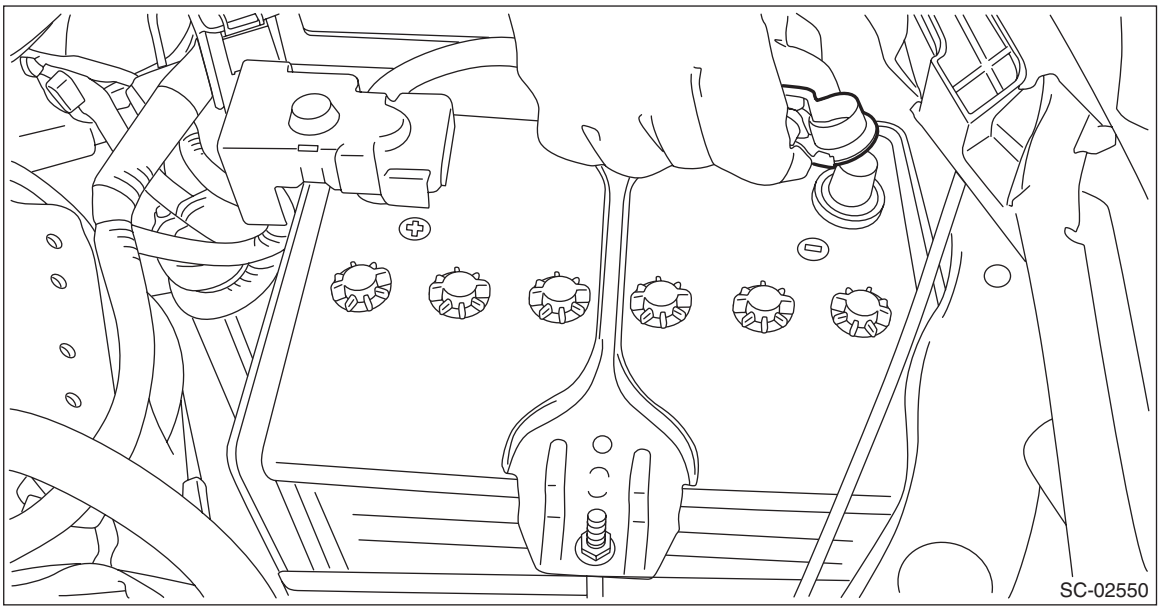
C: INSPECTION

Check that the ECM has no deformation, cracks or other damages.

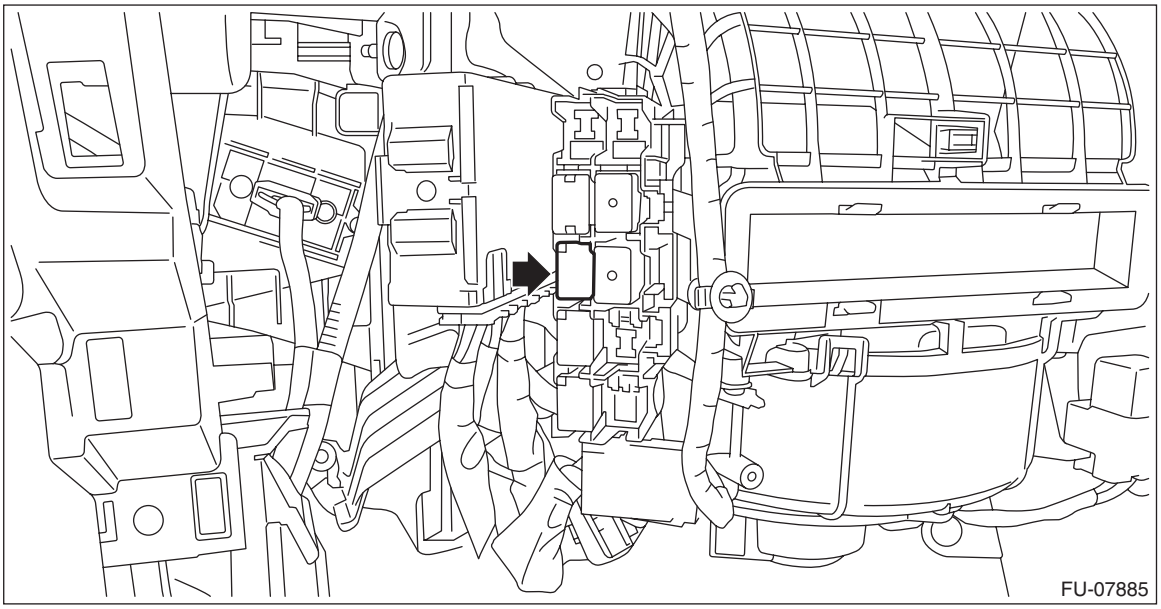
21.Main Relay

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Remove the glove box. <Ref. to EI-78, REMOVAL, Glove Box.>
3) Remove the main relay from relay block.



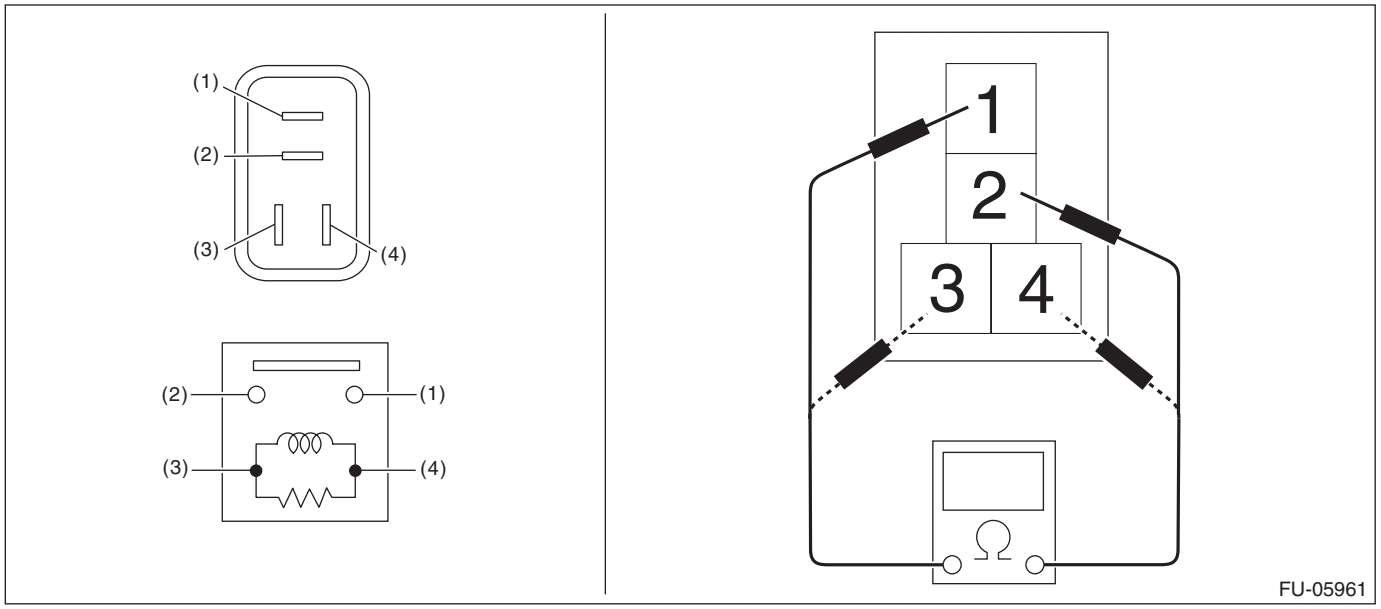
B: INSTALLATION

Install in the reverse order of removal.

C: INSPECTION

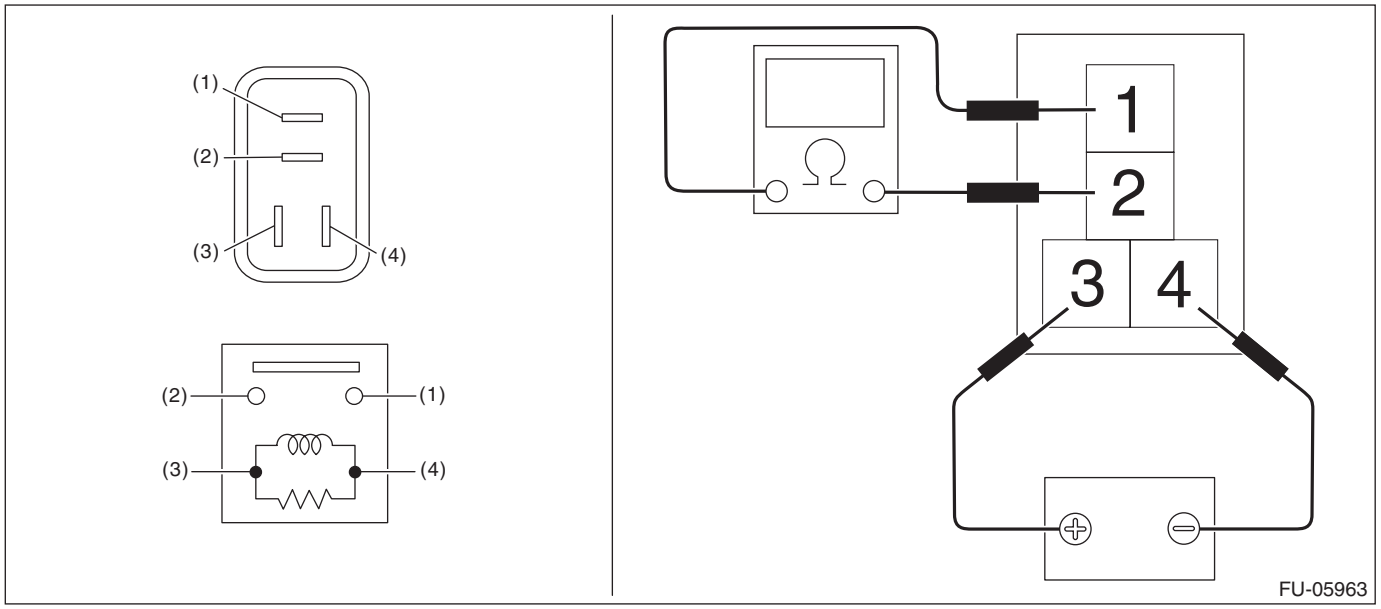
1) Check that the main relay has no deformation, cracks or other damages.

2) Measure the resistance between main relay terminals.



Terminal No.	Standard
1 and 2	1 MΩ or more
3 and 4	130.4 — 230.8 Ω (when 20°C (68°F))

3) Connect battery positive terminal to terminal No. 3 and battery ground terminal to terminal No. 4, and measure the resistance between the main relay terminals.

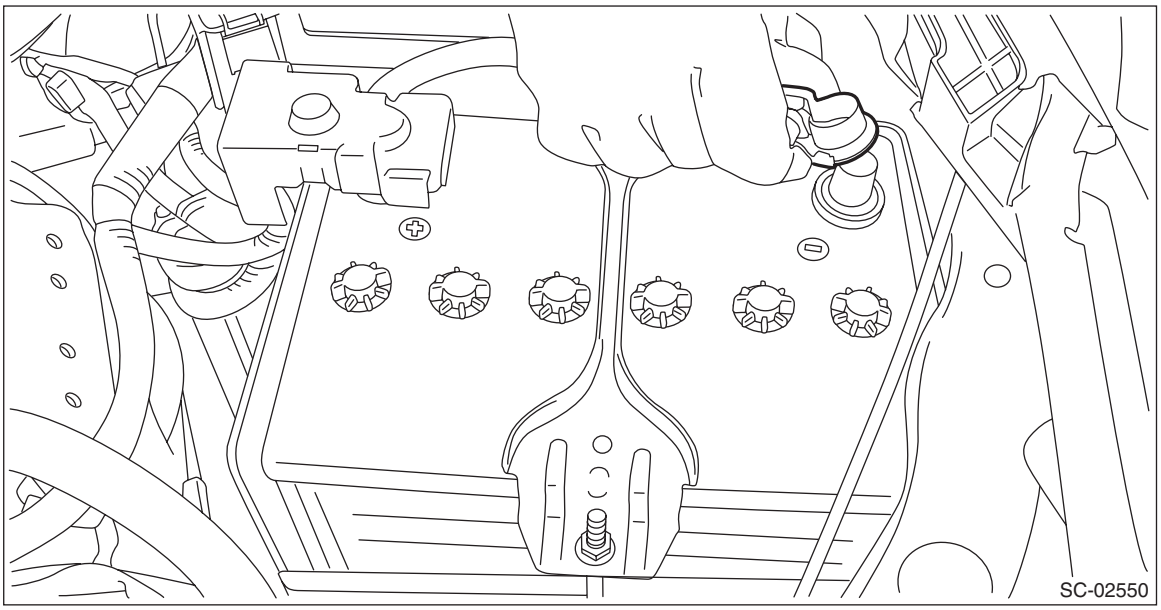


Terminal No.	Standard
1 and 2	Less than 1 Ω

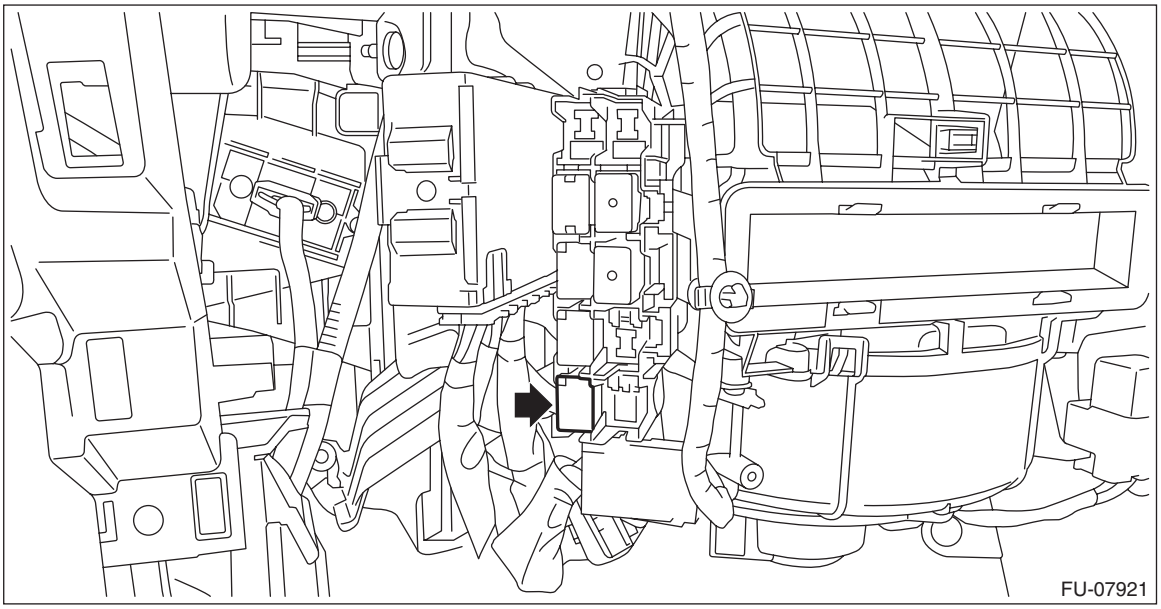
22.Fuel Pump Relay

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Remove the glove box. <Ref. to EI-78, REMOVAL, Glove Box.>
3) Remove the fuel pump relay from relay block.

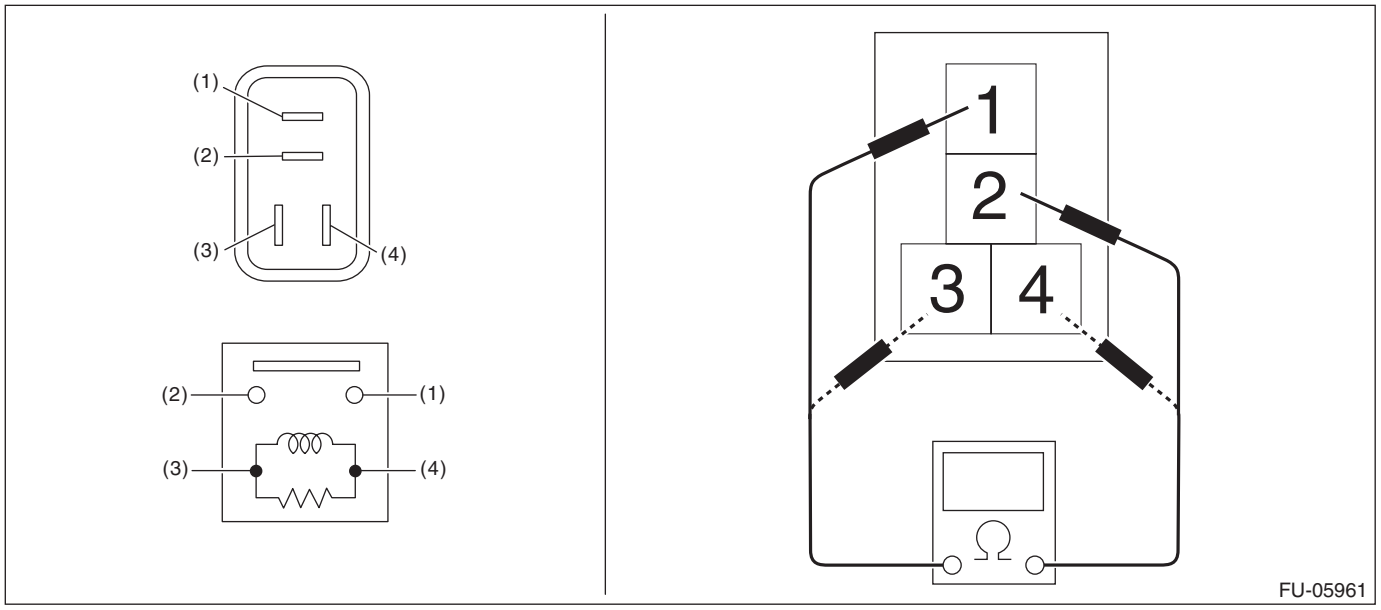


B: INSTALLATION

Install in the reverse order of removal.

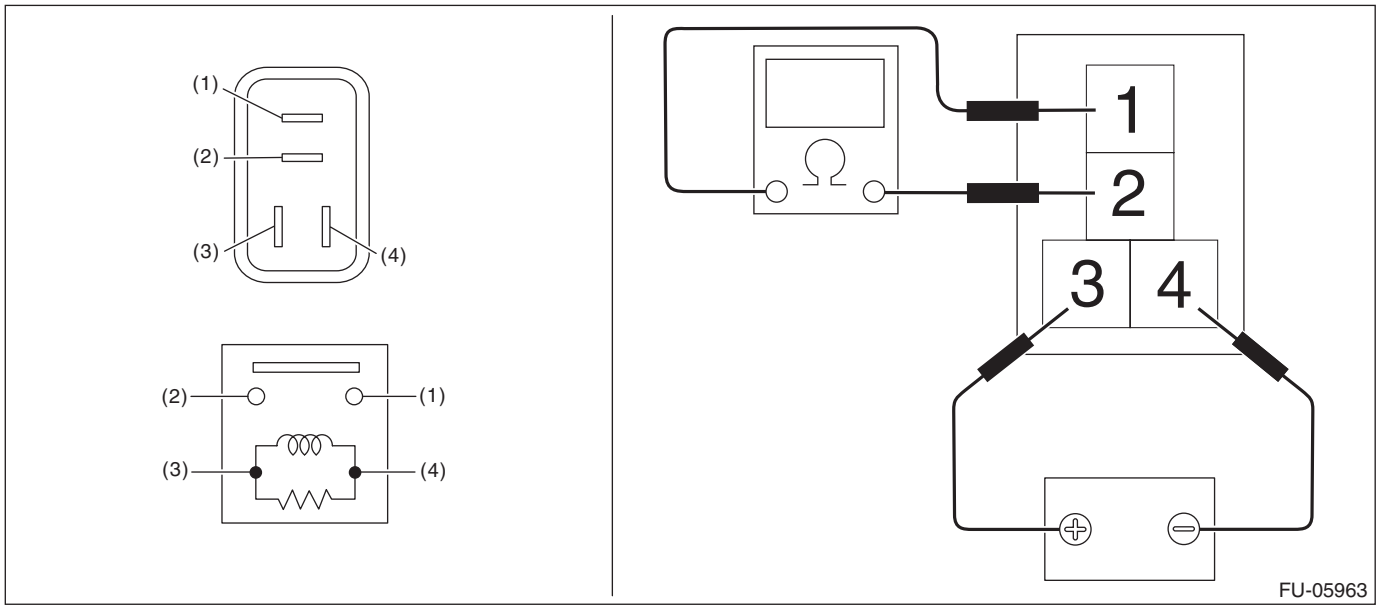
C: INSPECTION

1) Check that the fuel pump relay has no deformation, cracks or other damages.
2) Measure the resistance between fuel pump relay terminals.



Terminal No.	Standard
1 and 2	1 MΩ or more
3 and 4	93.8 — 136.4 Ω (when 20°C (68°F))

3) Connect battery positive terminal to terminal No. 3 and battery ground terminal to terminal No. 4, and measure the resistance between the fuel pump relay terminals.

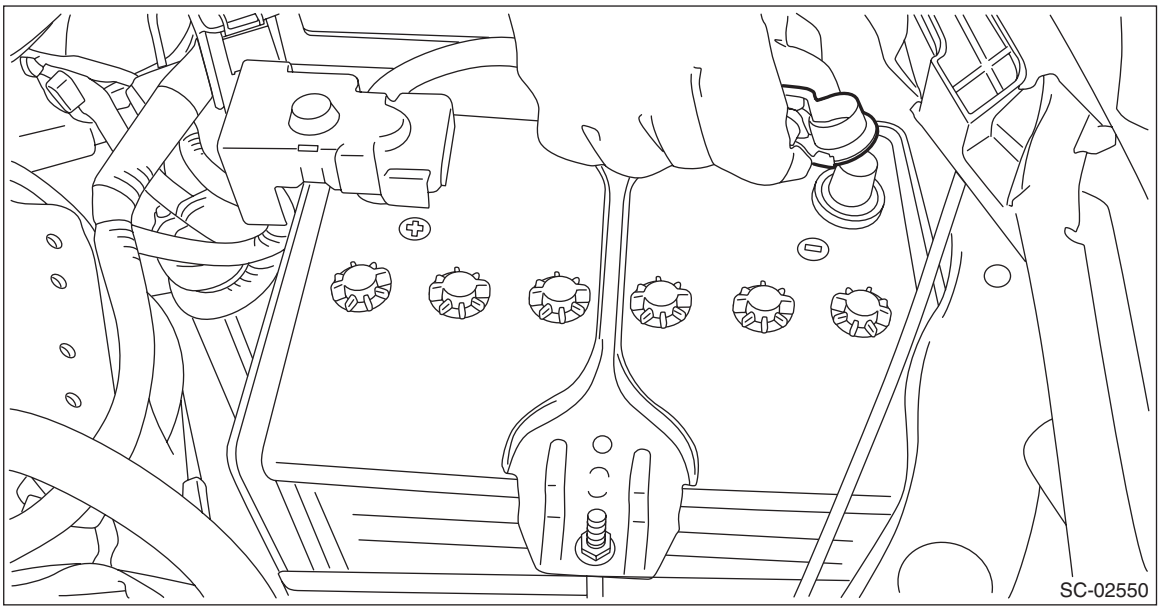


Terminal No.	Standard
1 and 2	Less than 1 Ω

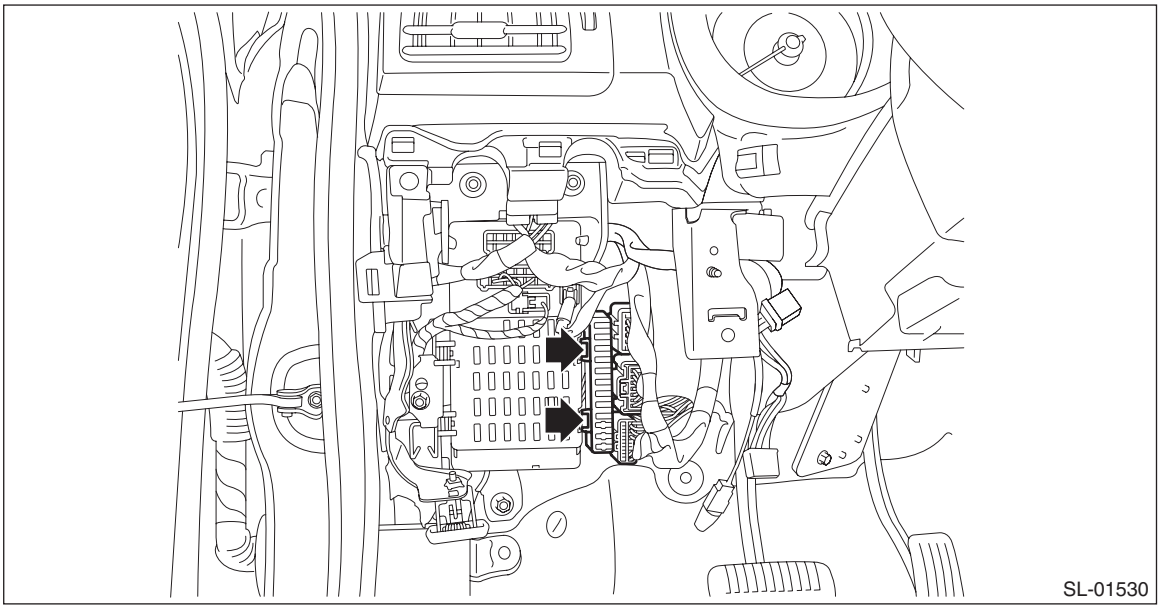
23.Electronic Throttle Control Relay

A: REMOVAL

1) Disconnect the ground cable from battery.

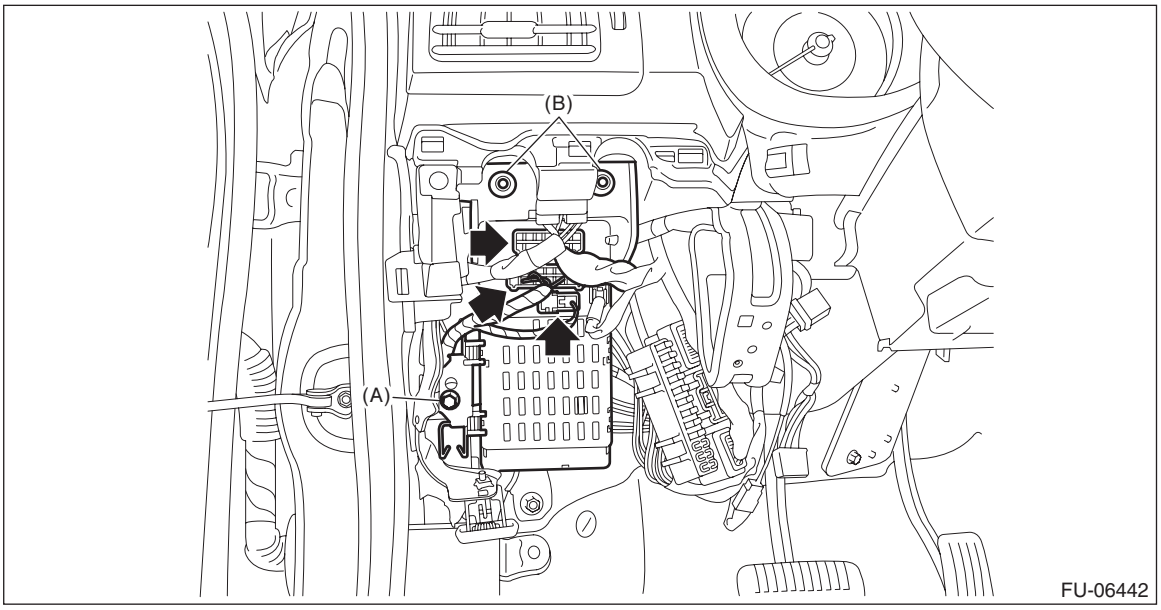


2) Remove the knee airbag module. <Ref. to AB-34, REMOVAL, Knee Airbag Module.>
3) Release the lock and remove the fuse holder from the relay & fuse box.



4) Disconnect the connectors from the relay & fuse box.

5) Remove the bolts (A) and nuts (B), and remove the relay & fuse box.



6) Remove the electronic throttle control relay from the relay block on the back side of the fuse block.

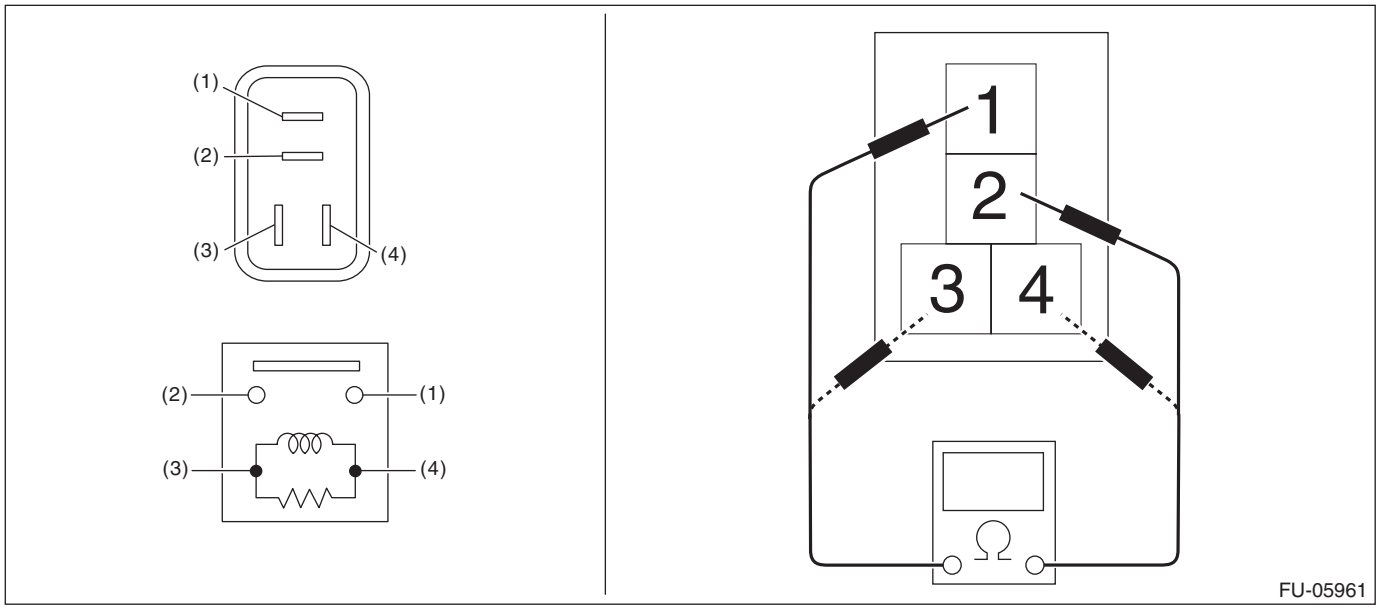
B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

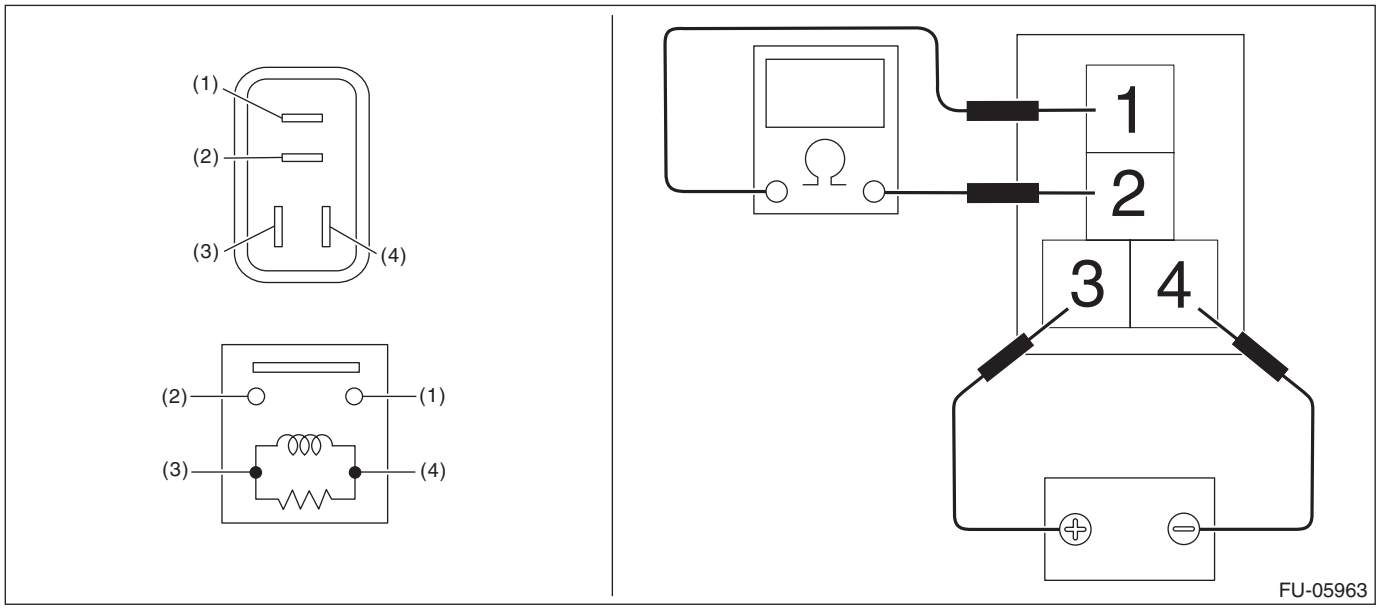
C: INSPECTION

1) Check that the electronic throttle control relay has no deformation, cracks or other damages.
2) Measure the resistance between electronic throttle control relay terminals.



Terminal No.	Standard
1 and 2	1 MΩ or more
3 and 4	93.8 — 136.4 Ω (when 20°C (68°F))

3) Connect battery positive terminal to terminal No. 3 and battery ground terminal to terminal No. 4, and measure the resistance between the electronic throttle control relay terminals.



Terminal No.	Standard
1 and 2	Less than 1 Ω

24.Fuel

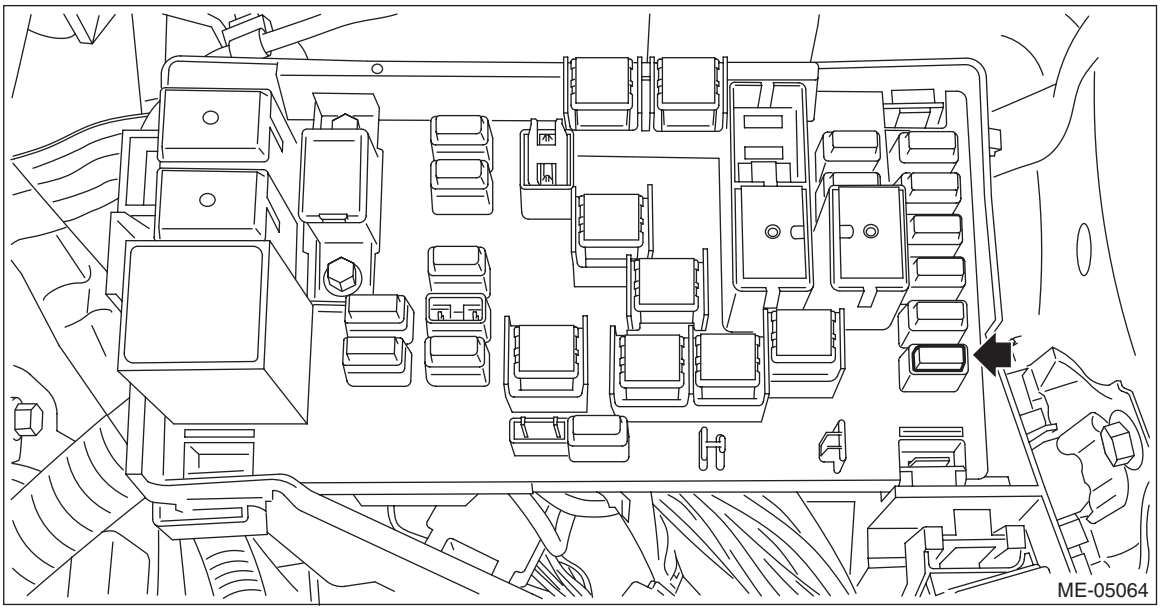
A: PROCEDURE

1. RELEASING OF FUEL PRESSURE

WARNING:
Place “NO OPEN FLAMES” signs near the working area.

CAUTION:
Be careful not to spill fuel.

1) Remove the fuse of fuel pump from main fuse box.



2) Start the engine and run it until it stalls.
3) After the engine stalls, crank it for five more seconds.
4) Turn the ignition switch to OFF.
5) Install the fuse of fuel pump to the main fuse box.

2. DRAINING FUEL (WITH SUBARU SELECT MONITOR)

WARNING:
Place “NO OPEN FLAMES” signs near the working area.

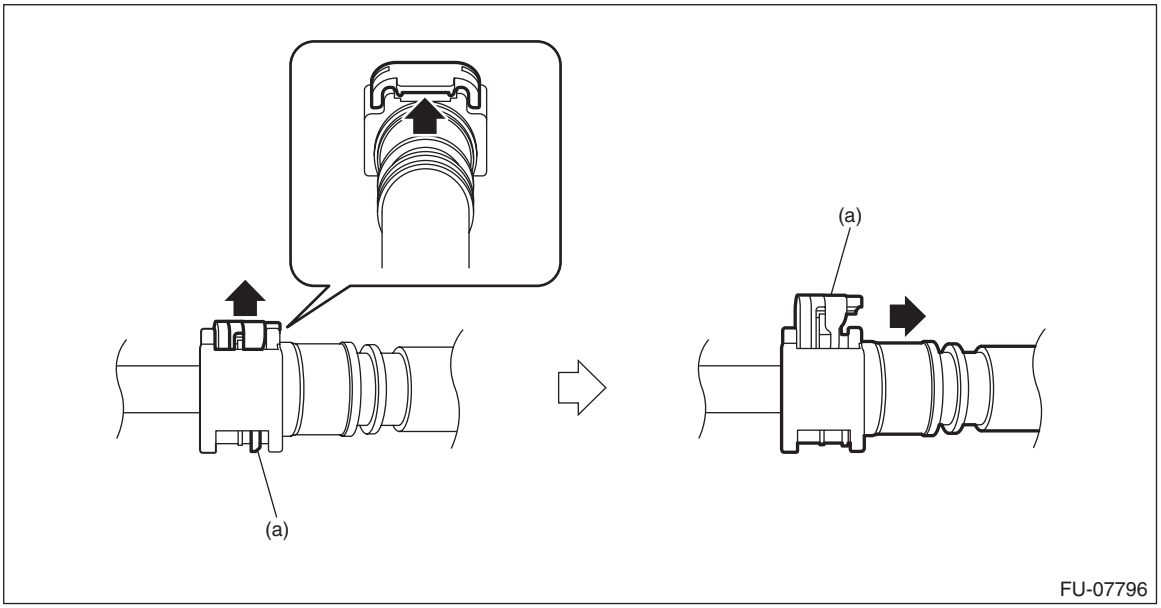
CAUTION:
Be careful not to spill fuel.

NOTE:
• If the fuel pump cannot be driven, refer to the procedures for draining from the fuel filler hose. <Ref. to FU(H4DO(w/o HEV))-112, DRAINING FUEL (THROUGH THE FUEL FILLER HOSE), PROCEDURE, Fuel.>
• Be careful not to let the battery run-out.
• Be aware that the fuel may remain in the fuel tank after draining the fuel.

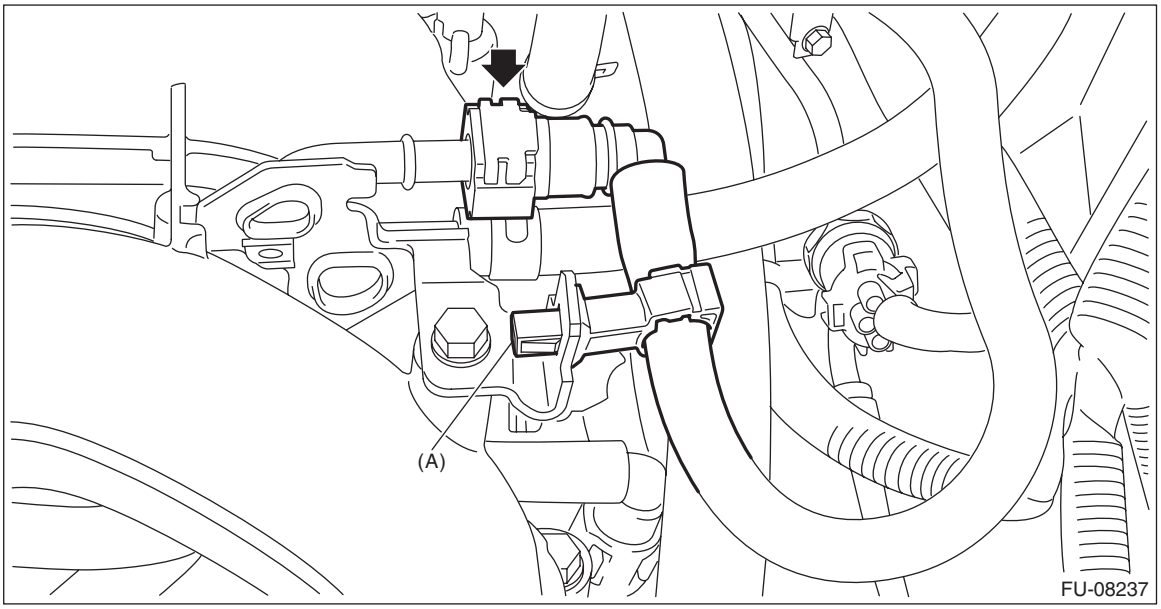
1) Release the fuel pressure. <Ref. to FU(H4DO(w/o HEV))-109, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Disconnect the quick connector on the fuel delivery tube from the fuel pipe assembly, and remove the clip (A) securing the fuel delivery tube to the fuel pipe assembly.

CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from the tubes using a container or cloth.**

NOTE:
Disconnect the quick connector as shown in the figure.



(a) Slider



3) Connect ST to the fuel delivery tube.
ST 18471AA000 FUEL PIPE ADAPTER
4) Connect the gasoline proof hose to ST and put the end of the hose in the container.
5) Drive the fuel pump and drain the fuel using Subaru Select Monitor.

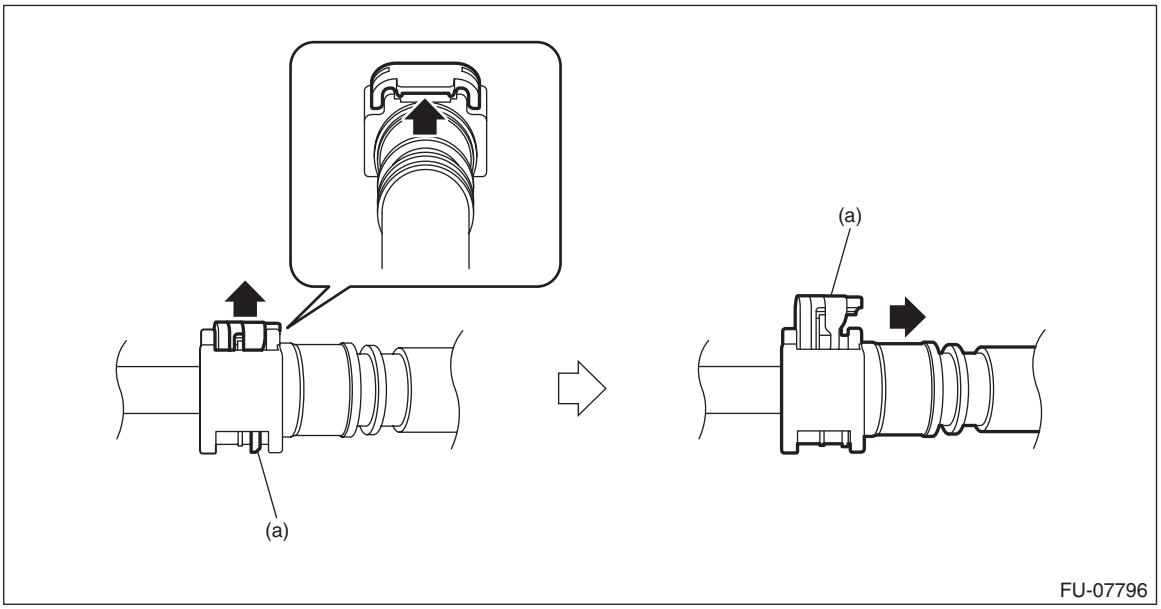
CAUTION:
Be careful not to spill fuel.

NOTE:
For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.

6) Install the related parts in the reverse order after draining the fuel.

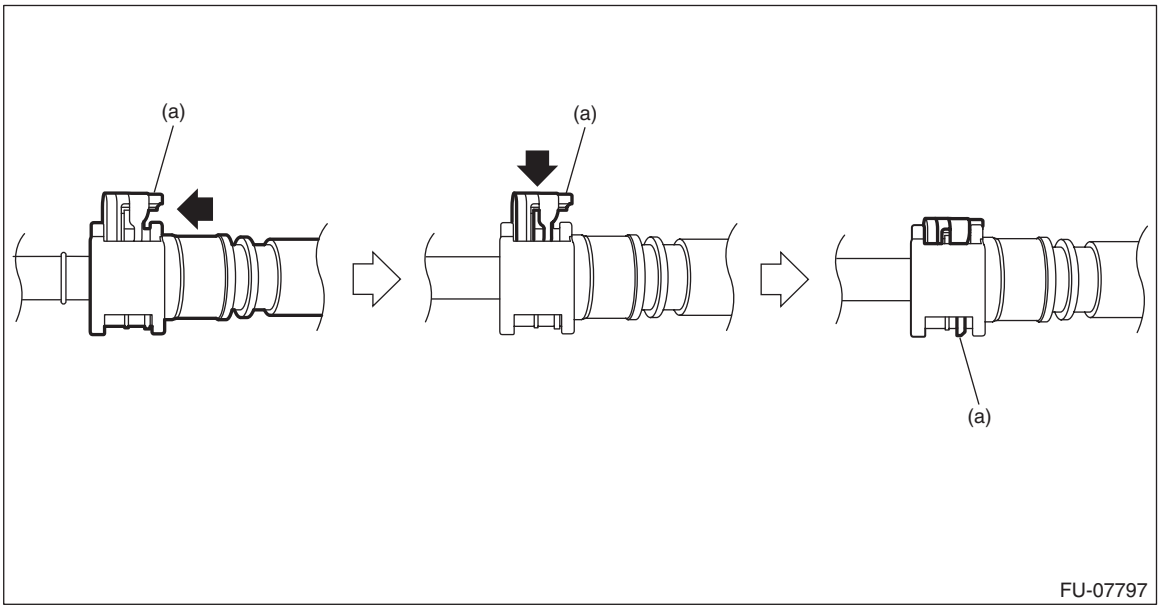
CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from the tubes using a container or cloth.**
- **Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.**
- **When connecting the quick connector, make sure to insert it all the way in before locking the slider.**
- **When it is difficult to lock the slider, check that the connector is fully inserted.**
- **After locking the slider, check again that the quick connector is securely connected.**

NOTE:
- Disconnect the quick connector on the fuel delivery tube as shown in the figure.



(a) Slider

- Connect the quick connector on the fuel delivery tube as shown in the figure.



(a) Slider

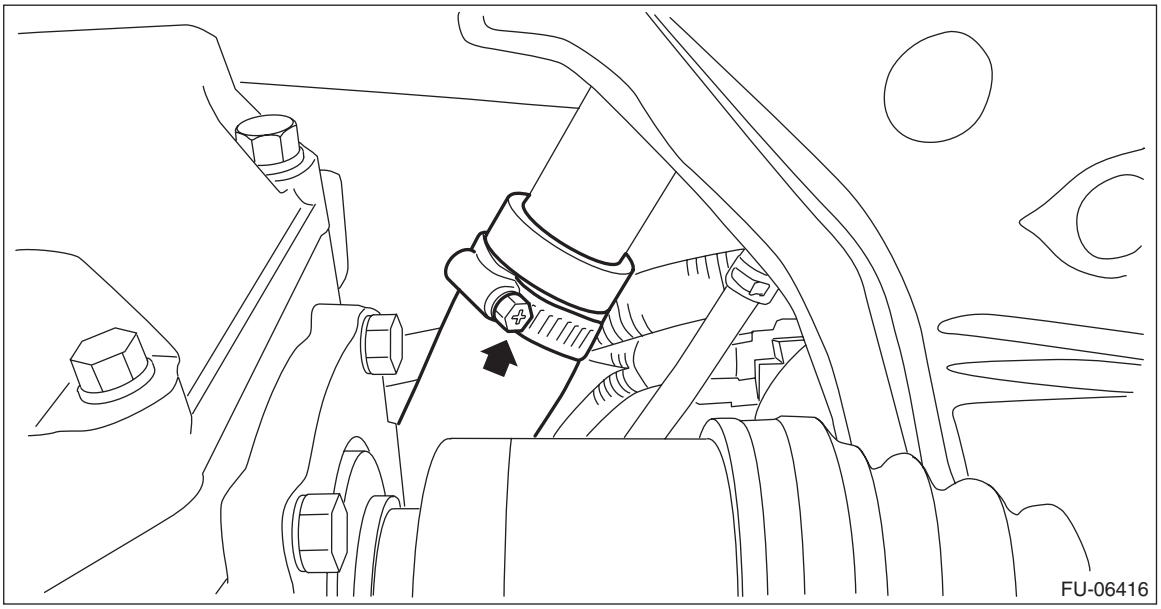
3. DRAINING FUEL (THROUGH THE FUEL FILLER HOSE)

WARNING:
Place “NO OPEN FLAMES” signs near the working area.

CAUTION:
- **Be careful not to spill fuel.**
- **Fuel may remain in the fuel filler pipe. Drain the fuel from the fuel filler pipe through the fill opening using the gasoline proof pump and the gasoline proof hose (ø10 or less) before the operation.**

NOTE:
Be aware that the fuel may remain in the fuel tank after draining the fuel.
1) Lift up the vehicle.
2) Remove the rear exhaust pipe and muffler. <Ref. to EX(H4DO(w/o HEV))-18, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4DO(w/o HEV))-22, REMOVAL, Muffler.>
3) Open the fuel filler lid and remove the fuel filler cap.
4) Drain the fuel from the fuel filler pipe through the filler opening using the gasoline proof pump and the gasoline proof hose (ø10 or less).
5) Disconnect the fuel filler hose from the fuel filler pipe assembly.

CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from hoses using a container or cloth.**



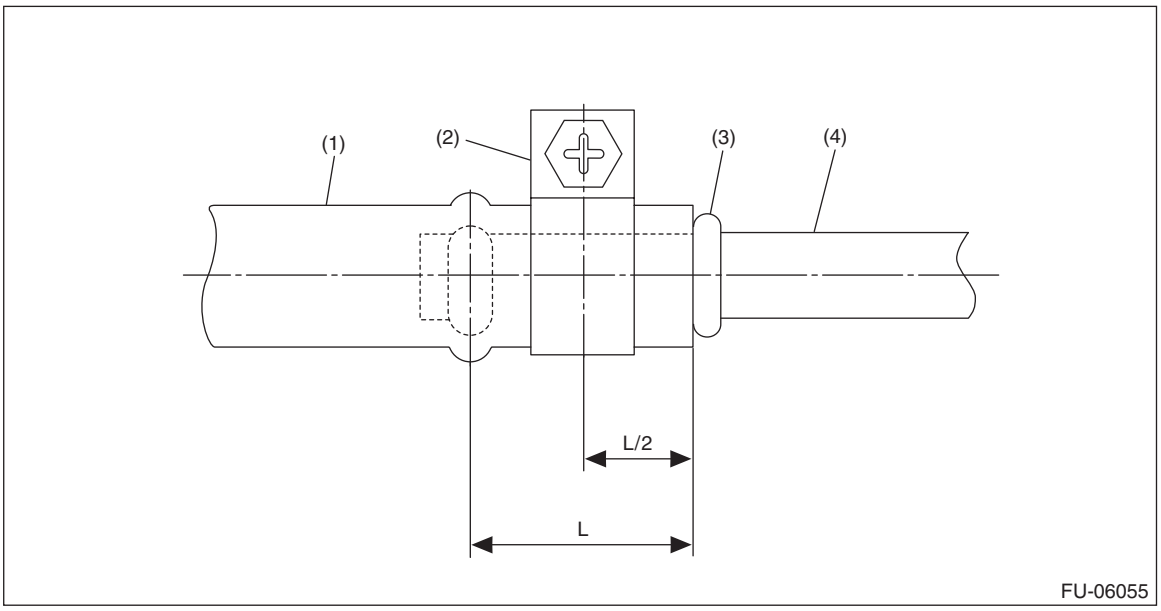
6) Set the container under the vehicle and insert the gasoline proof hose (ø10 or less) into the fuel filler hose to drain the fuel.

CAUTION:
Be careful not to spill fuel.

7) Install the related parts in the reverse order after draining the fuel.

NOTE:
Correctly insert the fuel filler hose to the spool, and then install the clamp as shown.

Tightening torque:
2.5 N·m (0.3 kgf-m, 1.8 ft-lb)



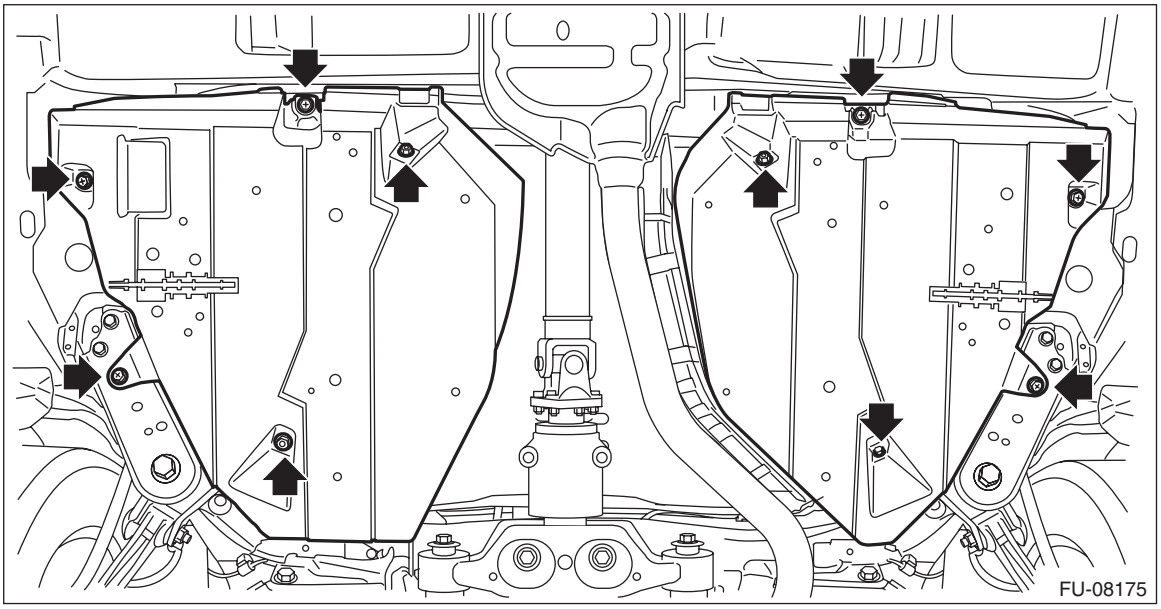
(1) Fuel filler hose
(2) Clamp
(3) Spool
(4) Fuel filler pipe

25.Fuel Tank Protector

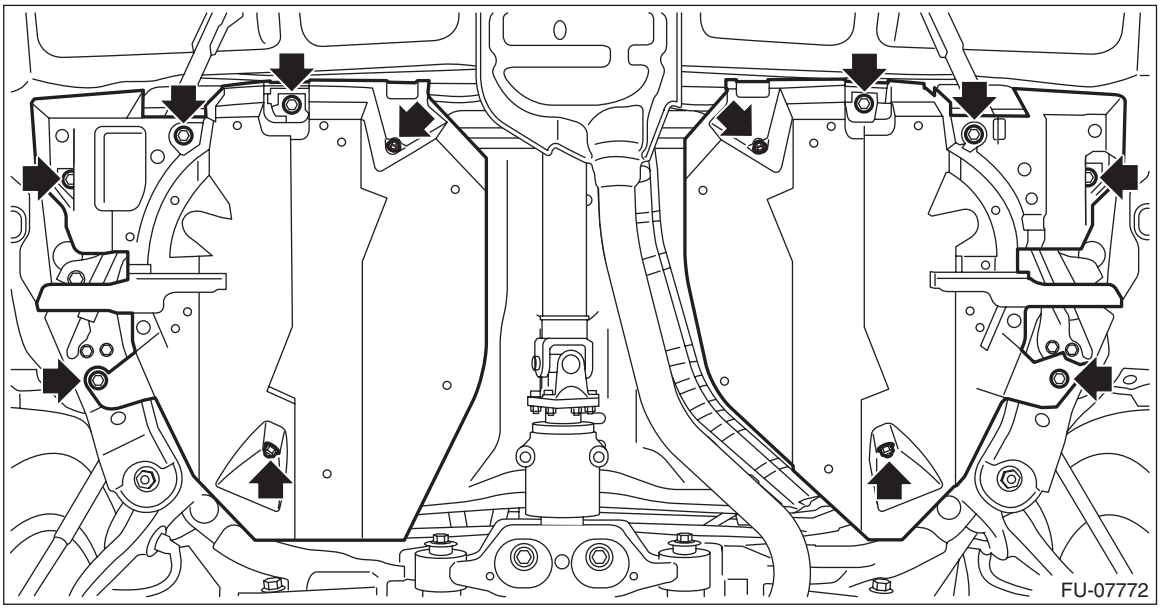
A: REMOVAL

1) Lift up the vehicle.
2) Remove the bolt and nuts and remove the fuel tank protector.

- Except for XV model



- XV model



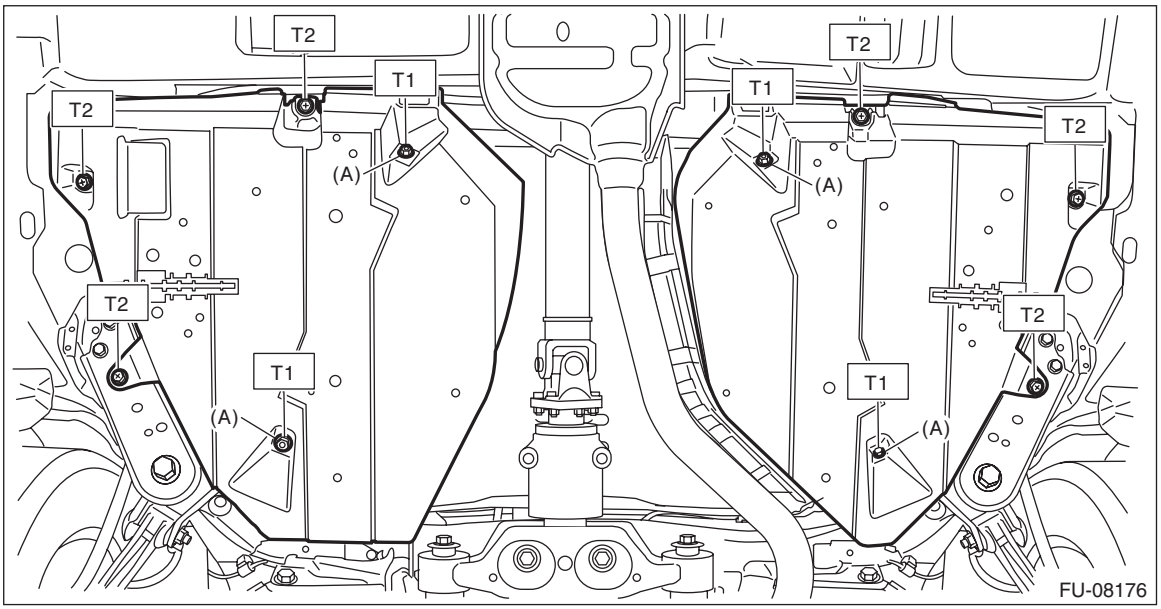
B: INSTALLATION

Install in the reverse order of removal.

NOTE:
Use a new self-locking nut.

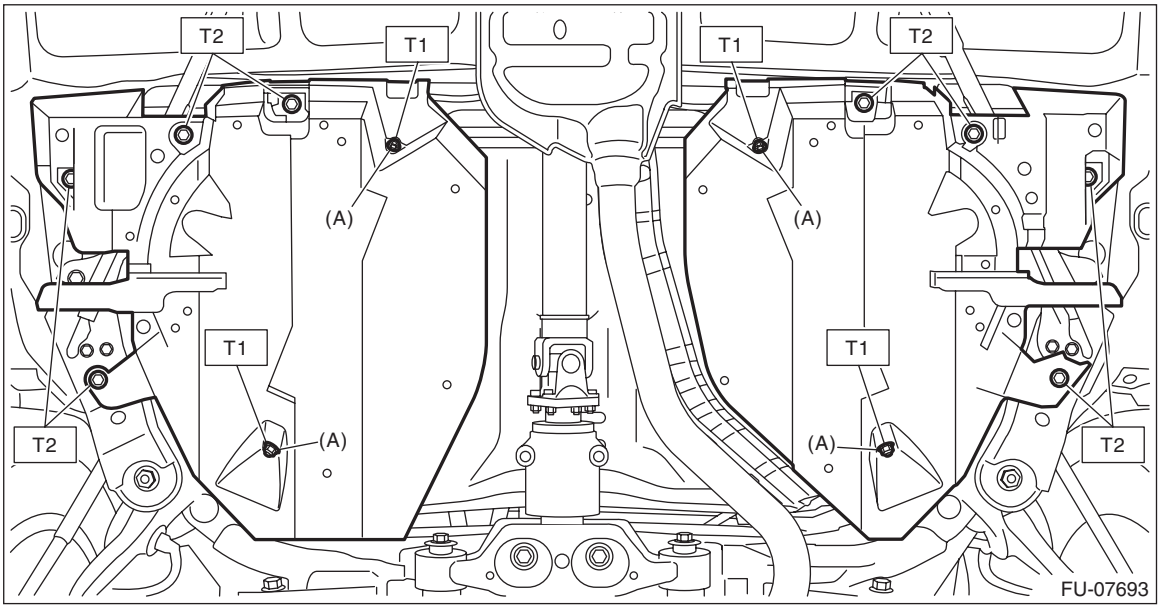
Tightening torque:
T1: 9 N·m (0.9 kgf-m, 6.6 ft-lb)
T2: 18 N·m (1.8 kgf-m, 13.3 ft-lb)

- Except for XV model



(A) Self-locking nut

- XV model



(A) Self-locking nut

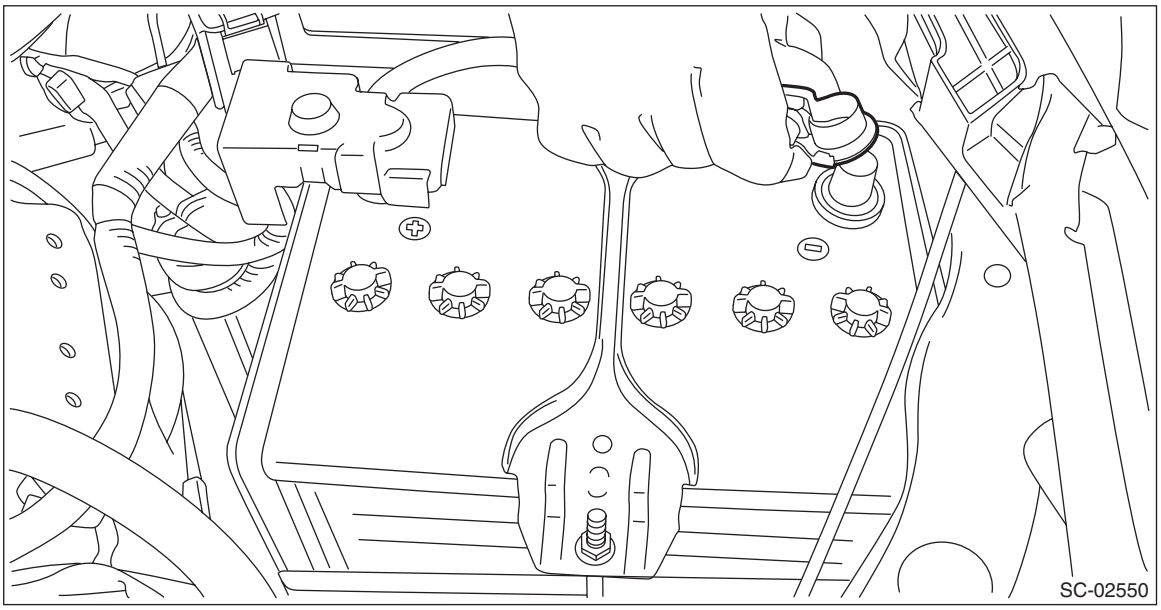
26.Fuel Tank

A: REMOVAL

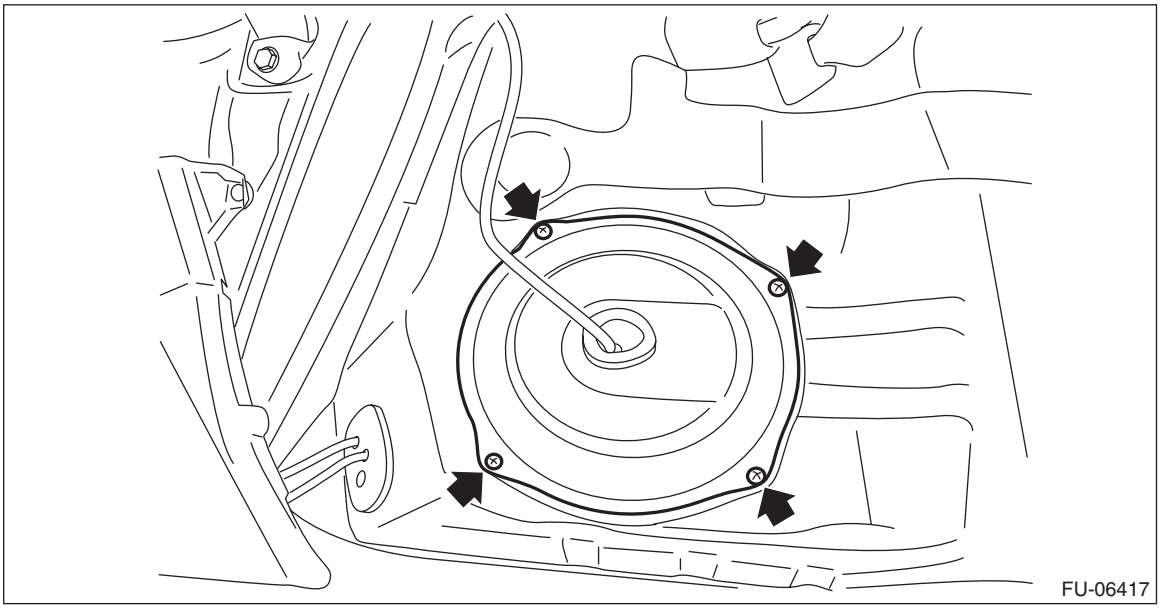
WARNING:
Place “NO OPEN FLAMES” signs near the working area.

CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from the tubes using a container or cloth.**

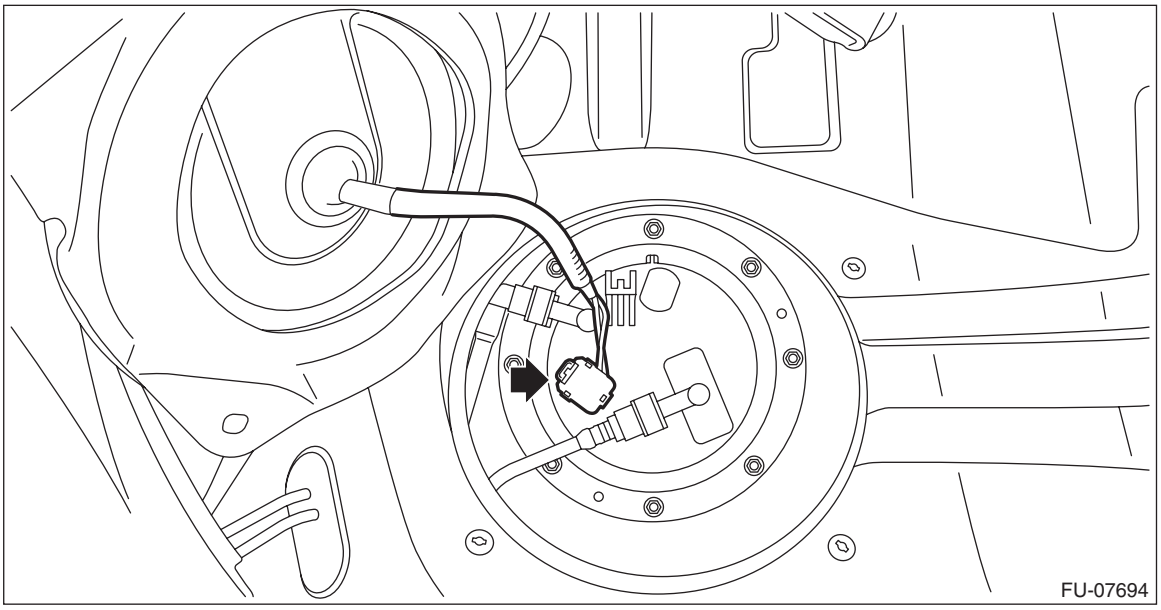
1) Release the fuel pressure. <Ref. to FU(H4DO(w/o HEV))-109, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Drain fuel. <Ref. to FU(H4DO(w/o HEV))-109, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
3) Disconnect the ground cable from battery.



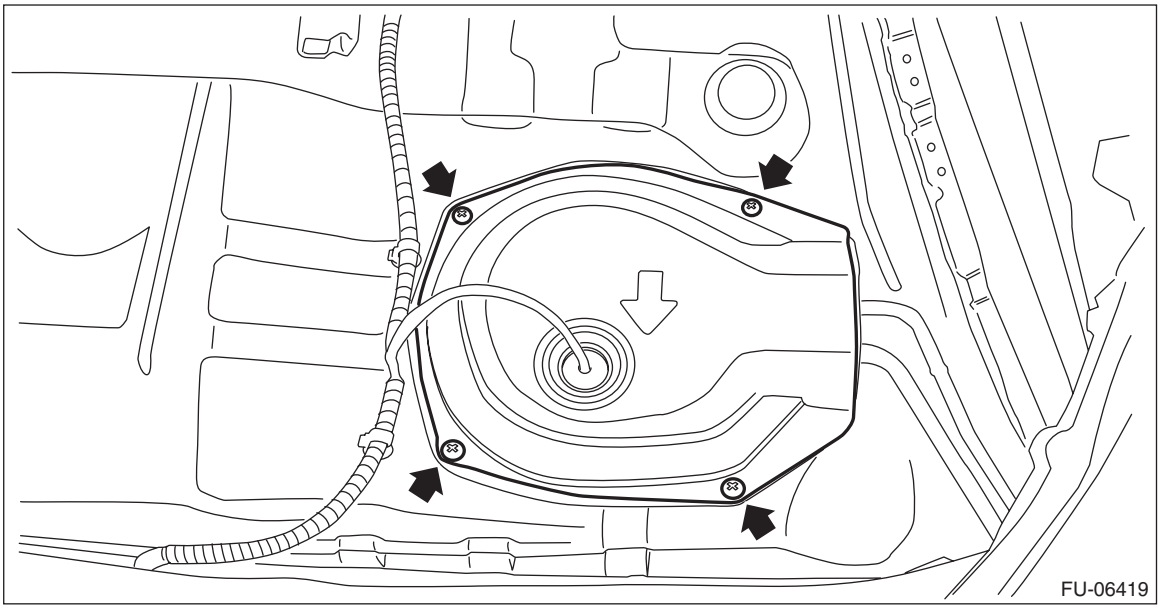
4) Remove the rear seat cushion. <Ref. to SE-23, REMOVAL, Rear Seat.>
5) Remove the service hole cover of fuel pump.



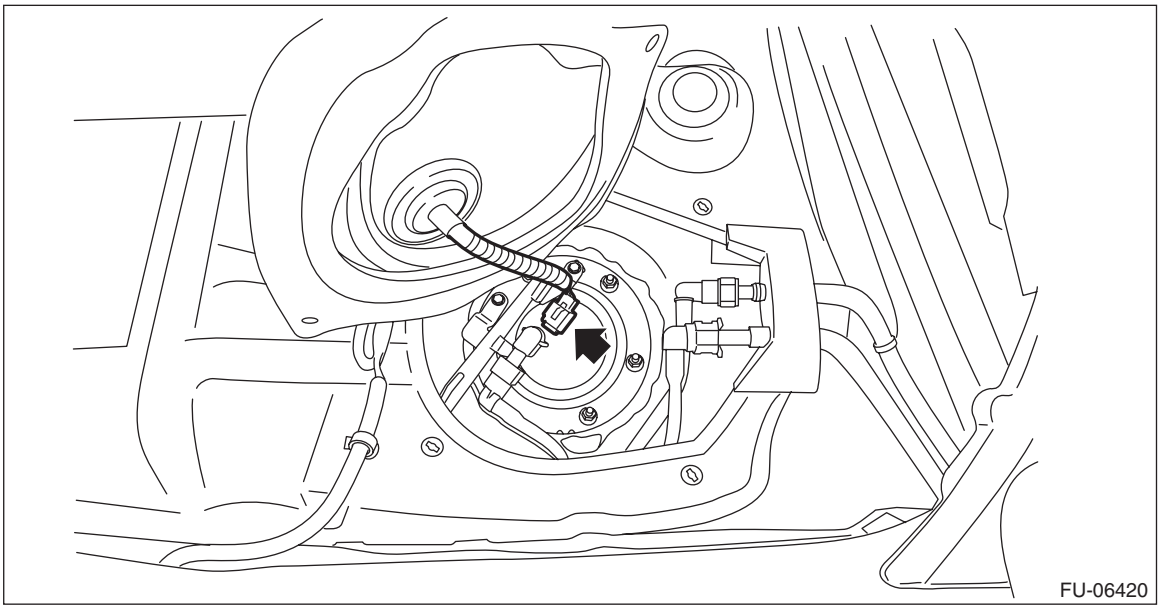
6) Disconnect connectors from the fuel pump, and move aside the service hole cover.



7) Remove the service hole cover of fuel sub level sensor.

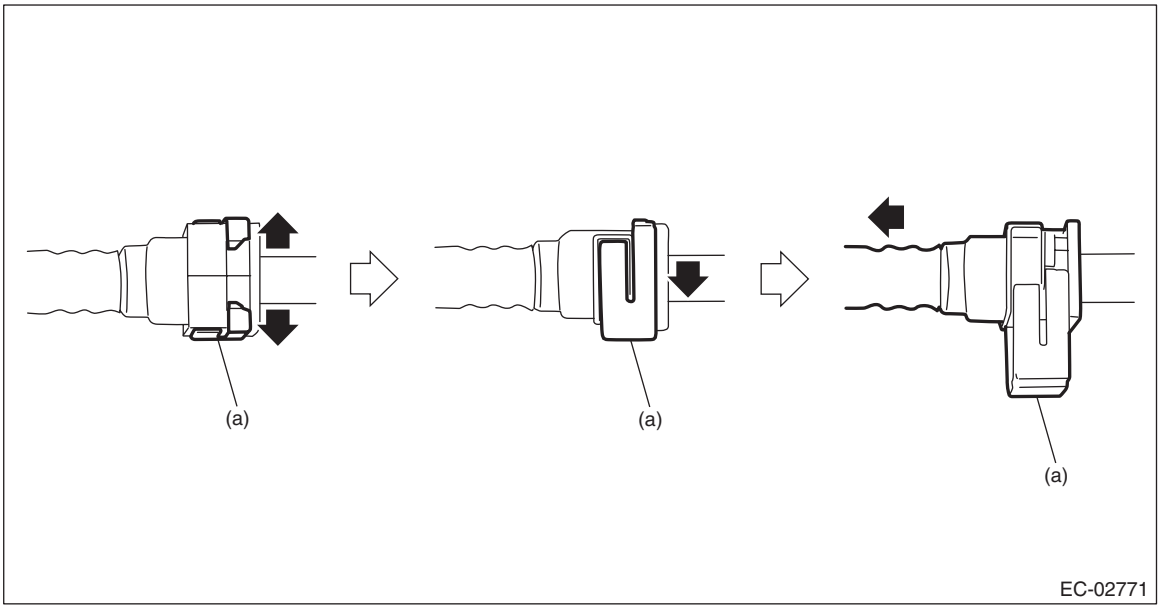


8) Disconnect connectors from the fuel sub level sensor, and move aside the service hole cover.

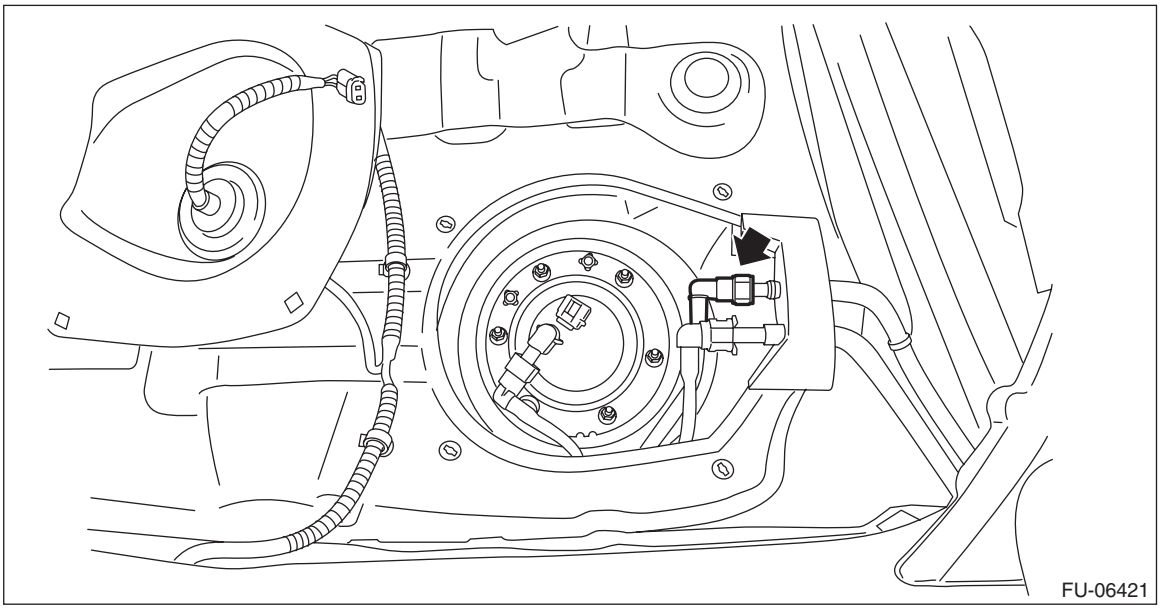


9) Disconnect the quick connector on the fuel delivery tube.

NOTE:
Disconnect the quick connector as shown in the figure.

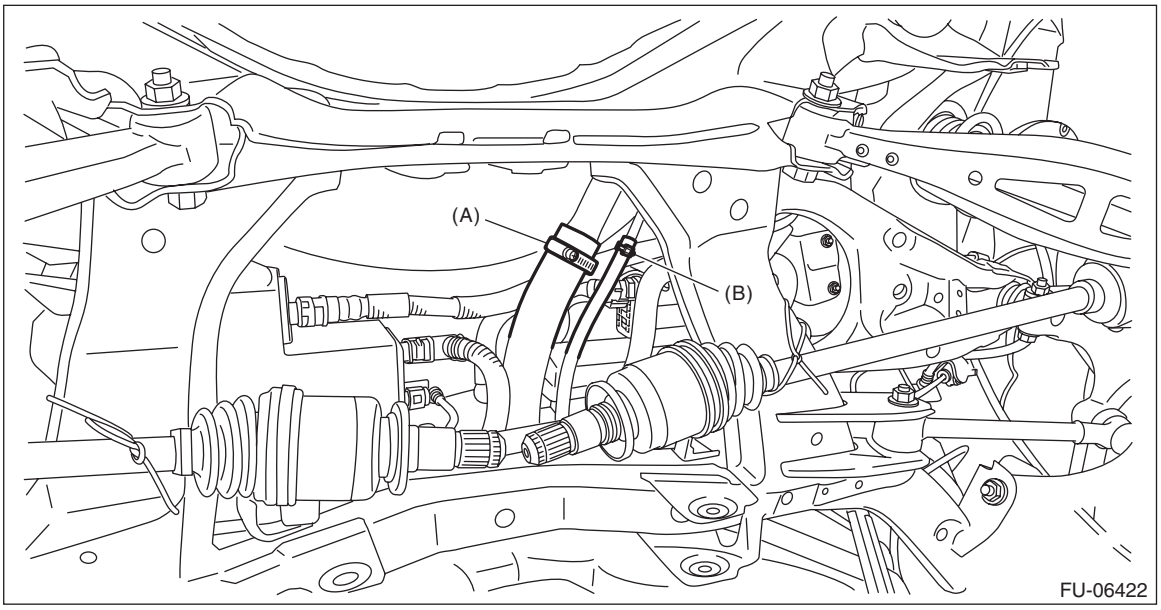


(a) Slider



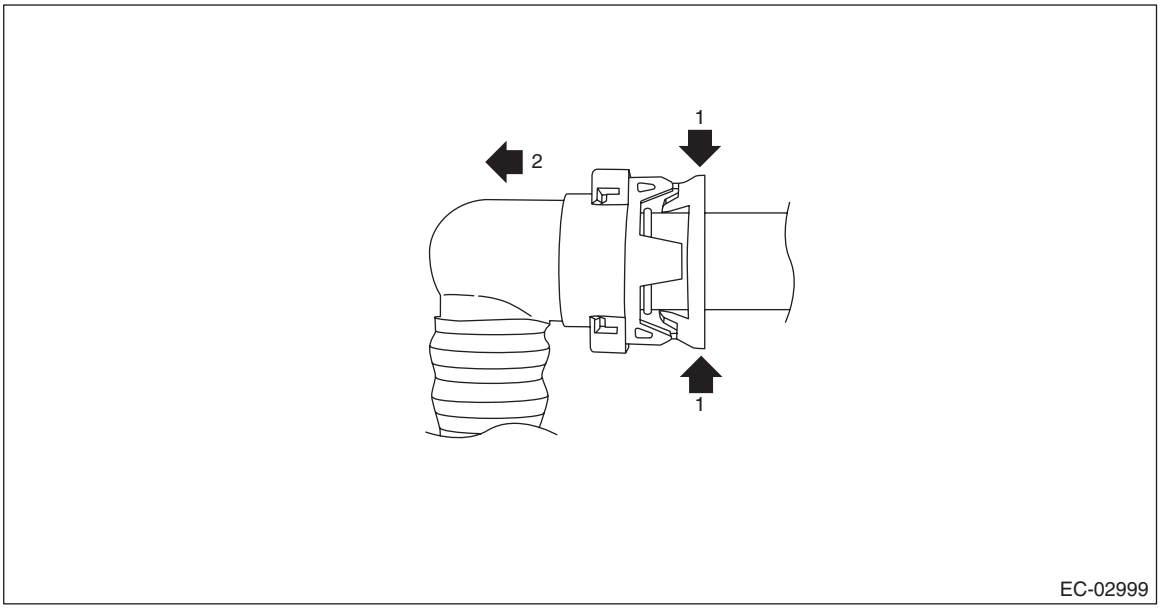
10) Lift up the vehicle.
11) Remove the rear exhaust pipe and muffler. <Ref. to EX(H4DO(w/o HEV))-18, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4DO(w/o HEV))-22, REMOVAL, Muffler.>
12) Remove the rear differential. <Ref. to DI-22, REMOVAL, Rear Differential (T-type).> <Ref. to DI-41, REMOVAL, Rear Differential (VA-type).>

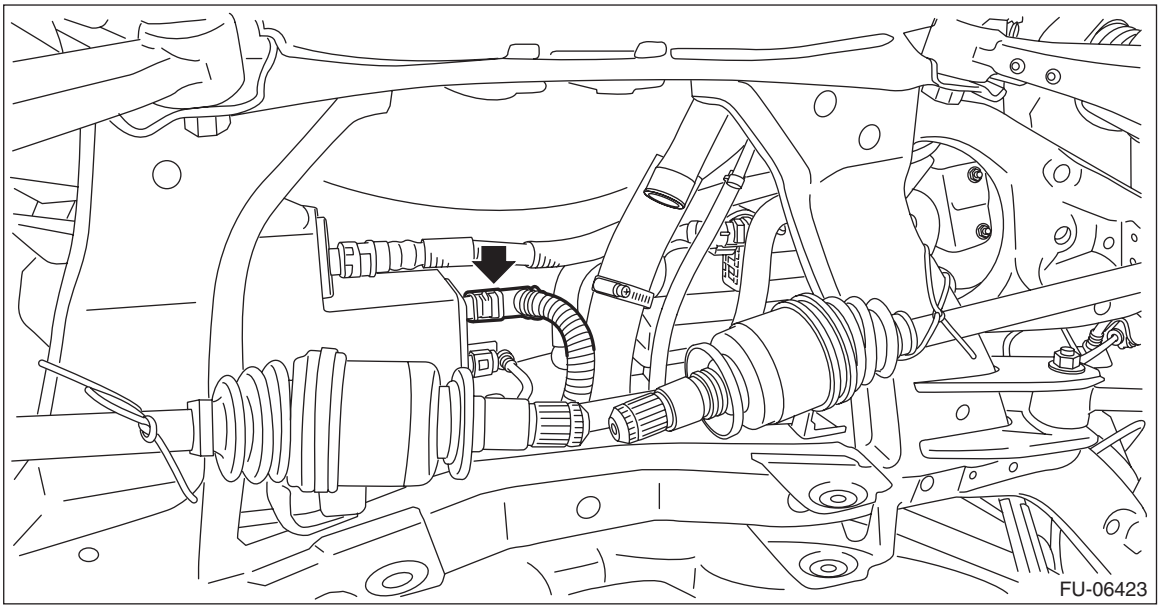
13) Disconnect the fuel filler hose (A) and evaporation hose (B) from the fuel filler pipe assembly.



14) Disconnect the vent tube from canister.

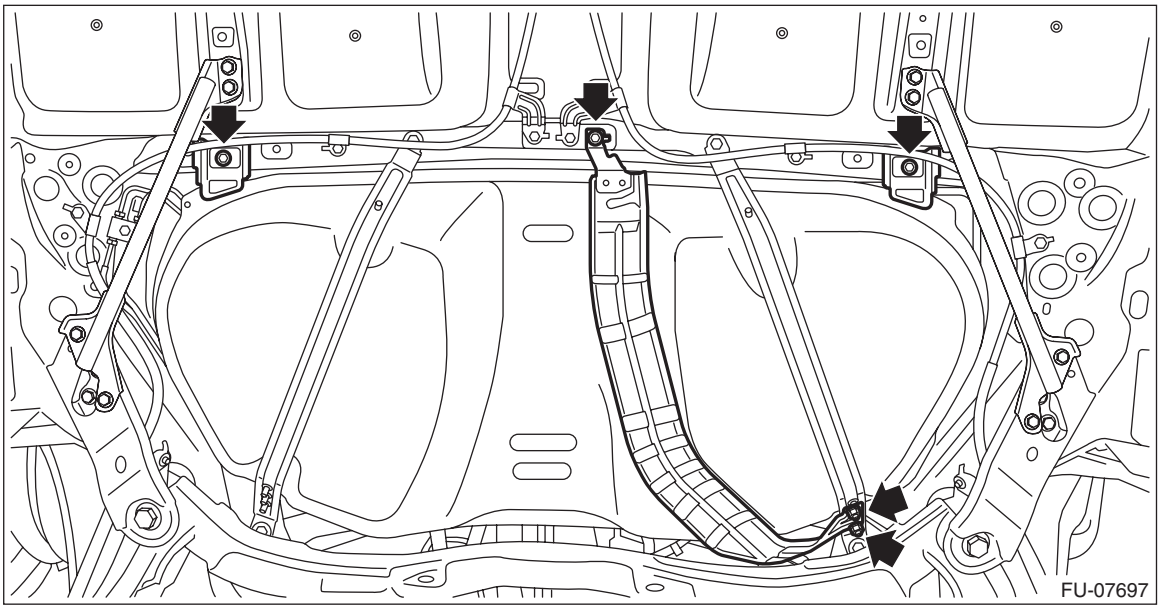
NOTE:
Disconnect the quick connector as shown in the figure.



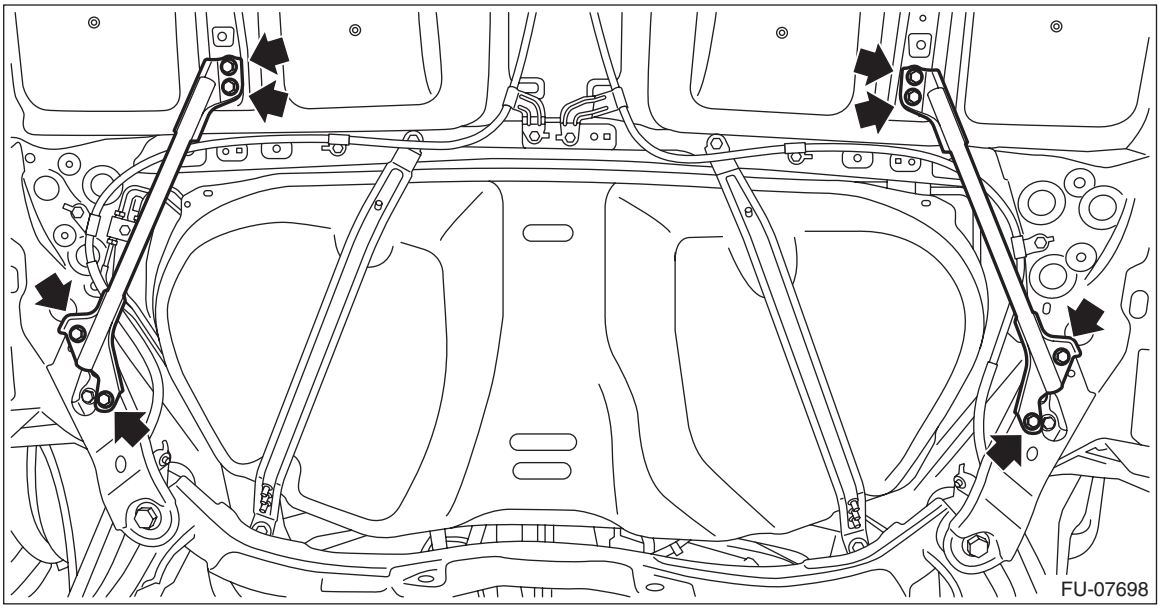


15) Remove the fuel tank protector. <Ref. to FU(H4DO(w/o HEV))-114, REMOVAL, Fuel Tank Protector.>

16) Remove the heat shield cover and stopper.

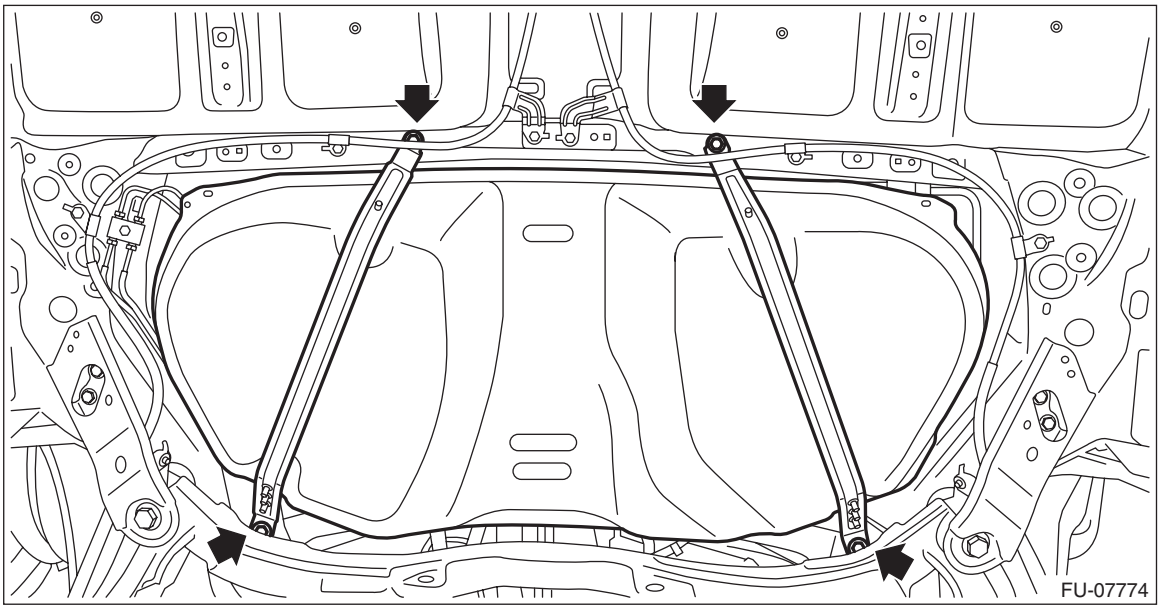


17) Remove the stay - rear frame COMPL. (XV model)



18) Support the fuel tank with a transmission jack, remove the bolts from the fuel tank band, and remove the fuel tank from the vehicle.

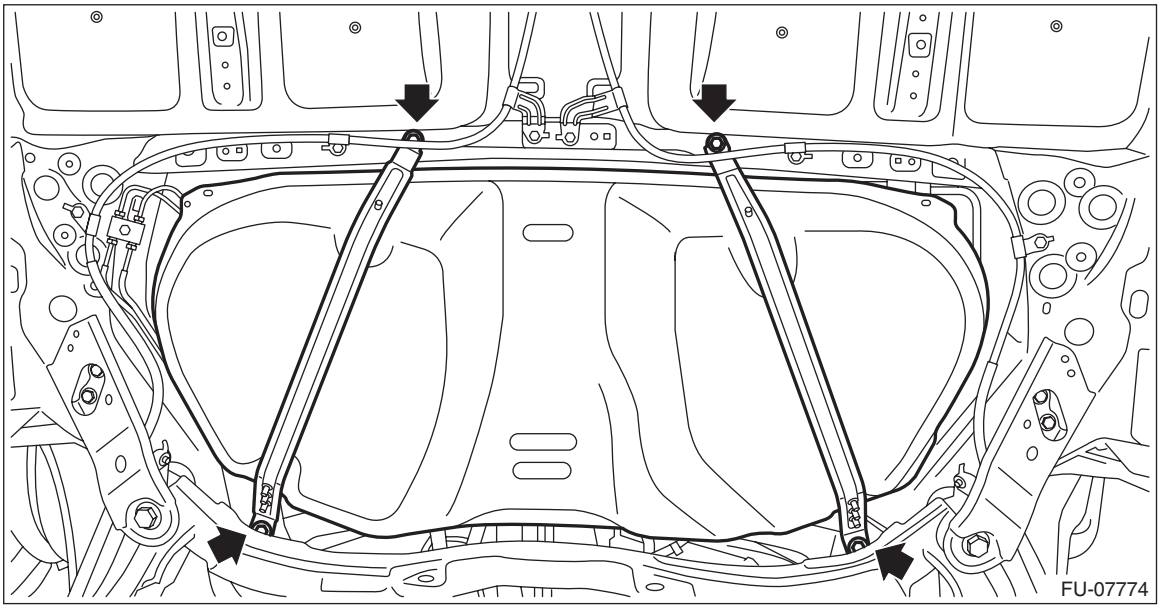
WARNING:
- **A helper is required to perform this work.**
- **Fuel may remain in the fuel tank. This will cause the left and right sides to be unbalanced. Be careful not to drop the fuel tank.**



B: INSTALLATION

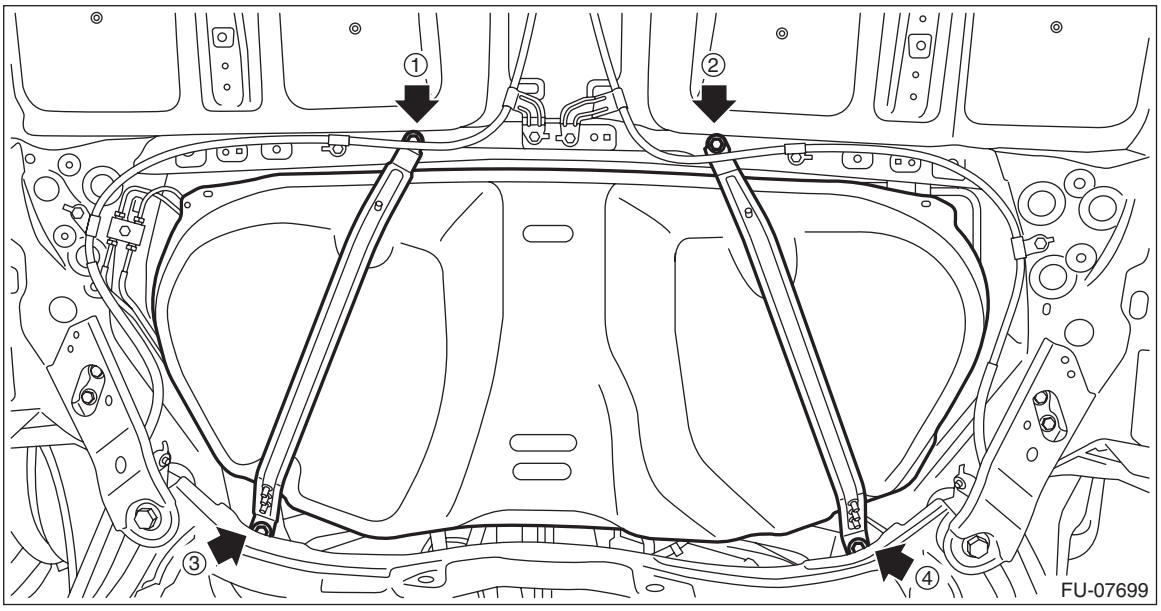
1) Support the fuel tank with a transmission jack, set the fuel tank in place, and temporarily tighten the bolts of the fuel tank band.

WARNING:
A helper is required to perform this work.



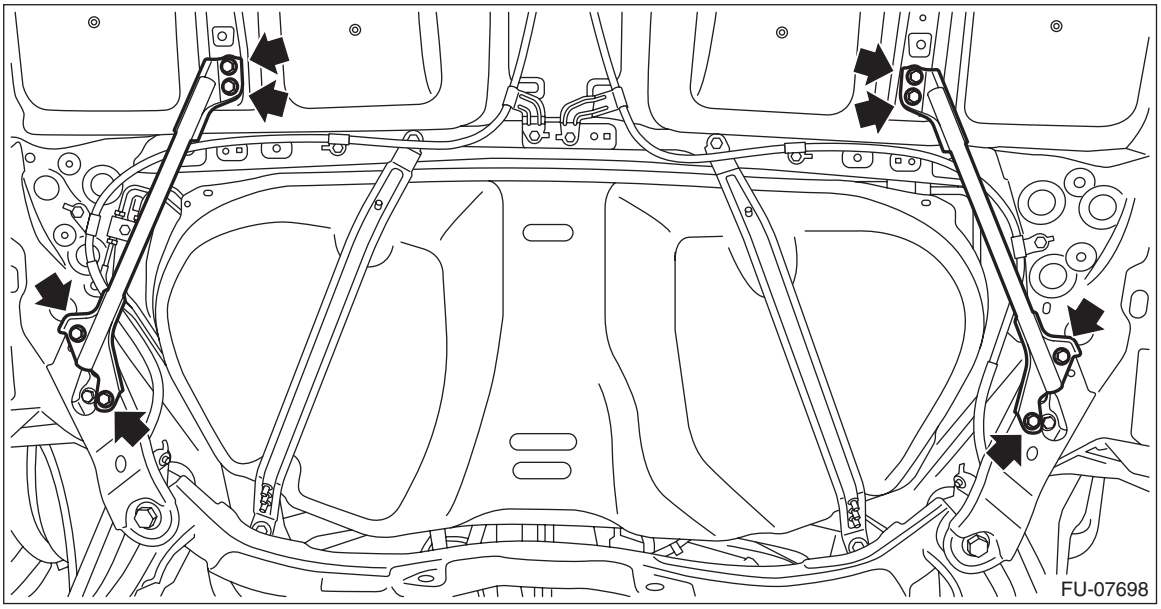
2) Tighten the bolts of the fuel tank band in the order shown in the figure.

Tightening torque:
33 N·m (3.4 kgf-m, 24.3 ft-lb)



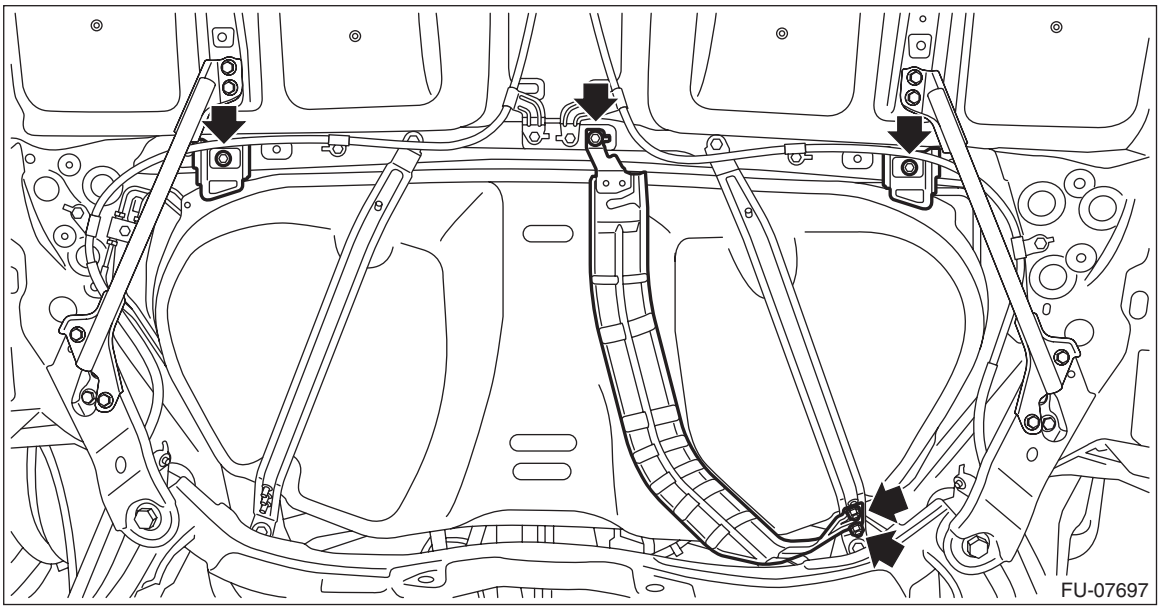
3) Install the stay - rear frame COMPL. (XV model)

Tightening torque:
33 N·m (3.4 kgf-m, 24.3 ft-lb)



4) Install the heat shield cover and stopper.

Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)

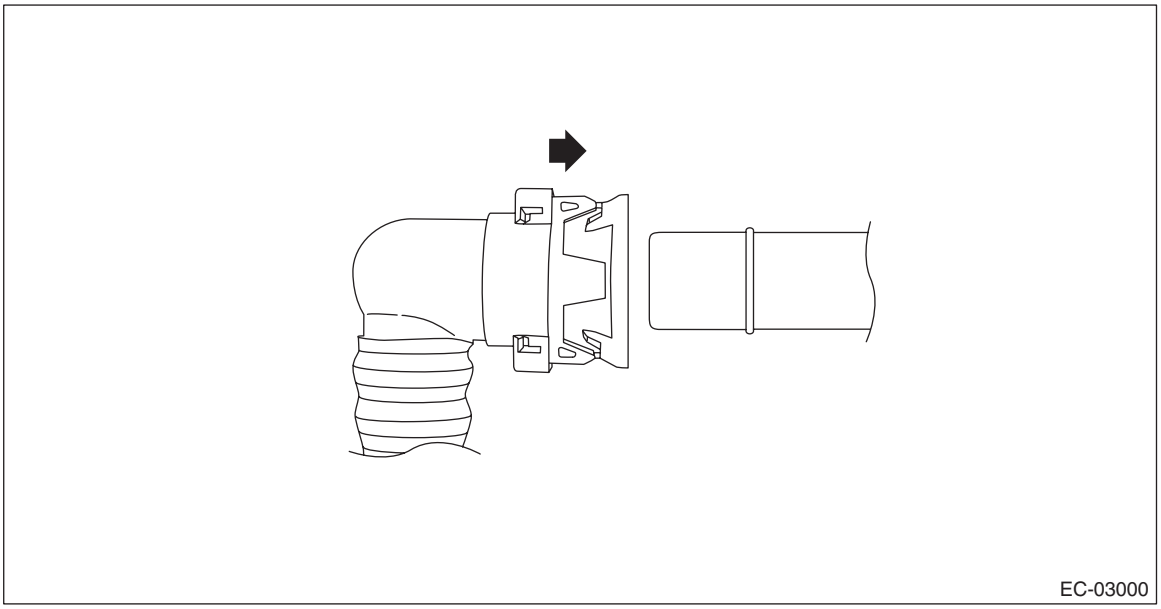


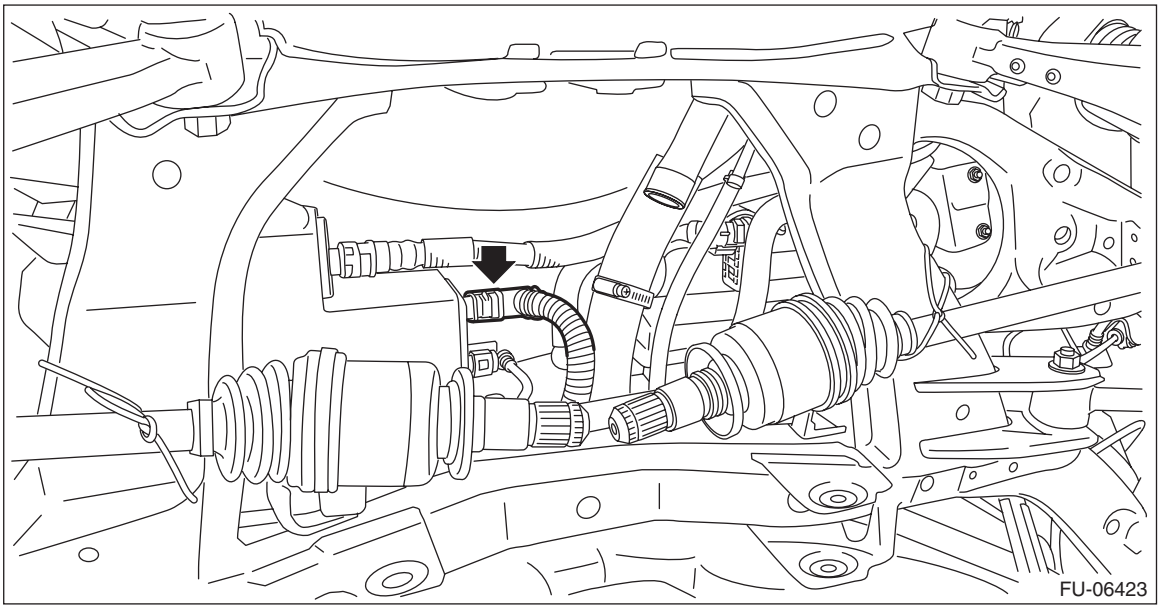
5) Install the fuel tank protector. <Ref. to FU(H4DO(w/o HEV))-115, INSTALLATION, Fuel Tank Protector.>

6) Connect the vent tube to the canister.

CAUTION:
• Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
• Make sure that the quick connector is securely connected.

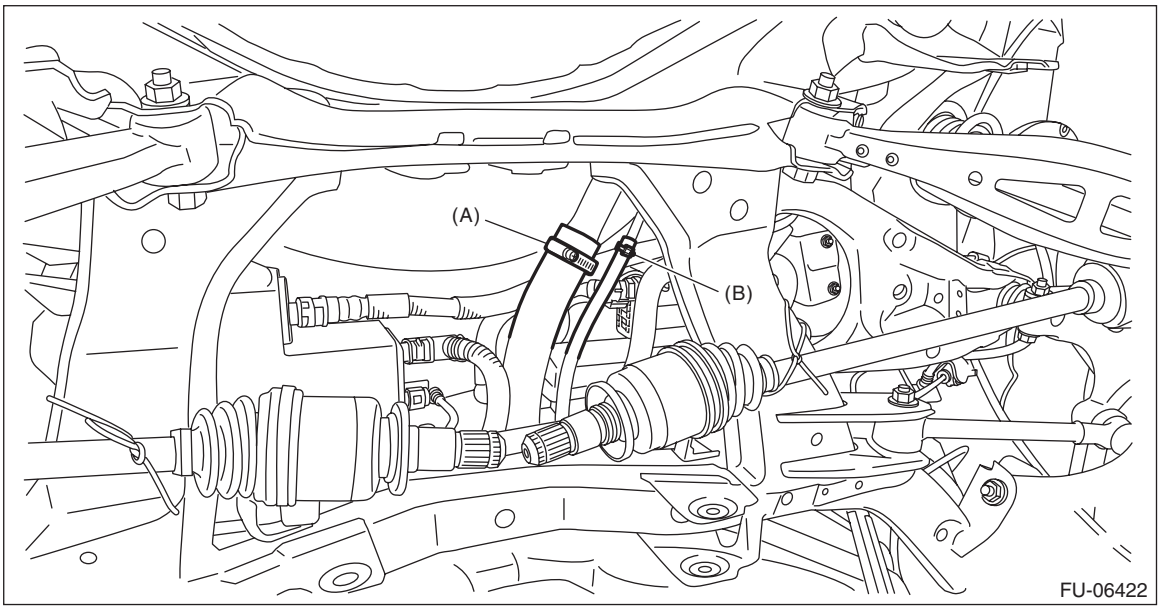
NOTE:
Connect the quick connector as shown in the figure.

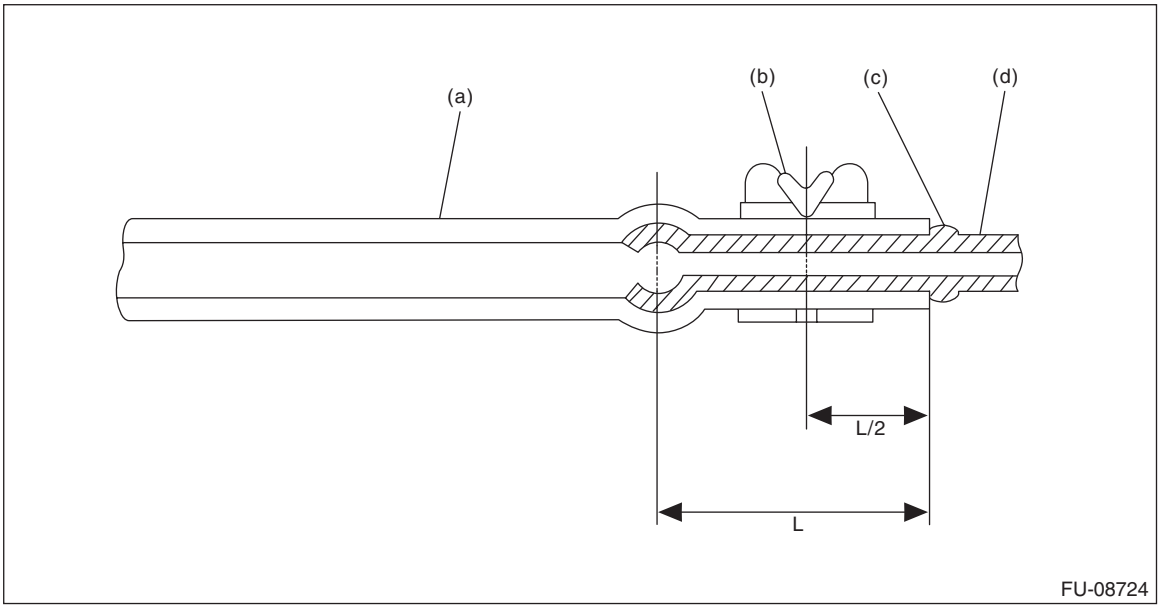




7) Securely insert the fuel filler hose (A) and evaporation hose (B) until the hose end contacts the spool, then attach the clamp or clip as shown in the figure.

Tightening torque:
2.5 N·m (0.3 kgf-m, 1.8 ft-lb)





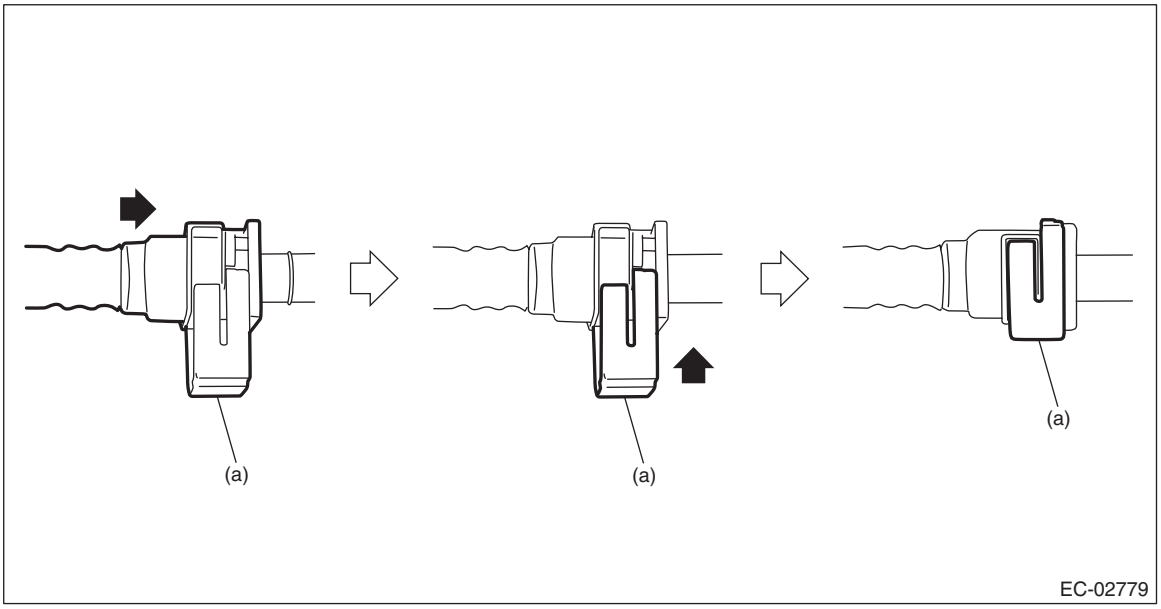
(a) Hose
(b) Clamp or clip
(c) Spool or bump
(d) Pipe

8) Install the rear differential. <Ref. to DI-24, INSTALLATION, Rear Differential (T-type).> <Ref. to DI-41, INSTALLATION, Rear Differential (VA-type).>
9) Install the rear exhaust pipe and muffler. <Ref. to EX(H4DO(w/o HEV))-20, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4DO(w/o HEV))-25, INSTALLATION, Muffler.>

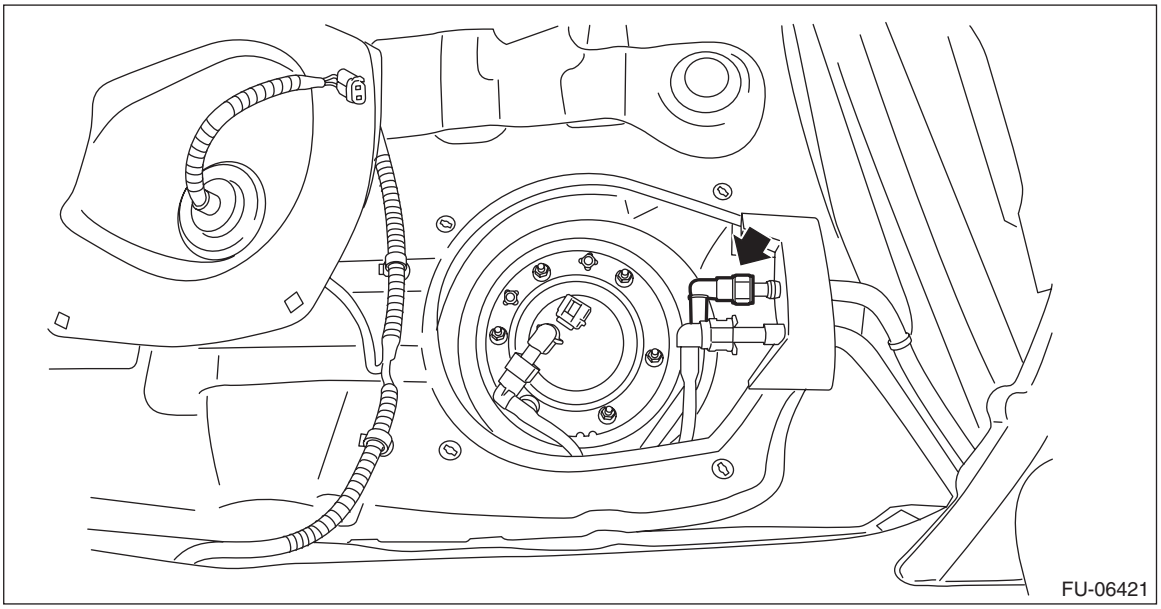
10) Connect the quick connector of the fuel delivery tube.

CAUTION:
• Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
• When connecting the quick connector, make sure to insert it all the way in before locking the slider.
• When it is difficult to lock the slider, check that the connector is fully inserted.
• After locking the slider, check again that the quick connector is securely connected.

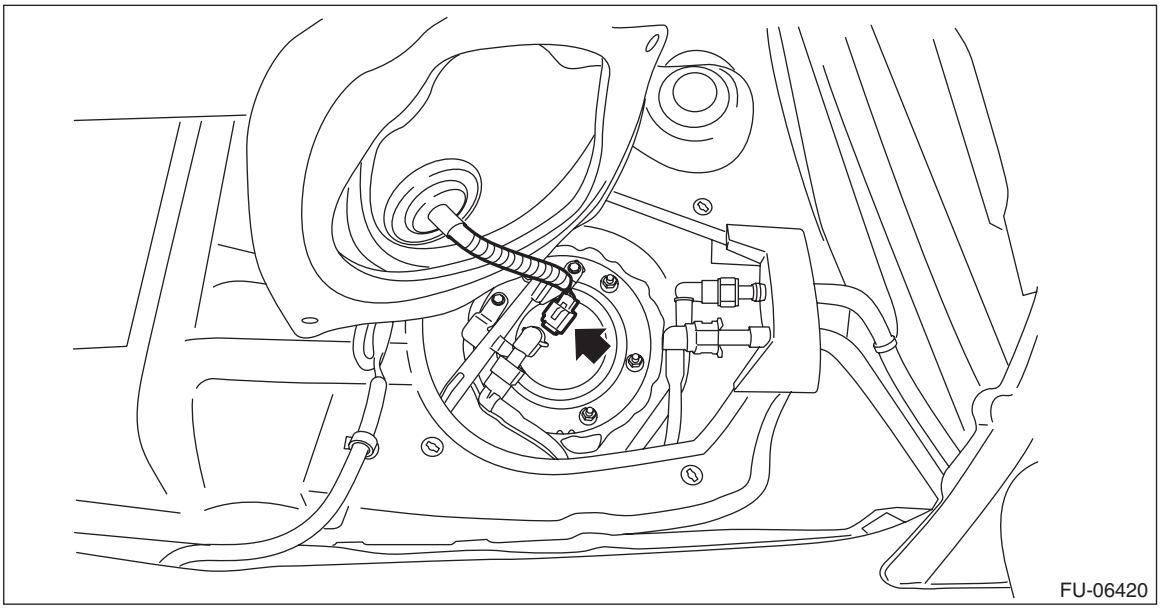
NOTE:
Connect the quick connector as shown in the figure.



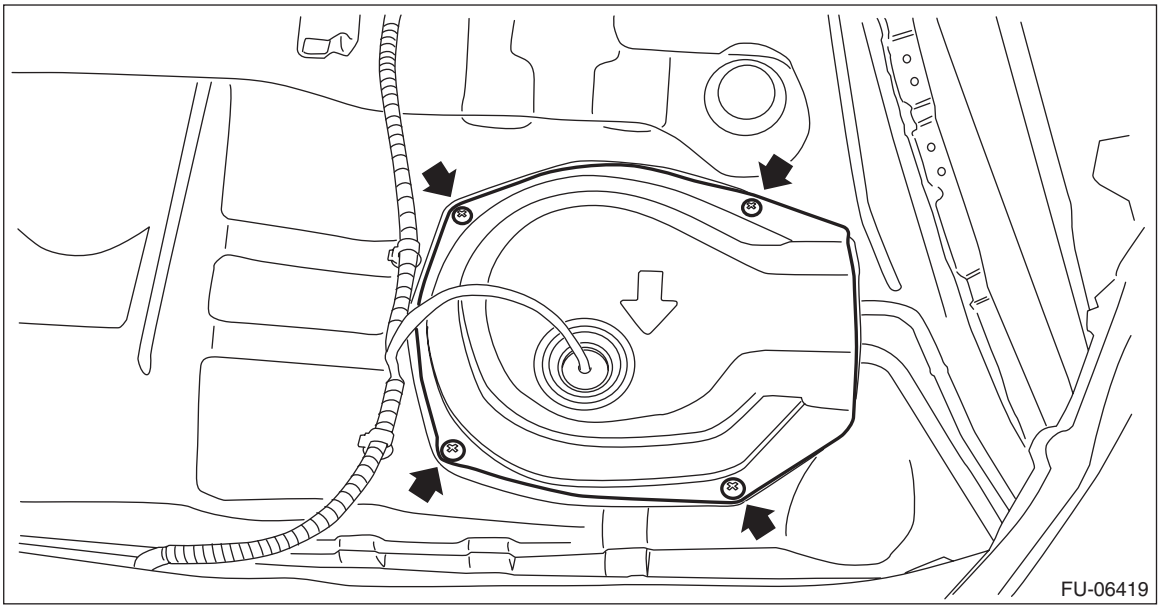
(a) Slider



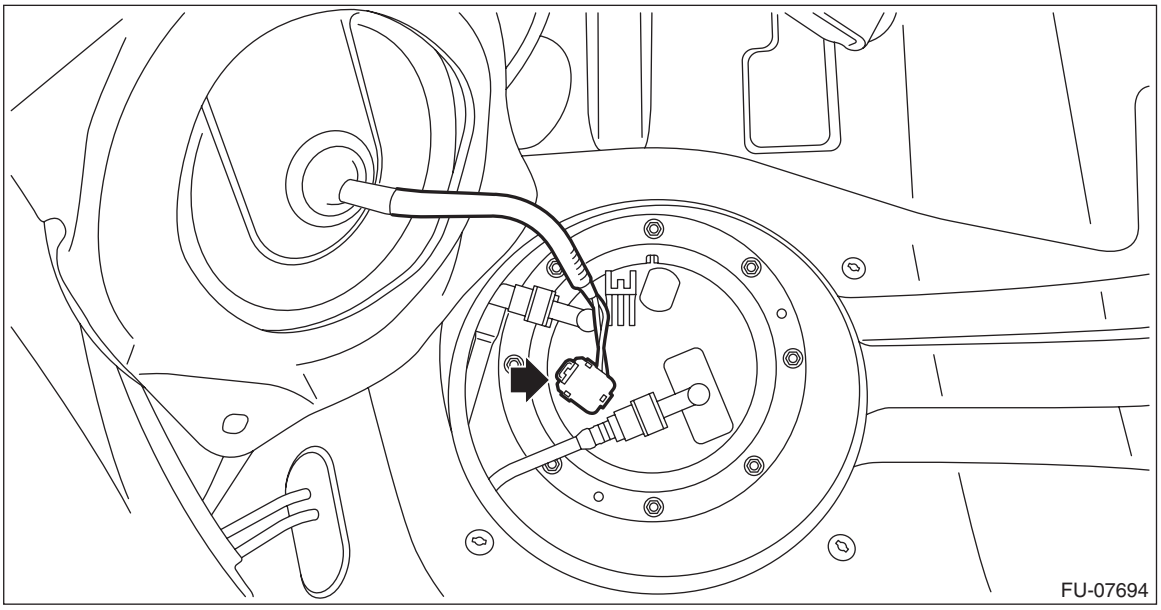
11) Connect the connector to the fuel sub level sensor.



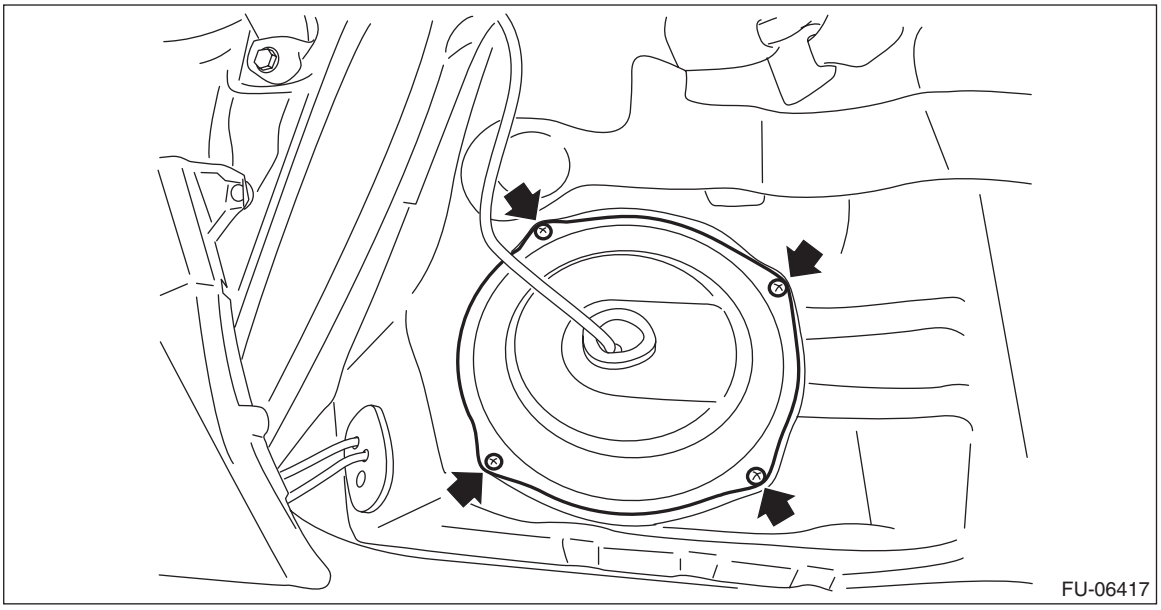
12) Install the service hole cover of fuel sub level sensor.



13) Connect the connector to the fuel pump.

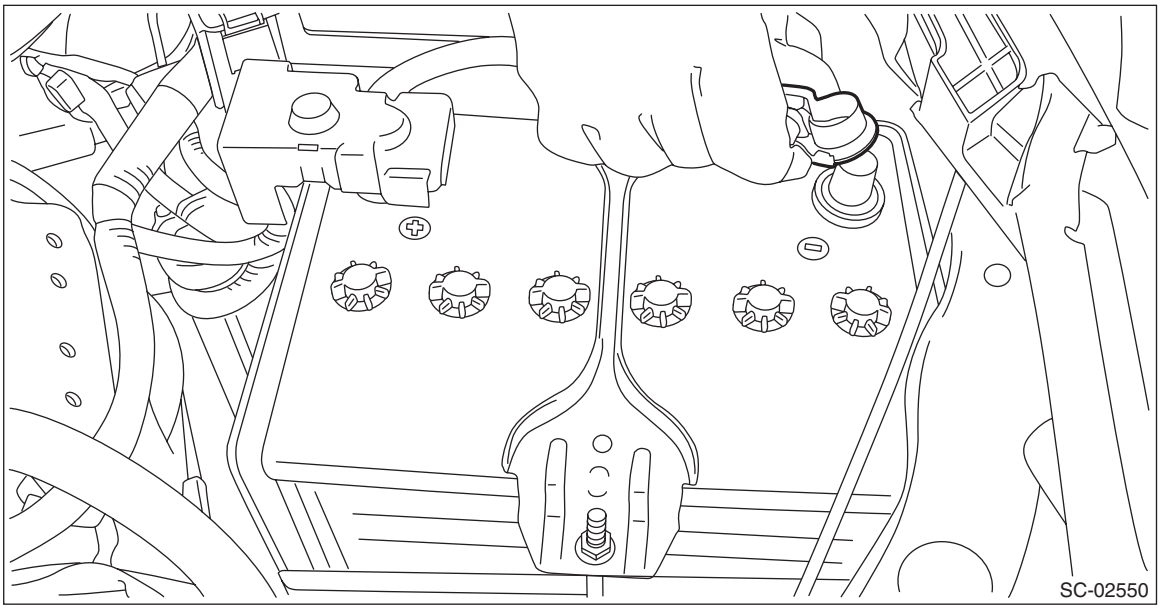


14) Install the service hole cover of fuel pump.



15) Install the rear seat cushion. <Ref. to SE-27, INSTALLATION, Rear Seat.>

16) Connect the battery ground terminal.



C: INSPECTION

1) Check that the fuel tank and fuel pipe have no deformation, cracks and other damages.
2) Check that the fuel hose and tube have no cracks, damage or loose part.

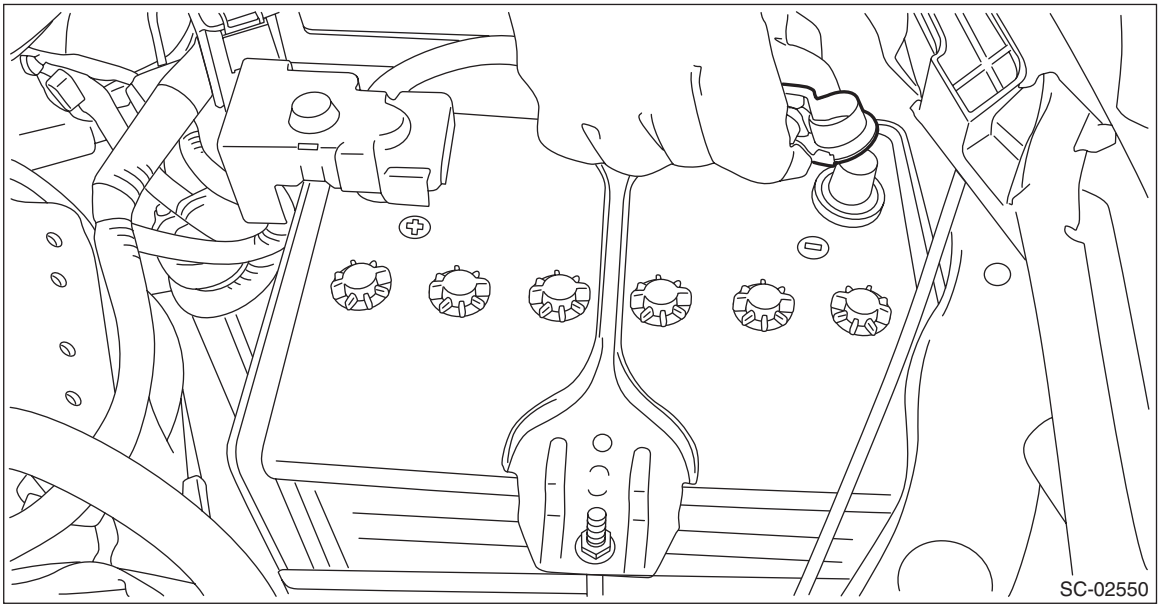
27.Fuel Filler Pipe

A: REMOVAL

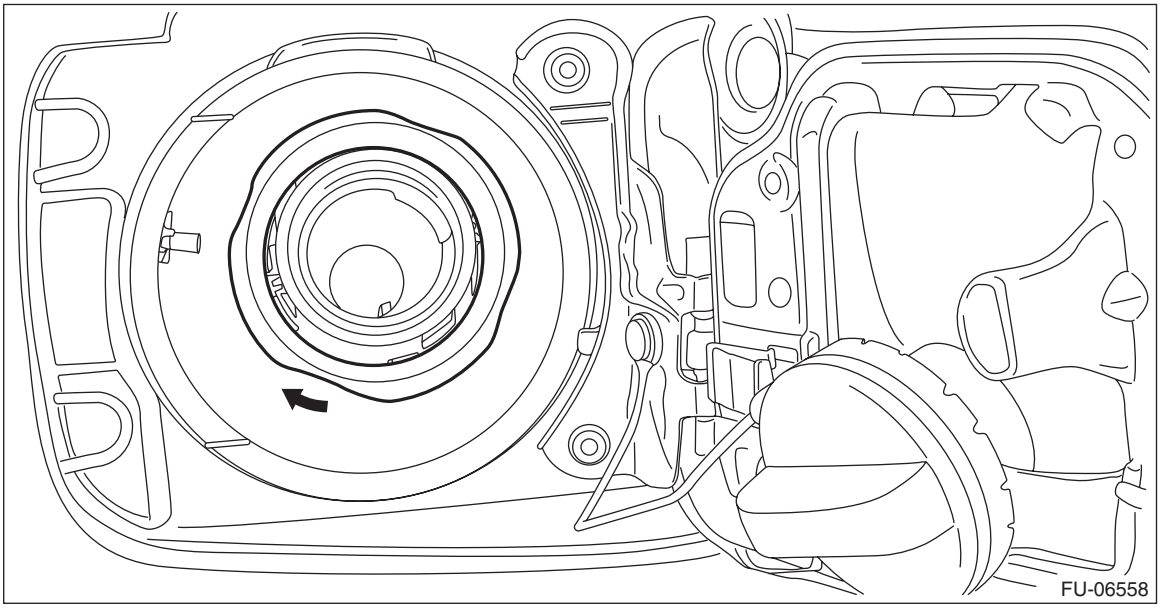
WARNING:
Place “NO OPEN FLAMES” signs near the working area.

CAUTION:
Be careful not to spill fuel.

1) Release the fuel pressure. <Ref. to FU(H4DO(w/o HEV))-109, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Drain fuel. <Ref. to FU(H4DO(w/o HEV))-109, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
3) Disconnect the ground cable from battery.

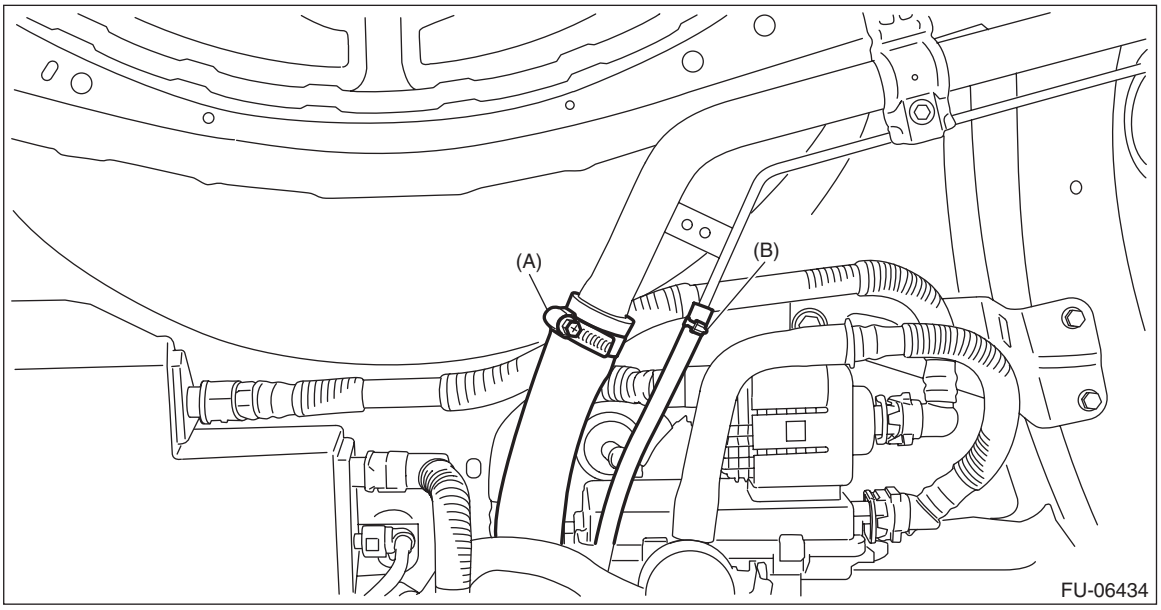


4) Open the fuel filler lid and remove the fuel filler cap.
5) Turn the fuel filler pipe protector in the direction of the arrow to unlock and remove it.

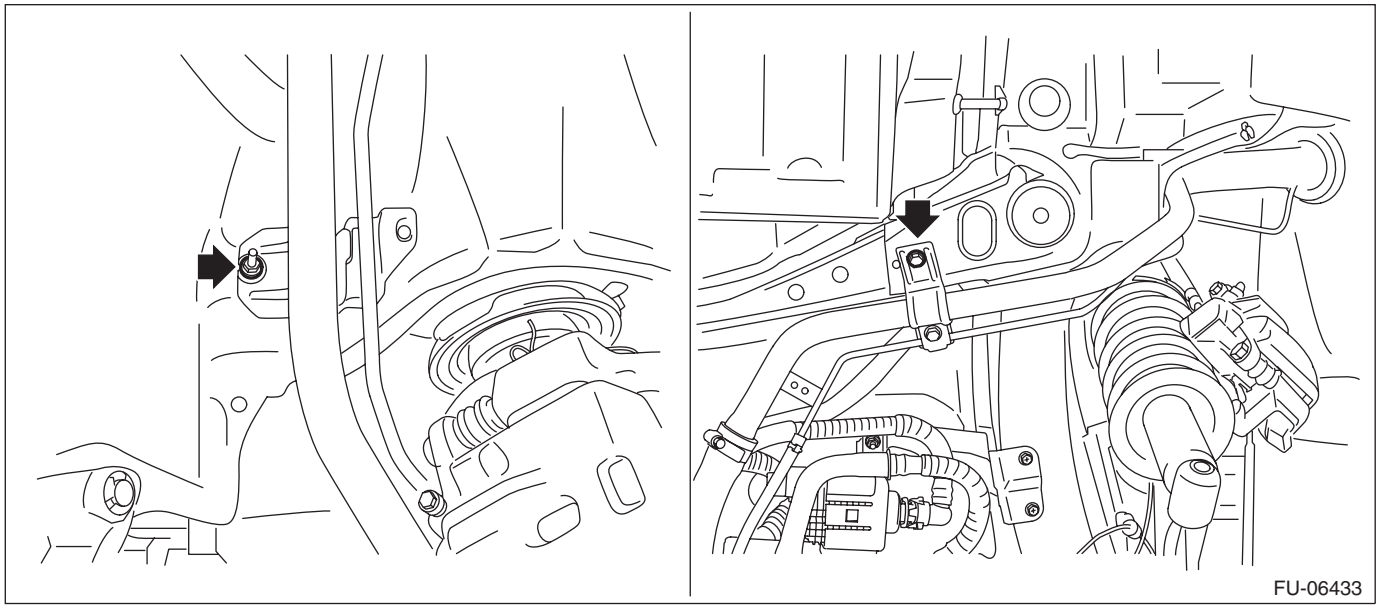


6) Remove the rear sub frame assembly. <Ref. to RS-9, REMOVAL, Rear Sub Frame.>
7) Remove the rear mud guard RH. <Ref. to EI-33, REMOVAL, Mud Guard.>

8) Disconnect the fuel filler hose (A) and evaporation hose (B) from the fuel filler pipe assembly.



9) Remove the bolts and nuts which secure the fuel filler pipe assembly to the vehicle.

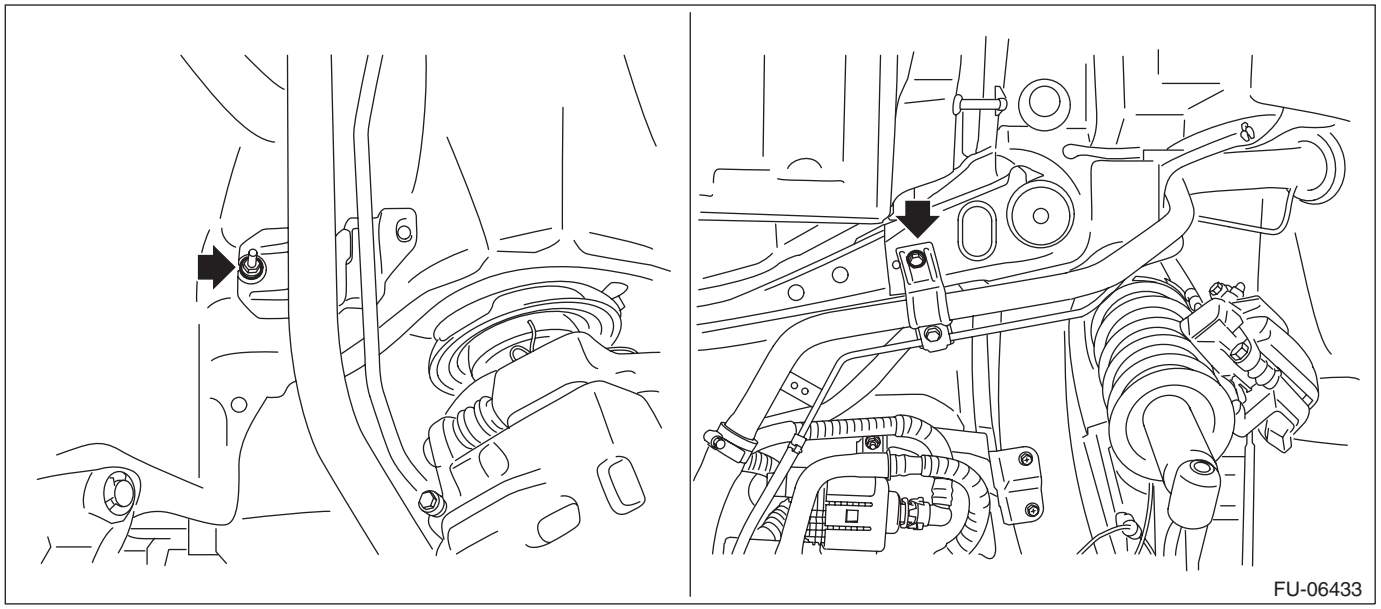


10) Remove the fuel filler pipe assembly from the underside of the vehicle.

B: INSTALLATION

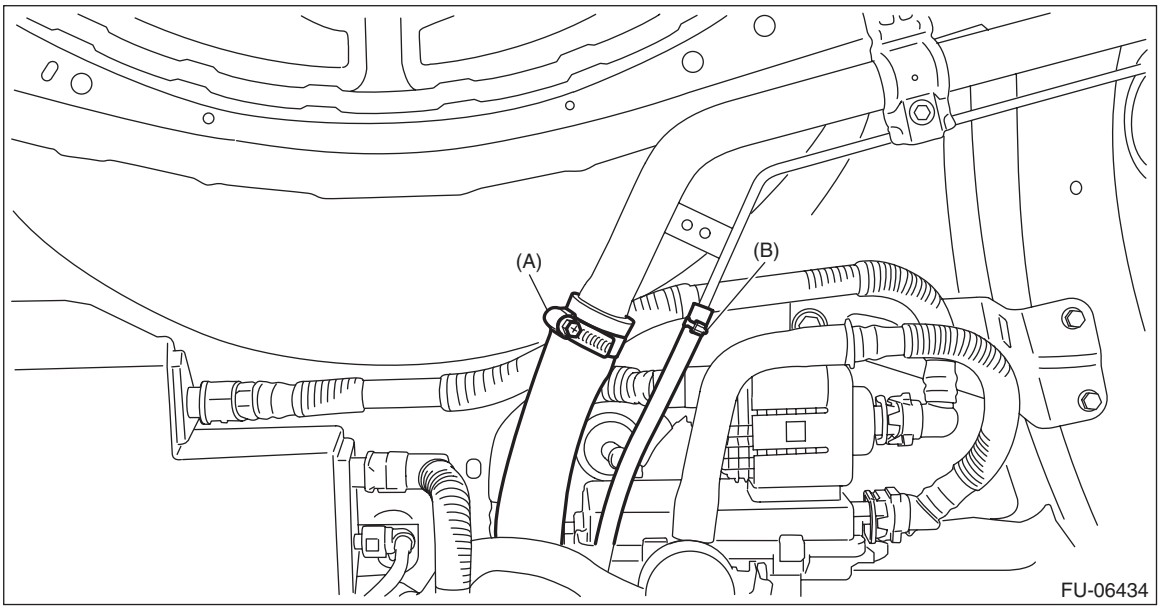
1) Open the fuel filler lid.
2) Insert the fuel filler pipe assembly into the rubber saucer from inside of the rear fender.
3) Install the fuel filler pipe assembly to the vehicle.

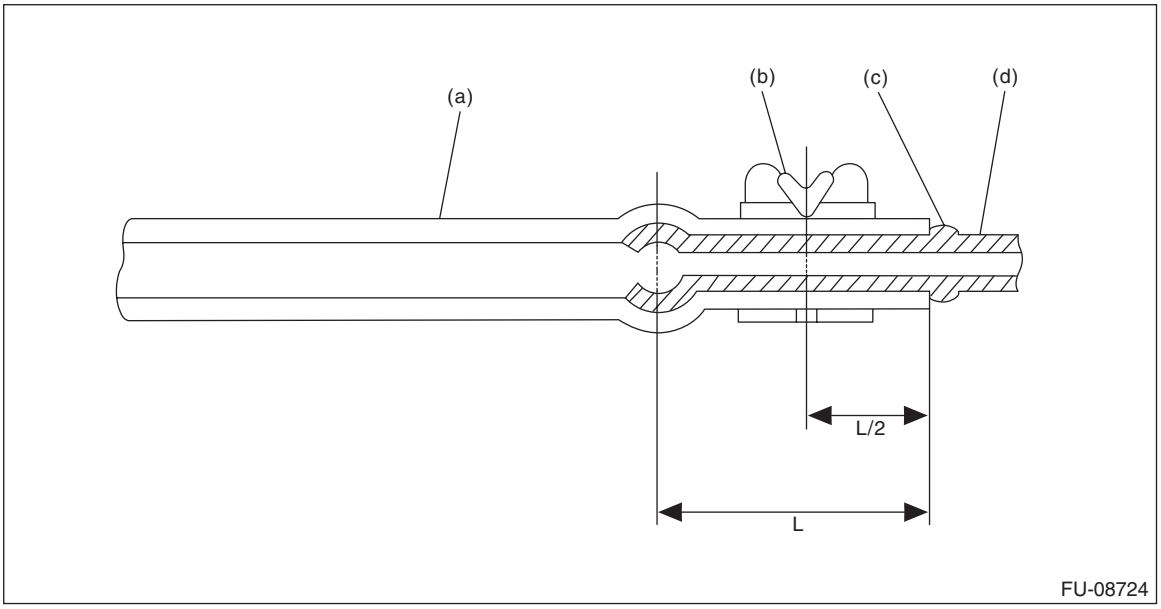
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



4) Securely insert the fuel filler hose (A) and evaporation hose (B) until the hose end contacts the spool, then attach the clamp or clip as shown in the figure.

Tightening torque:
2.5 N·m (0.3 kgf-m, 1.8 ft-lb)

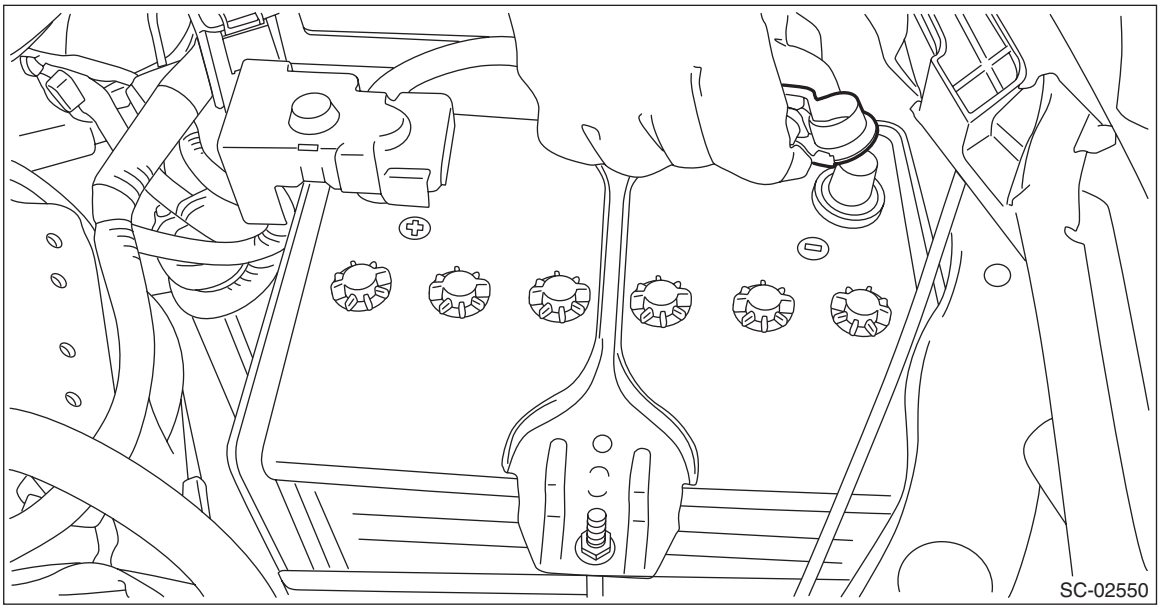




(a) Hose
(b) Clamp or clip
(c) Spool or bump
(d) Pipe

5) Install the rear mud guard RH. <Ref. to EI-33, INSTALLATION, Mud Guard.>
6) Install the rear sub frame assembly. <Ref. to RS-15, INSTALLATION, Rear Sub Frame.>

7) Connect the battery ground terminal.



8) Inspect the wheel alignment and adjust if necessary.
9) Perform reinitialization of the auto headlight beam leveler system. (Model with auto headlight beam leveler) <Ref. to LI-20, PROCEDURE, Auto Headlight Beam Leveler System.>
10) Adjust the steering angle sensor. <Ref. to VDC-26, ADJUSTMENT, VDC Control Module and Hydraulic Control Unit (VDCCM&H/U).>

C: INSPECTION

1) Check that the fuel filler pipe assembly has no deformation, cracks or other damages.
2) Check that the fuel hose has no cracks, damage or loose part.

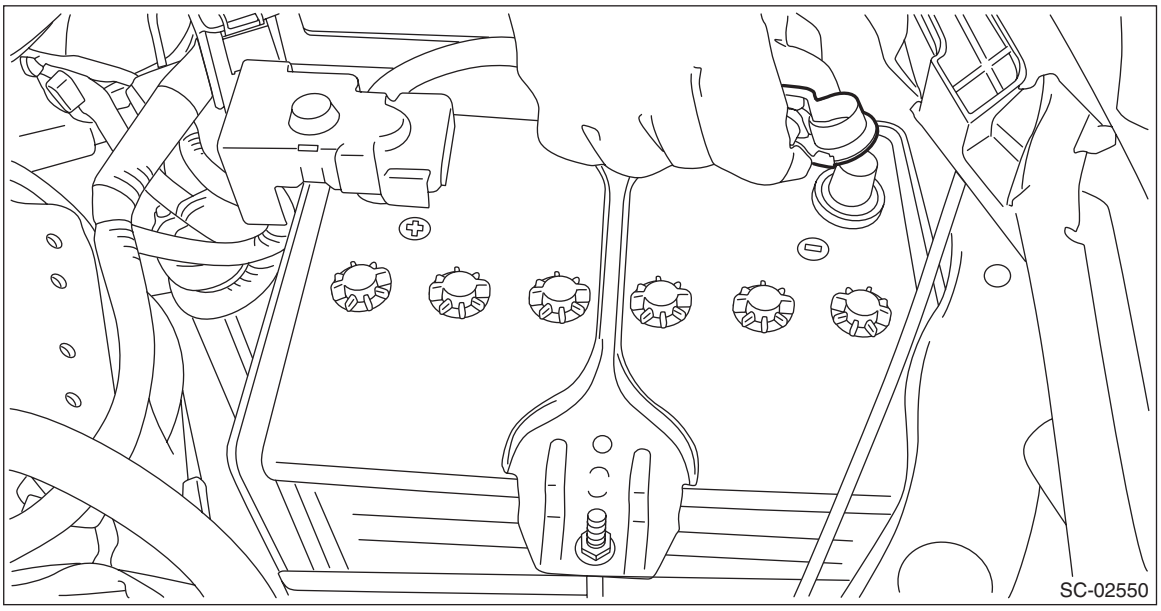
28.Fuel Pump

A: REMOVAL

WARNING:
Place “NO OPEN FLAMES” signs near the working area.

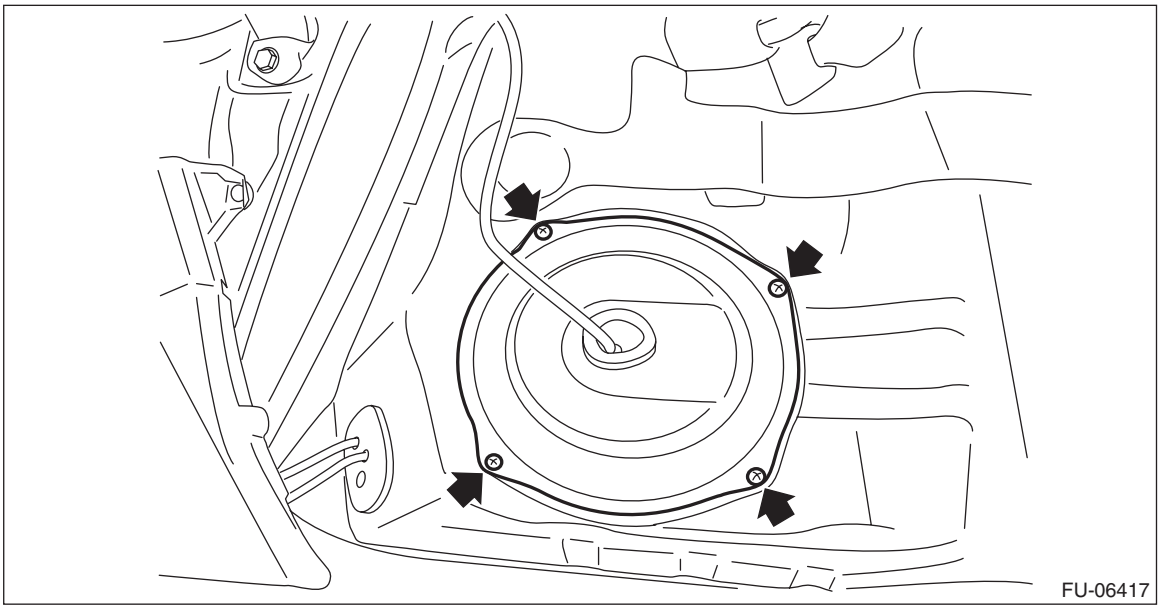
CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from the tubes using a container or cloth.**
- **If the fuel gauge indicates that two thirds or more of the fuel is remaining, be sure to drain fuel before starting work to avoid the fuel to spill.**

NOTE:
Fuel pump assembly consists of fuel pump, fuel filter and fuel level sensor.
1) Release the fuel pressure. <Ref. to FU(H4DO(w/o HEV))-109, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Drain fuel. <Ref. to FU(H4DO(w/o HEV))-109, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
3) Disconnect the ground cable from battery.

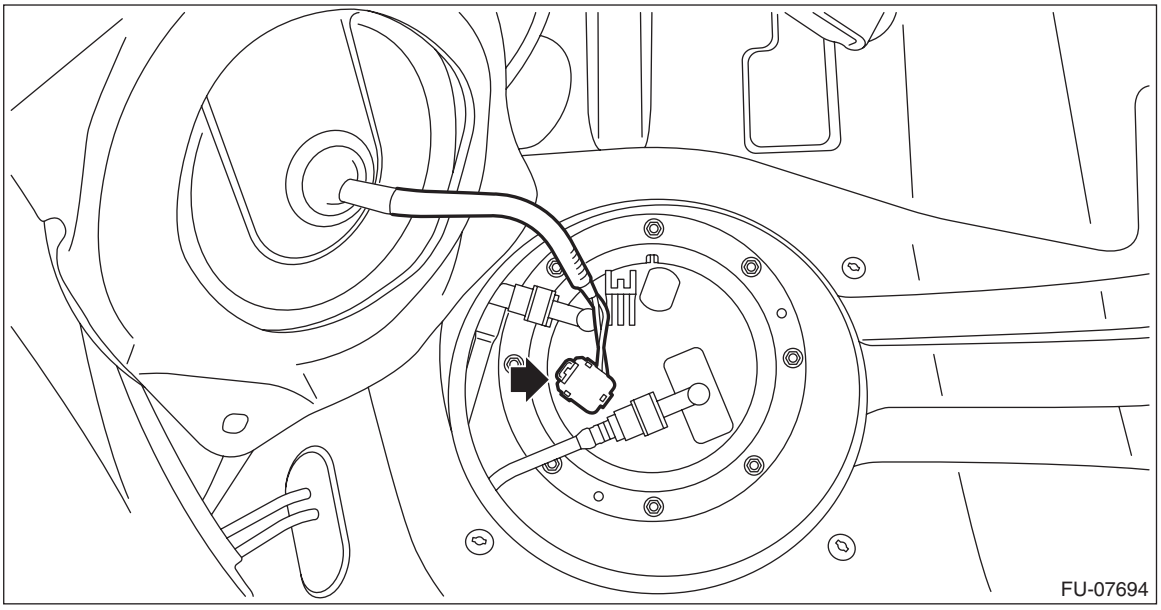


4) Remove the rear seat cushion. <Ref. to SE-23, REMOVAL, Rear Seat.>

5) Remove the service hole cover of fuel pump.

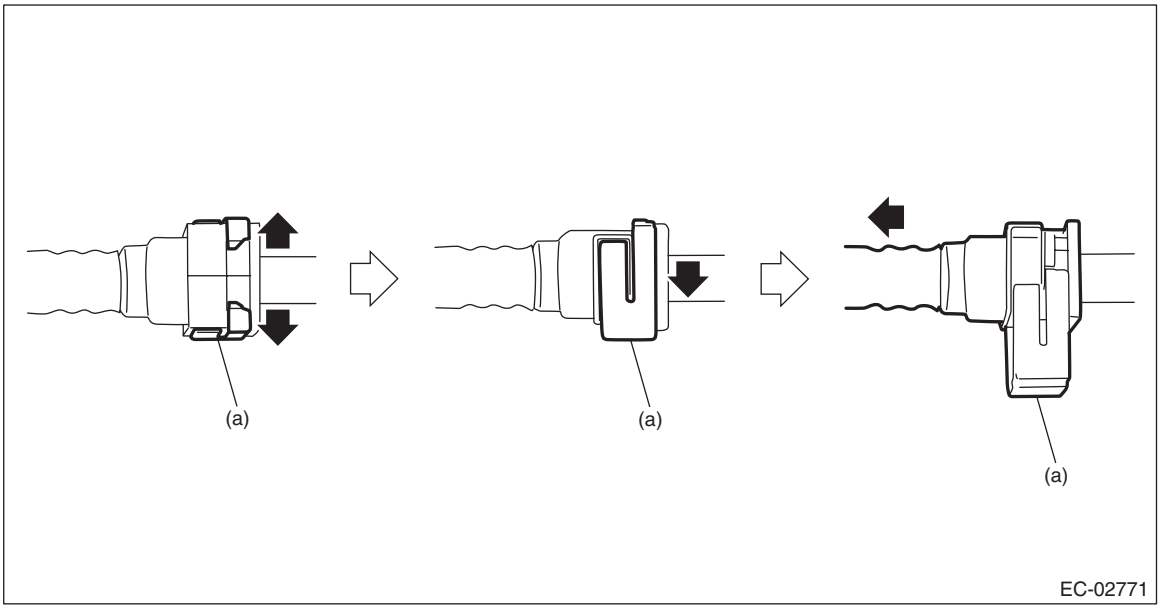


6) Disconnect connectors from the fuel pump, and move aside the service hole cover.

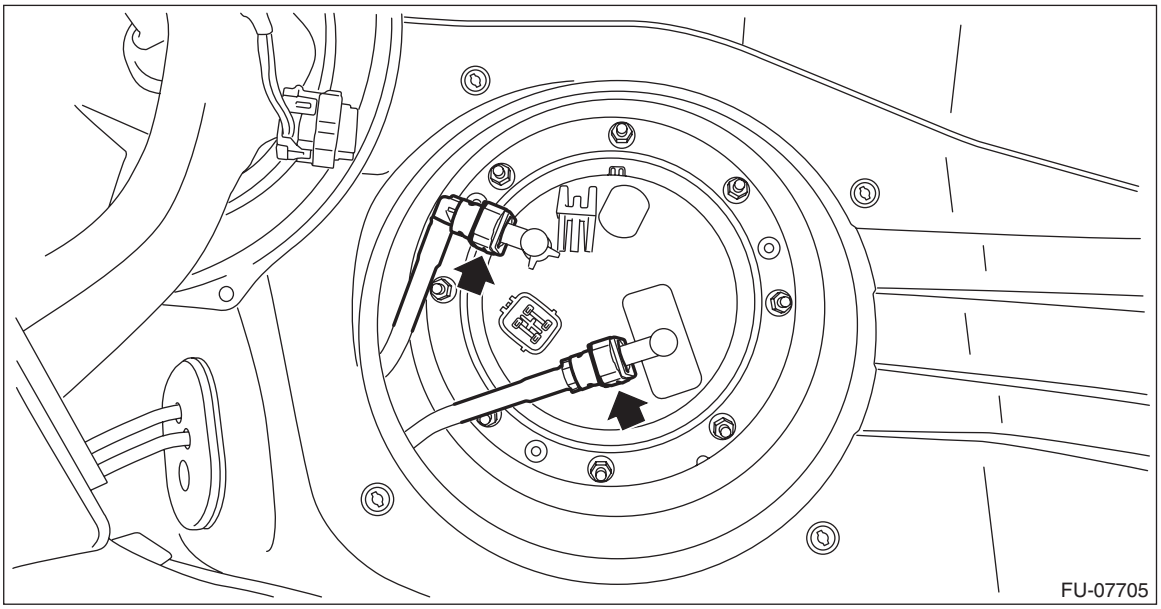


7) Disconnect the quick connector of fuel delivery tube and jet pump tube.

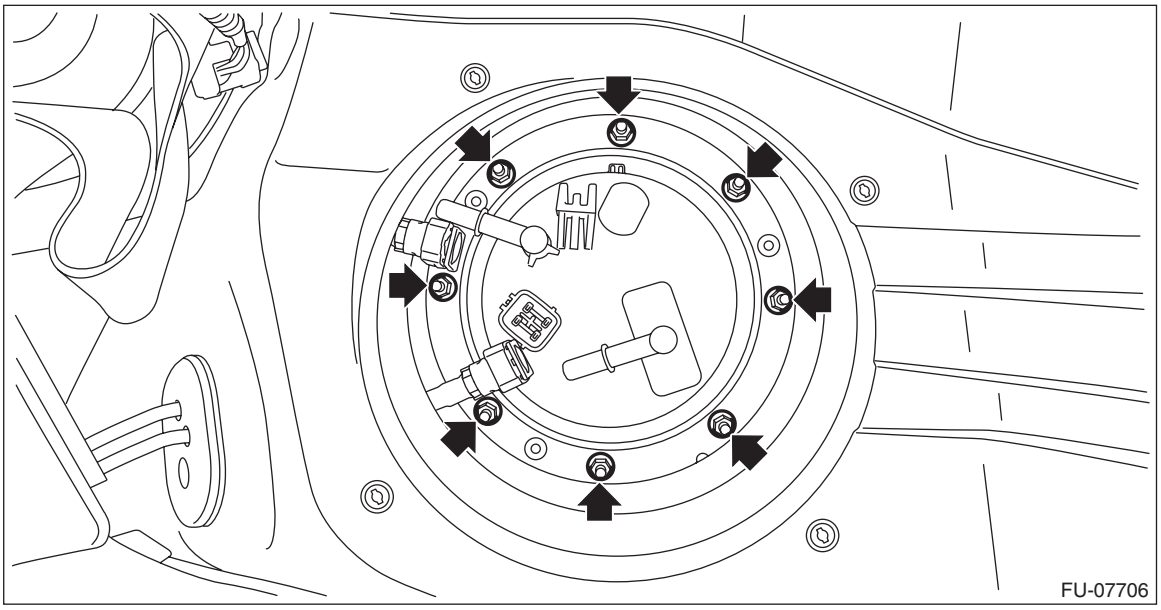
NOTE:
Disconnect the quick connector as shown in the figure.



(a) Slider



8) Remove the nuts which hold the fuel pump upper plate to the fuel tank.



9) Remove the fuel pump assembly from the fuel tank.

CAUTION:
Be careful not to let the arm and float of fuel level sensor contact the fuel tank.

B: INSTALLATION

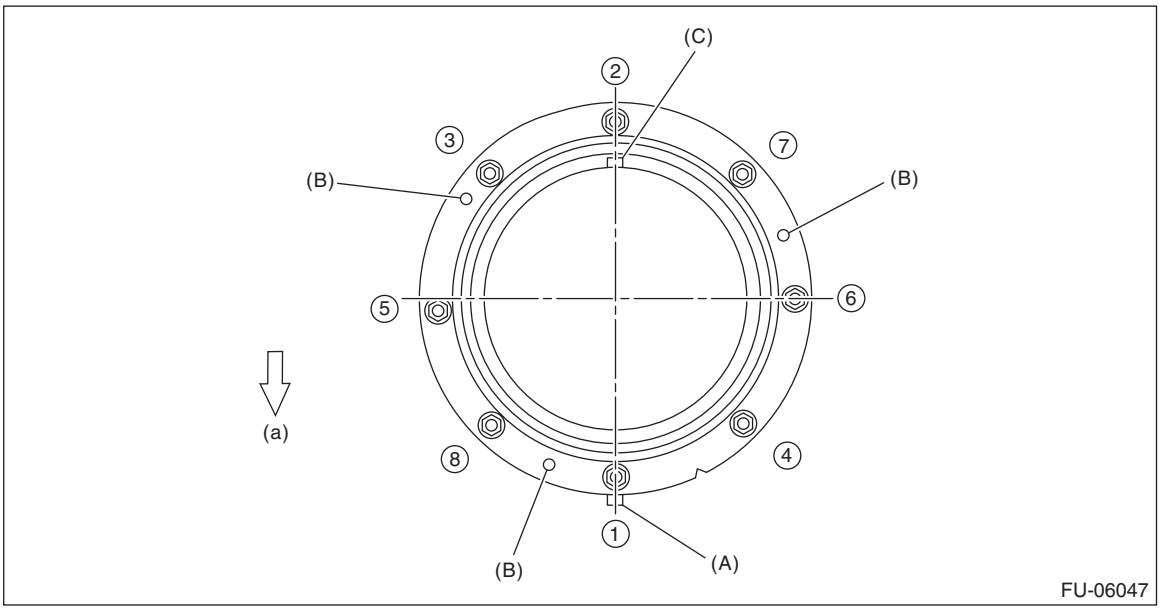
Install in the reverse order of removal while being careful of the following.

CAUTION:
Set the arm and float of the fuel level sensor while paying attention to prevent them from contacting the fuel tank. If the arm of the fuel level sensor is bent, the fuel gauge may not read correctly.

- Make sure the sealing portion is free from fuel or foreign matter before installation.
- Align protrusion (A) of the gasket to the position shown in the figure.
- Align the protrusion (C) of the fuel pump upper plate cushion with the protrusion (C) of fuel pump assembly.
- Align the protrusion (C) of fuel pump upper plate cushion with the cutout on the fuel pump upper plate.
- Insert the protrusion (B) of gasket to the fuel pump upper plate. (3 places)
- Tighten the nuts to the specified torque in the order as shown in the figure.

NOTE:
- Use a new gasket.

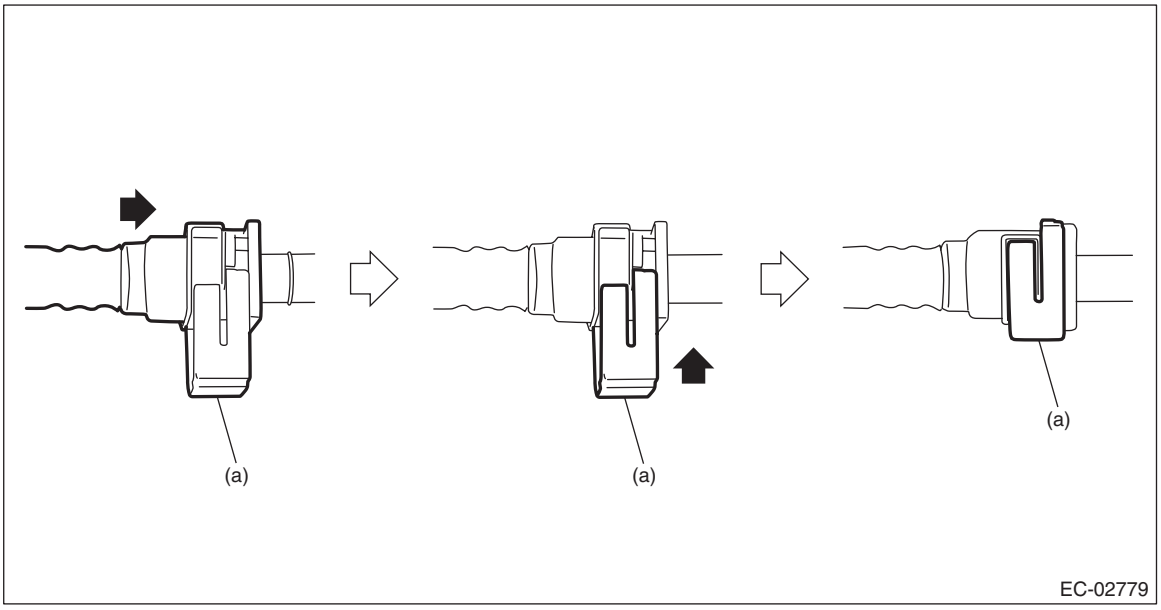
Tightening torque:
4.4 N·m (0.4 kgf-m, 3.2 ft-lb)



(a) Front side of vehicle

- Connect the quick connector as shown in the figure.

CAUTION:
- **Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.**
- **When connecting the quick connector, make sure to insert it all the way in before locking the slider.**
- **When it is difficult to lock the slider, check that the connector is fully inserted.**
- **After locking the slider, check again that the quick connector is securely connected.**

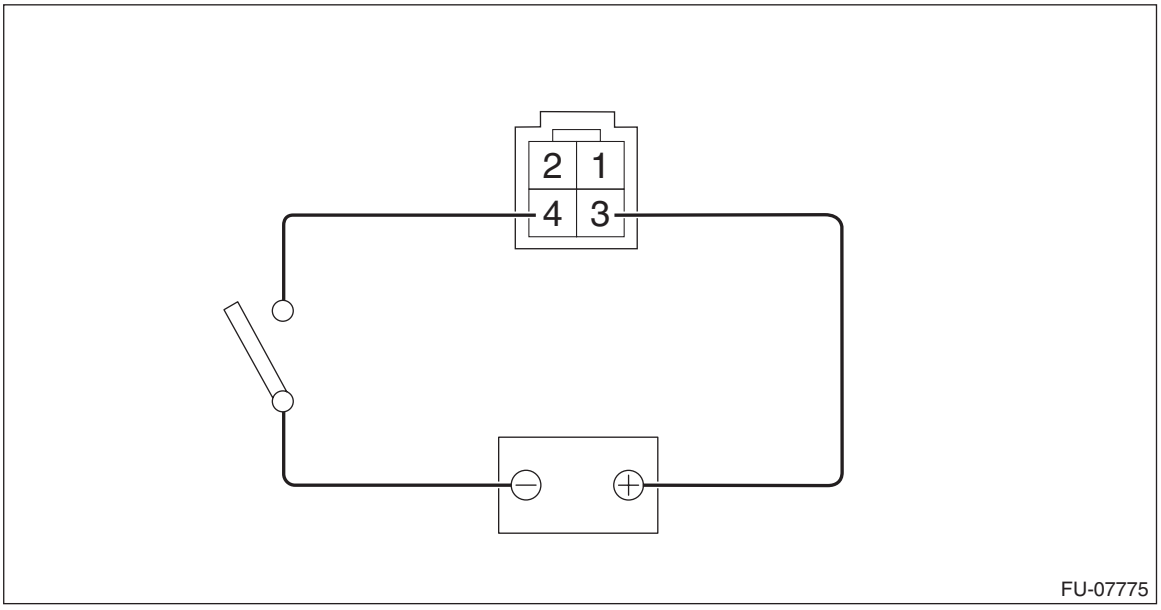


(a) Slider

C: INSPECTION

1) Check that the fuel pump has no deformation, cracks or other damages.
2) Connect the battery positive terminal to terminal No. 3 and the battery ground terminal to terminal No. 4, and inspect the fuel pump operation.

WARNING:
- **Wipe off fuel completely.**
- **Keep the battery as far apart from fuel pump as possible.**
- **Do not run the fuel pump for a long time under non-load condition.**



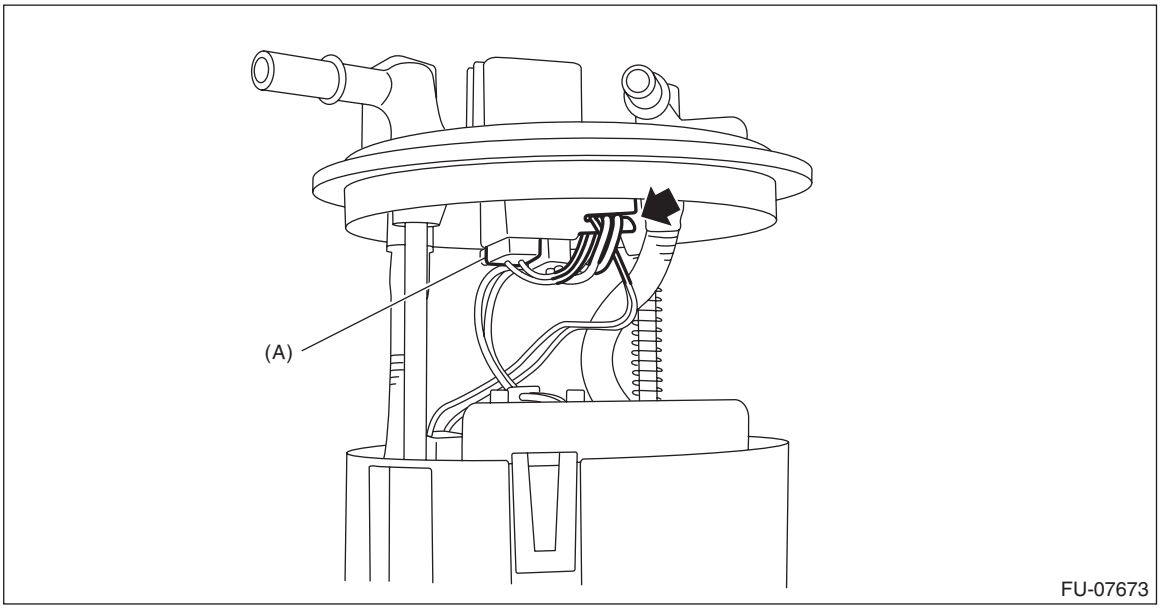
29.Fuel Level Sensor

A: REMOVAL

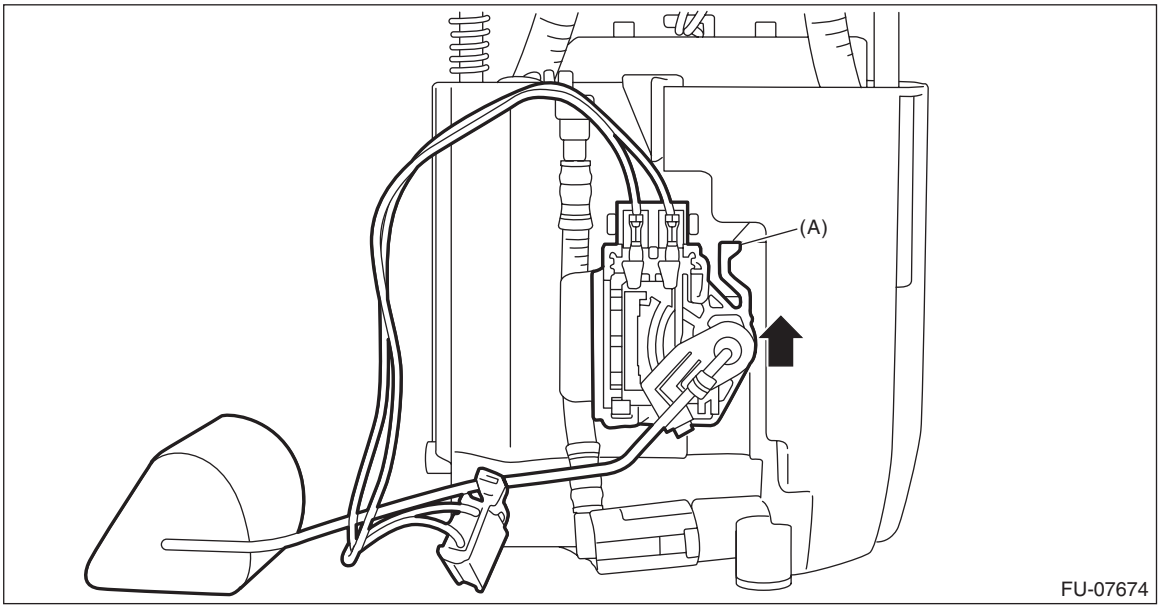
WARNING:
Place “NO OPEN FLAMES” signs near the working area.

CAUTION:
- **Be careful not to spill fuel.**
- **If the fuel gauge indicates that two thirds or more of the fuel is remaining, be sure to drain fuel before starting work to avoid the fuel to spill.**

NOTE:
The fuel level sensor is built in fuel pump assembly.
1) Remove the fuel pump assembly. <Ref. to FU(H4DO(w/o HEV))-137, REMOVAL, Fuel Pump.>
2) Disconnect the fuel level sensor connector (A), and pull out the connector cable and fuel level sensor harness from the clip.



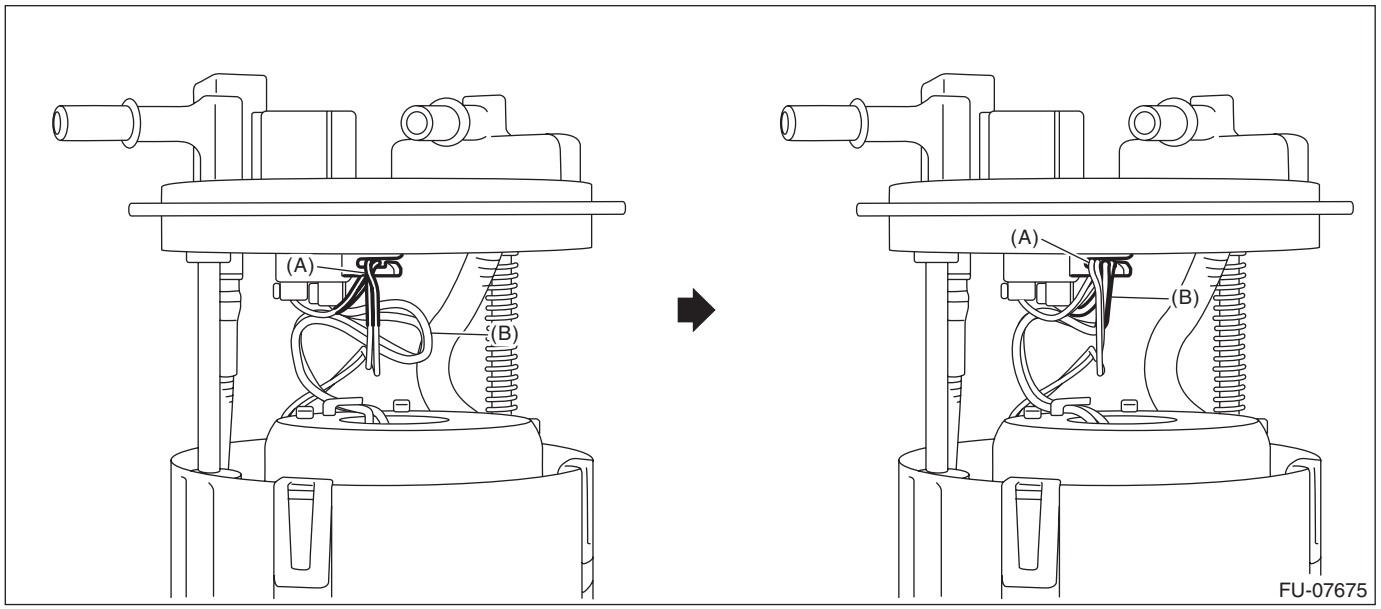
3) While pressing the claw (A) of the fuel level sensor, slide the fuel level sensor in the direction of the arrow, and remove the fuel level sensor.



B: INSTALLATION

Install in the reverse order of removal.

CAUTION:
Be sure to install the fuel level sensor harness to the clip first, then install the connector cable. Otherwise, malfunction may occur.

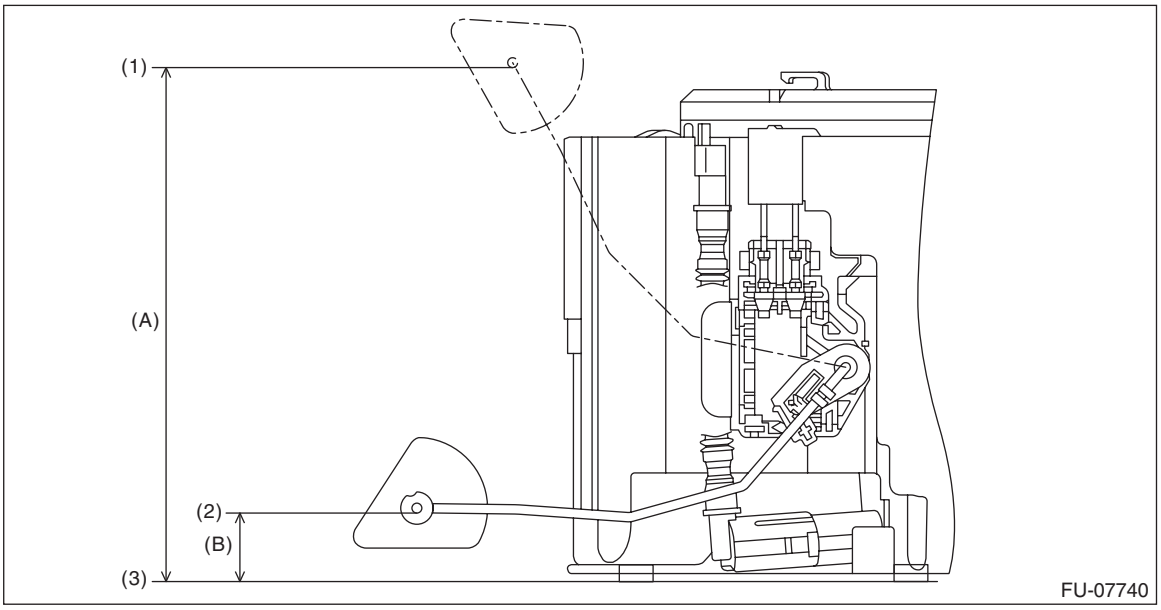


(A) Fuel level sensor harness (B) Connector cable

C: INSPECTION

1) Check that the fuel level sensor has no damage.
2) Measure the fuel level sensor float position.

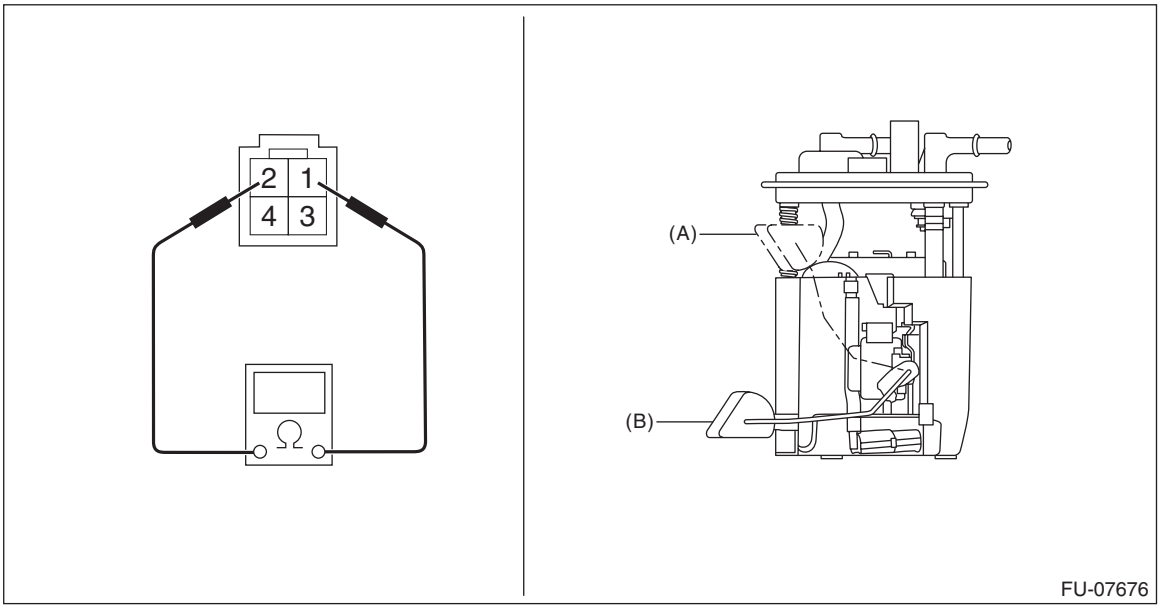
NOTE:
When inspecting the fuel level sensor, perform the work with the sensor installed to the fuel pump.



(1) FULL (2) EMPTY (3) Fuel tank seating surface

Float position	Standard
FULL to Fuel tank seating surface (A)	133.0±4 mm (5.236±0.157 in)
EMPTY to Fuel tank seating surface (B)	21.6±4 mm (0.850±0.157 in)

3) Check the resistance between fuel level sensor terminals by the connector on top of the fuel pump.



Float position	Terminal No.	Standard
FULL (A)	1 and 2	8.7±1.0 Ω
EMPTY (B)		139.1±2.0 Ω

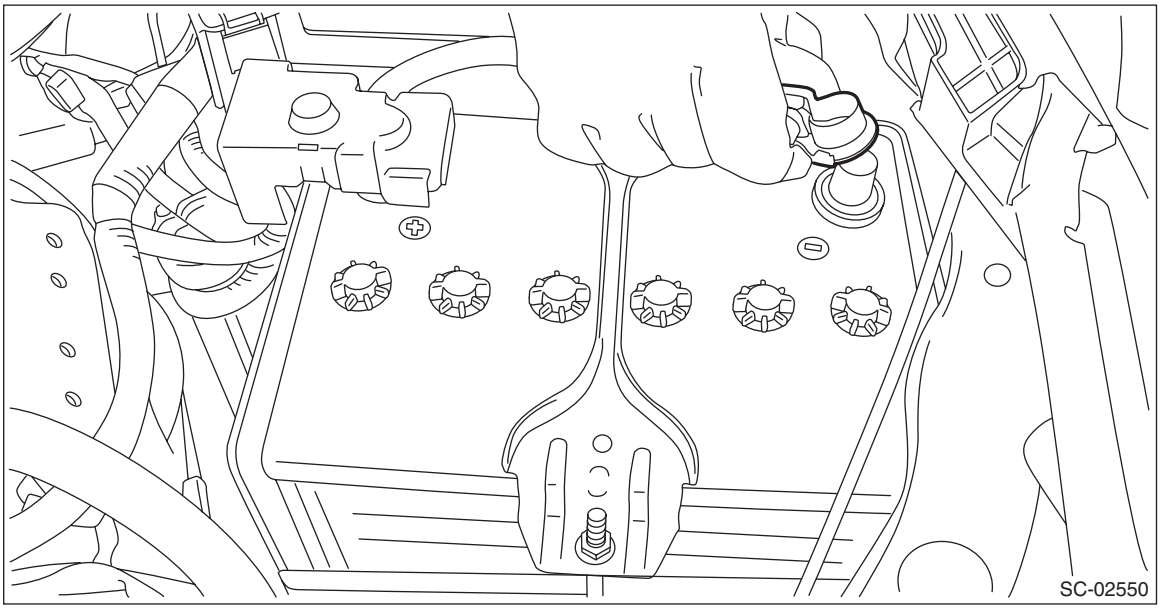
30.Fuel Sub Level Sensor

A: REMOVAL

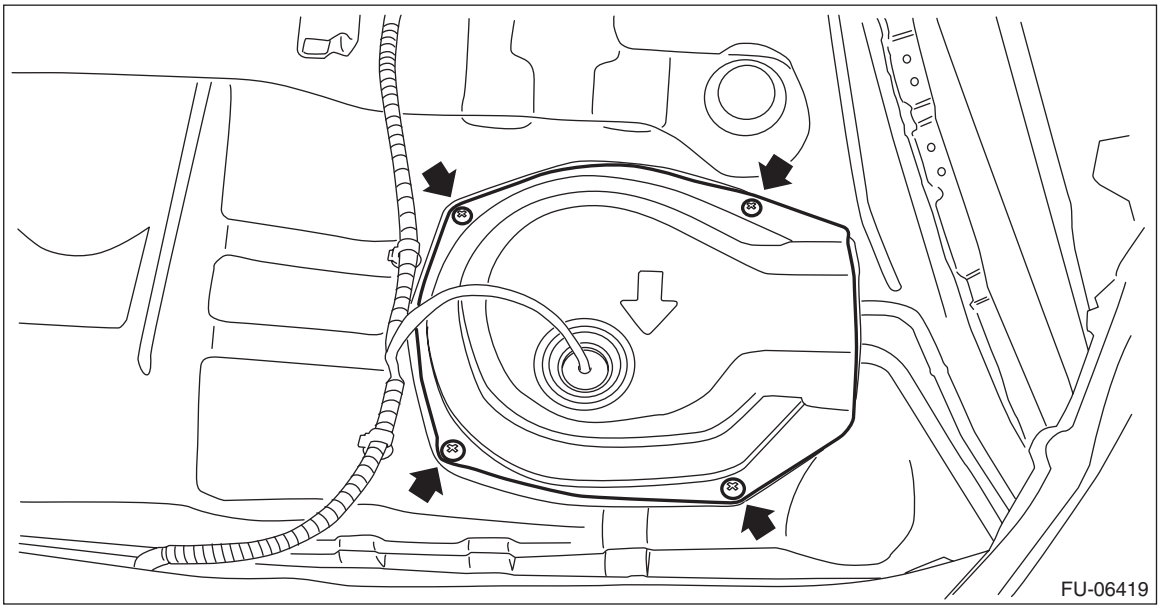
WARNING:
Place “NO OPEN FLAMES” signs near the working area.

CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from the tubes using a container or cloth.**
- **If the fuel gauge indicates that two thirds or more of the fuel is remaining, be sure to drain fuel before starting work to avoid the fuel to spill.**

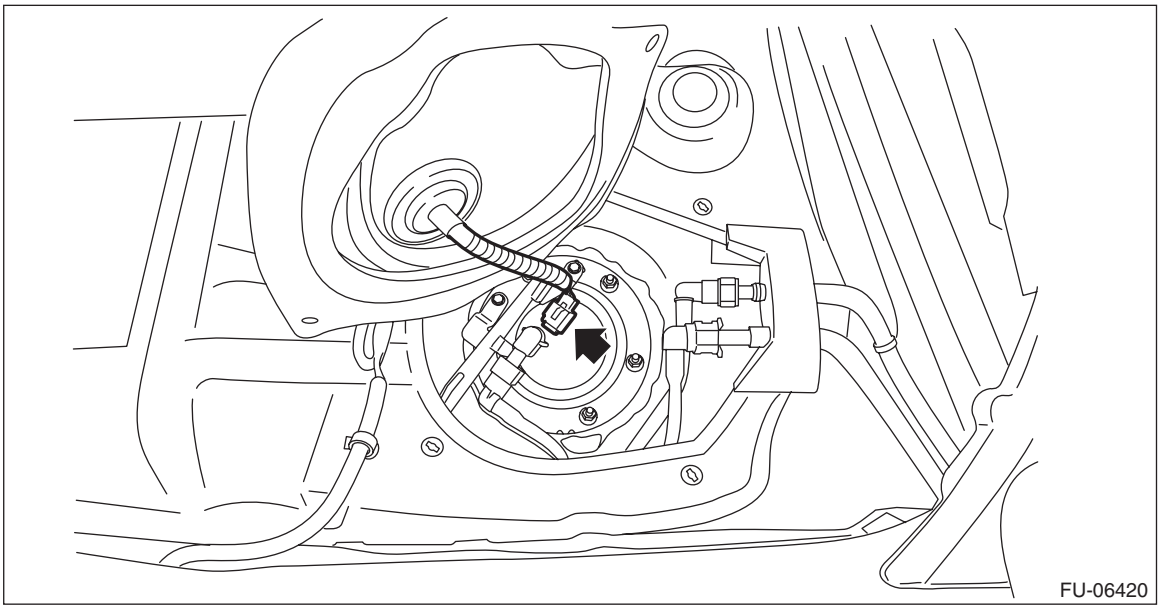
1) Release the fuel pressure. <Ref. to FU(H4DO(w/o HEV))-109, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Drain fuel. <Ref. to FU(H4DO(w/o HEV))-109, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
3) Disconnect the ground cable from battery.



4) Remove the rear seat cushion. <Ref. to SE-23, REMOVAL, Rear Seat.>
5) Remove the service hole cover of fuel sub level sensor.

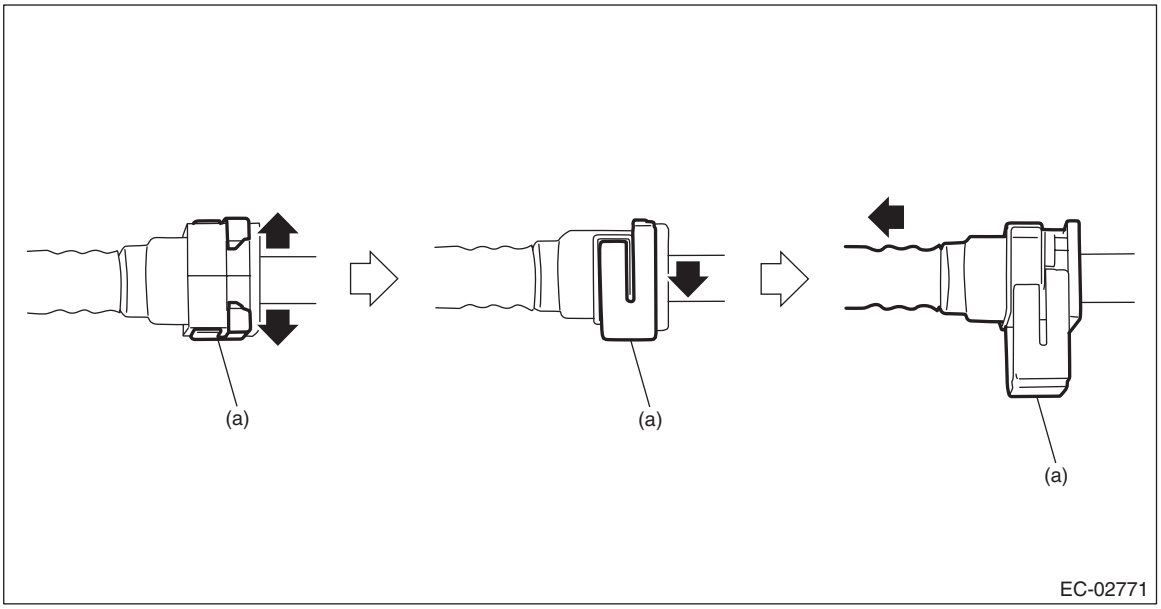


6) Disconnect connectors from the fuel sub level sensor, and move aside the service hole cover.

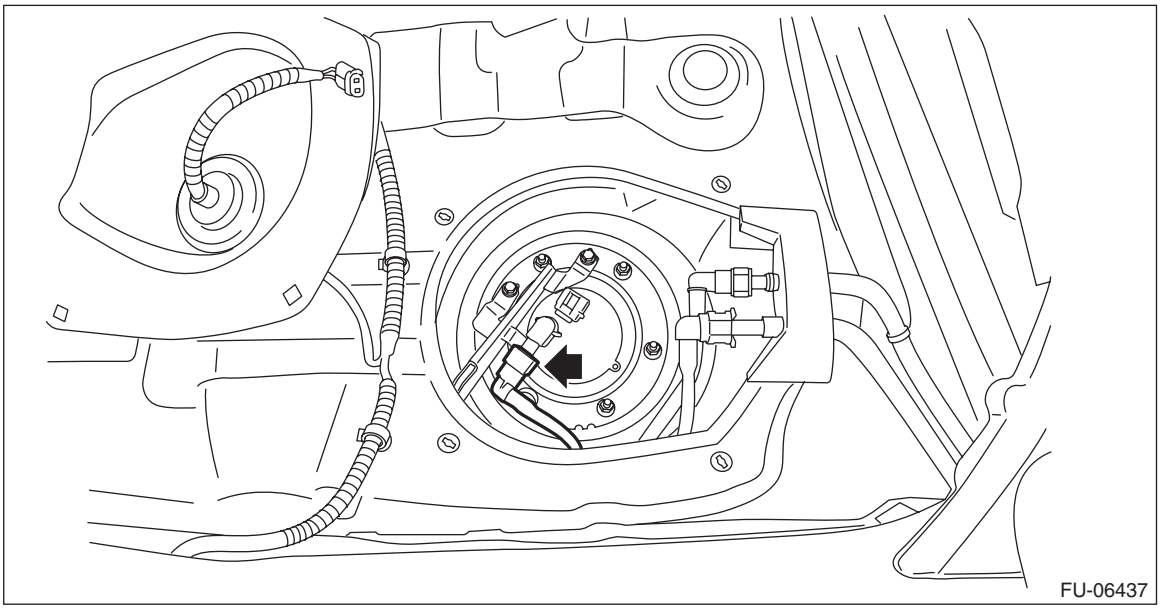


7) Disconnect the quick connector of the jet pump tube.

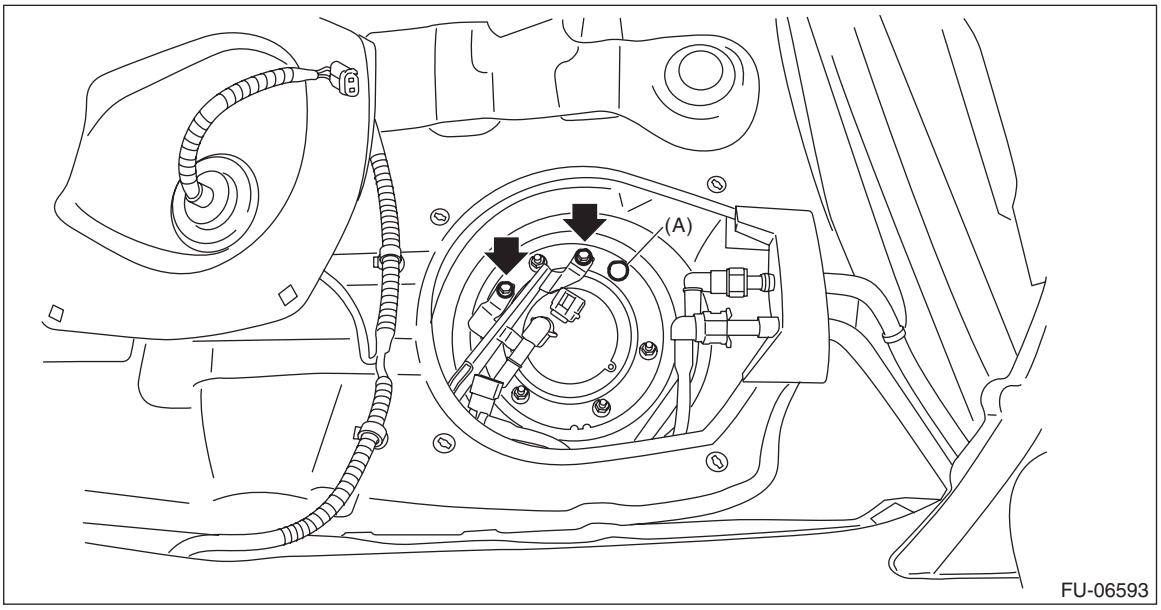
NOTE:
Disconnect the quick connector as shown in the figure.



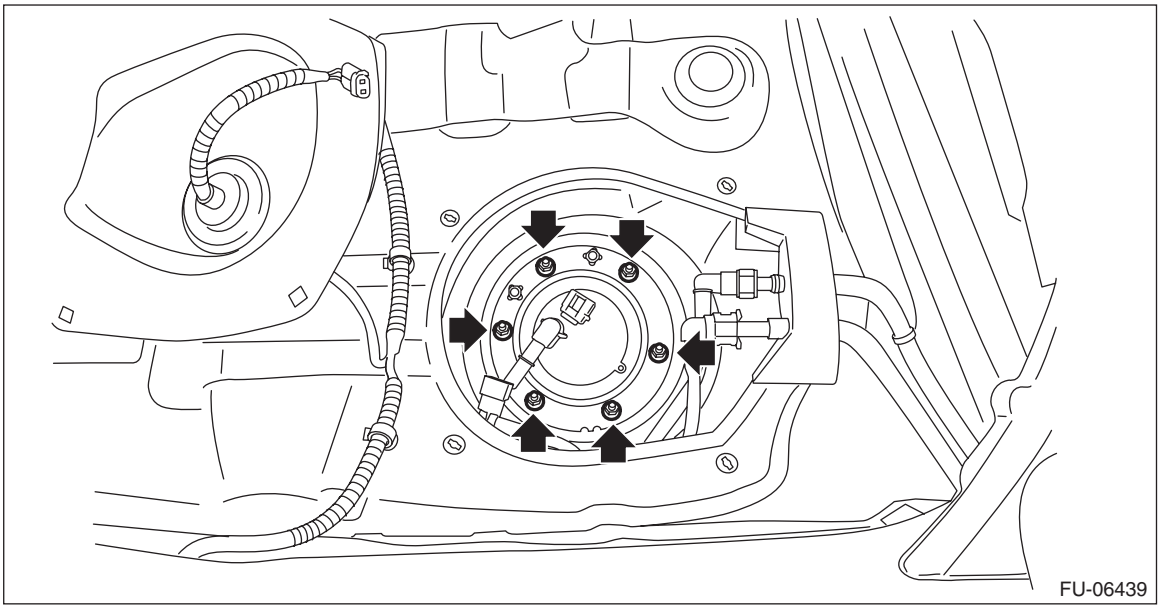
(a) Slider



8) Remove the fuel sub level sensor protector, and remove the rubber cap (A) from nut.



9) Remove the bolts and nuts which hold fuel sub level sensor protector and fuel sub level sensor upper plate to the fuel tank.



10) Remove the fuel sub level sensor from the fuel tank.

CAUTION:
Be careful not to let the arm and float of the fuel sub level sensor contact the fuel tank.

B: INSTALLATION

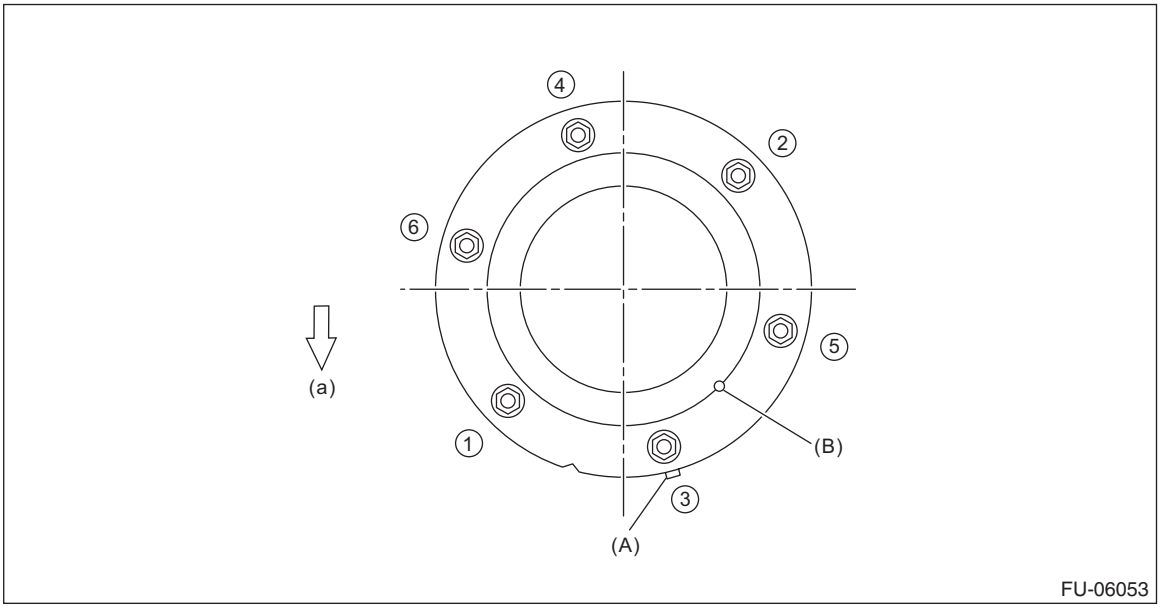
Install in the reverse order of removal while being careful of the following.

CAUTION:
Set the arm and float of the fuel sub level sensor while paying attention to prevent them from contacting the fuel tank. If the arm of the fuel sub level sensor is bent, the fuel gauge may not read correctly.

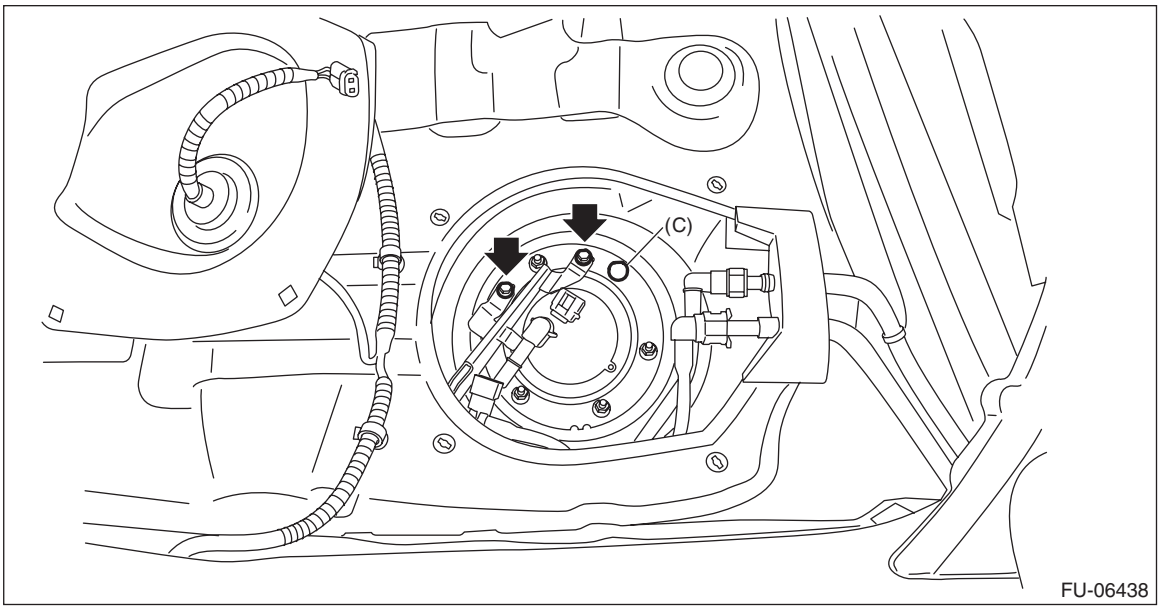
- Make sure the sealing portion is free from fuel or foreign matter before installation.
- Align protrusion (A) of the gasket to the position shown in the figure.
- Align the cutout in the fuel sub level sensor upper plate cushion with the protrusion (B) of the fuel sub level sensor.
- Align the protrusion (B) of the fuel sub level sensor upper plate cushion with the cutout in the fuel sub level sensor upper plate.
- Tighten the nuts and bolts to the specified torque in the order as shown in the figure.
- After tightening, install the rubber cap (C) at the position shown in the figure.

NOTE:
- Use a new gasket.
- Do not forget to install rubber cap (C).

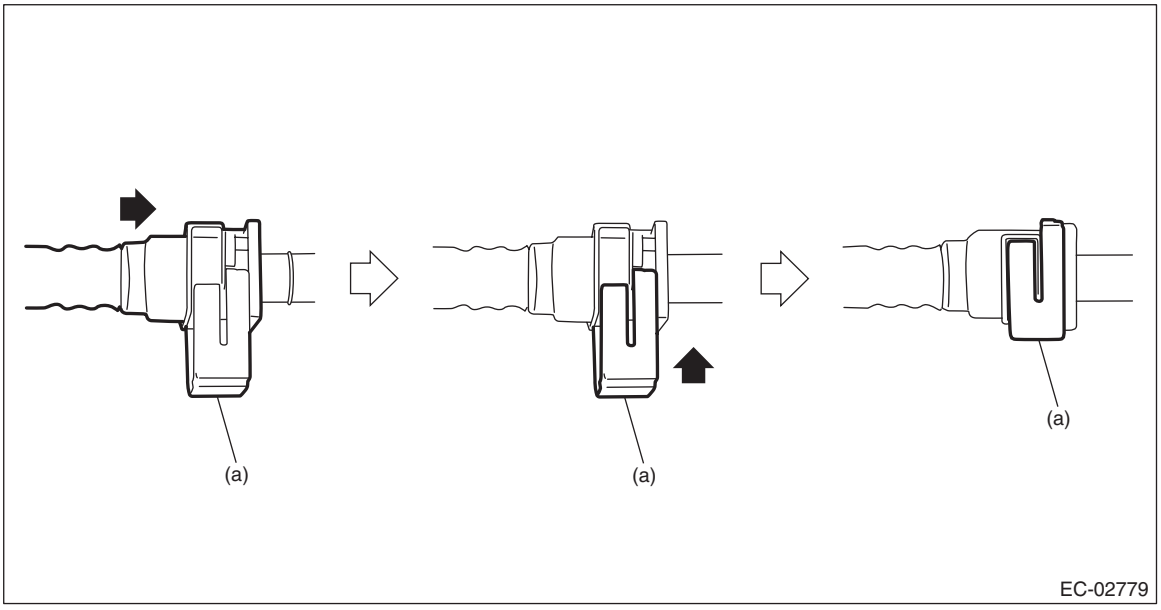
Tightening torque:
4.4 N·m (0.4 kgf-m, 3.2 ft-lb)



(a) Front side of vehicle



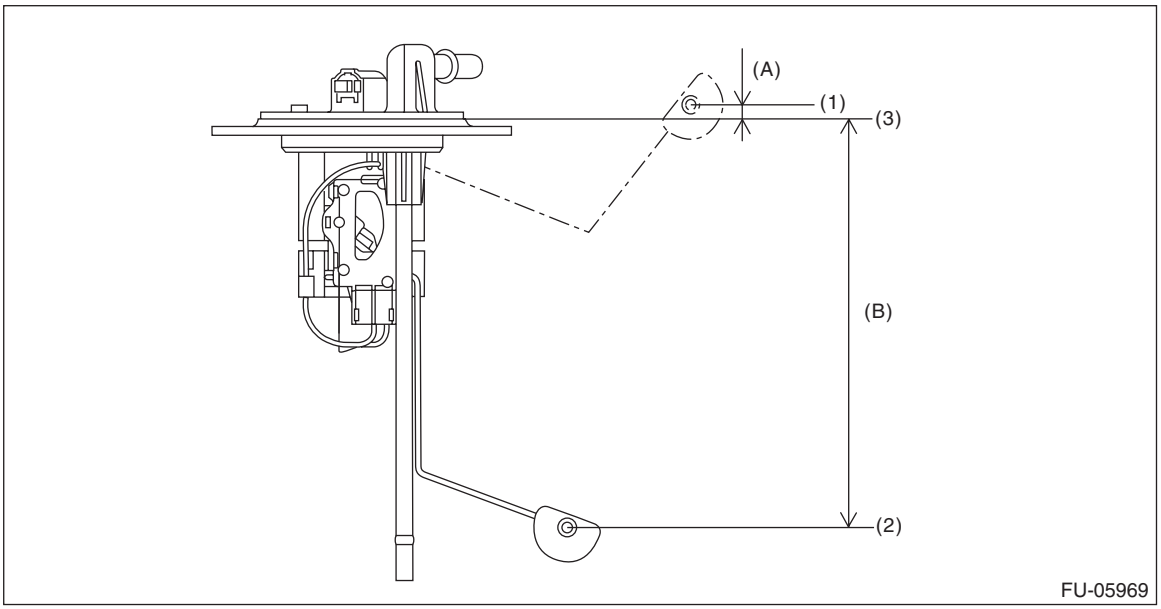
CAUTION:
• Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
• When connecting the quick connector, make sure to insert it all the way in before locking the slider.
• When it is difficult to lock the slider, check that the connector is fully inserted.
• After locking the slider, check again that the quick connector is securely connected.



(a) Slider

C: INSPECTION

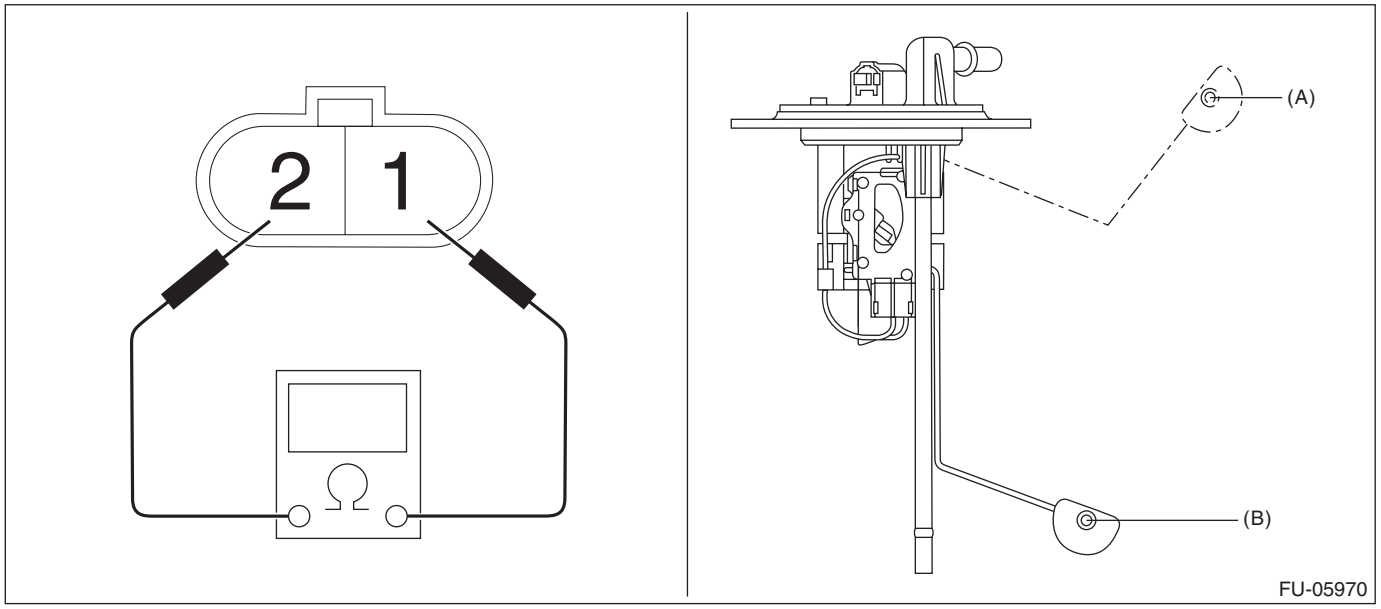
1) Check that the fuel sub level sensor has no damage.
2) Measure the fuel sub level sensor float position.



(1) FULL (2) EMPTY (3) Datum points

Float position	Standard
FULL to Datum point (A)	5.31±3.5 mm (0.209±0.138 in)
EMPTY to Datum point (B)	160.6±3.5 mm (6.32±0.138 in)

3) Measure the resistance between fuel sub level sensor terminals.



Float position	Terminal No.	Standard
FULL (A)	1 and 2	8.7±1.0 Ω
EMPTY (B)		270.9±4.0 Ω

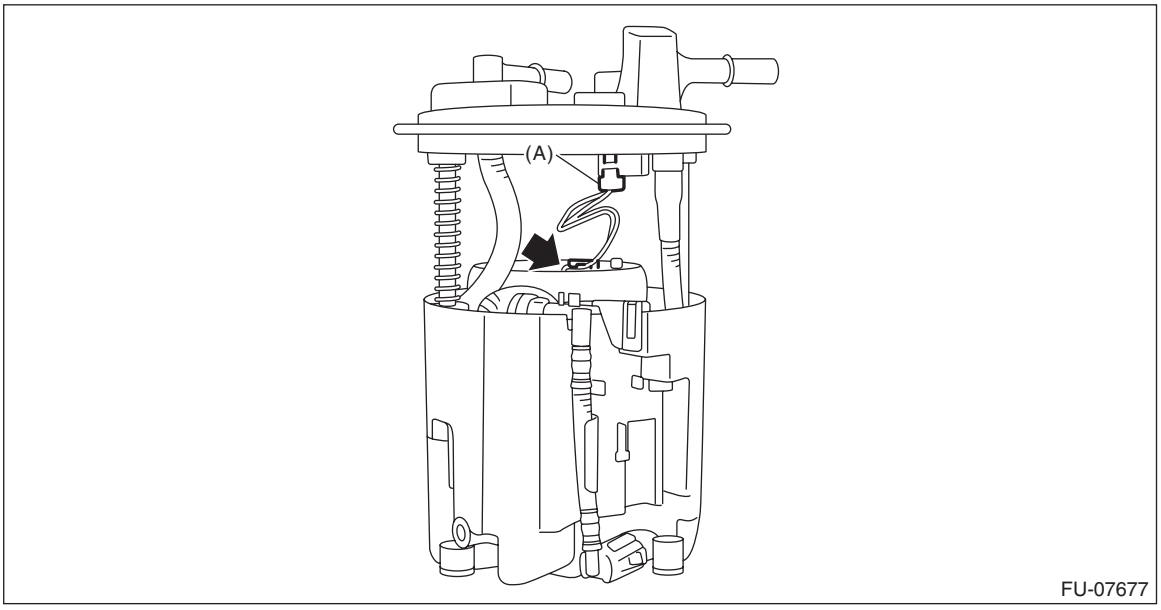
31.Fuel Filter

A: REMOVAL

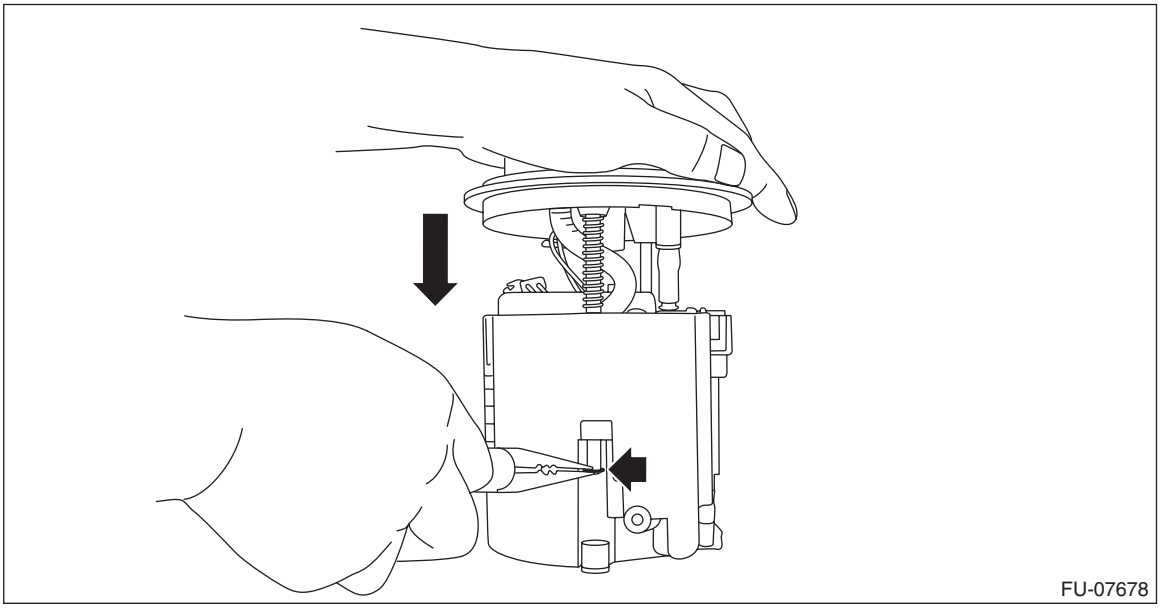
WARNING:
Place “NO OPEN FLAMES” signs near the working area.

CAUTION:
- **Be careful not to spill fuel.**
- **If the fuel gauge indicates that two thirds or more of the fuel is remaining, be sure to drain fuel before starting work to avoid the fuel to spill.**
- **Be careful not to drop or apply any impact to the fuel pump during work. This may deteriorate its performance.**

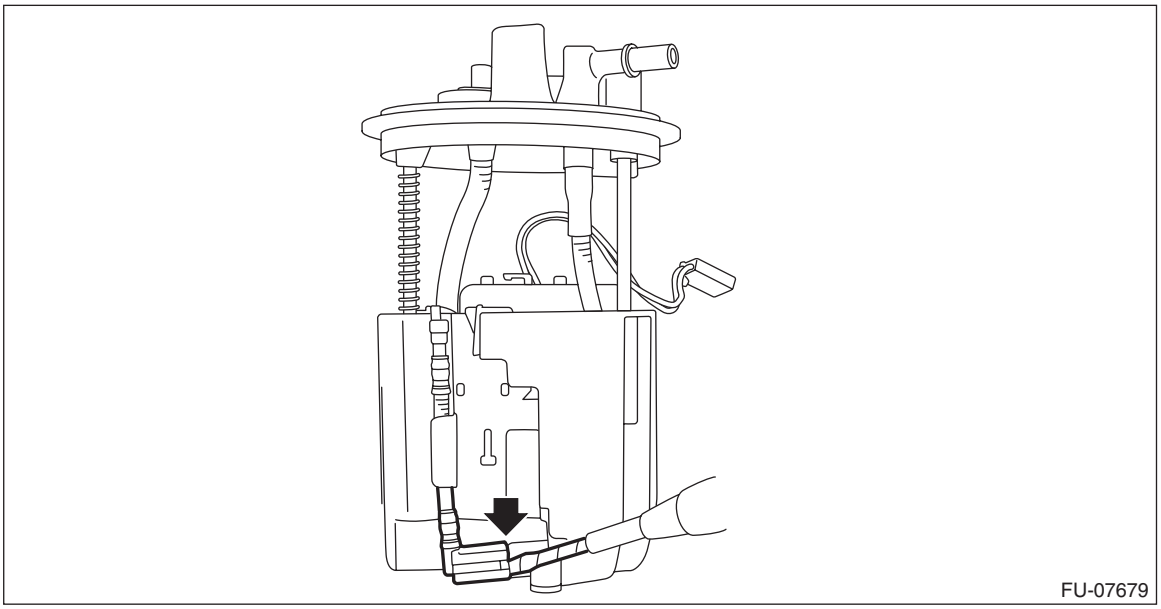
NOTE:
The fuel filter is built in fuel pump assembly.
1) Remove the fuel pump assembly. <Ref. to FU(H4DO(w/o HEV))-137, REMOVAL, Fuel Pump.>
2) Remove the fuel level sensor. <Ref. to FU(H4DO(w/o HEV))-143, REMOVAL, Fuel Level Sensor.>
3) Remove the connector cable from the clip, and disconnect the connector (A) of the connector cable.



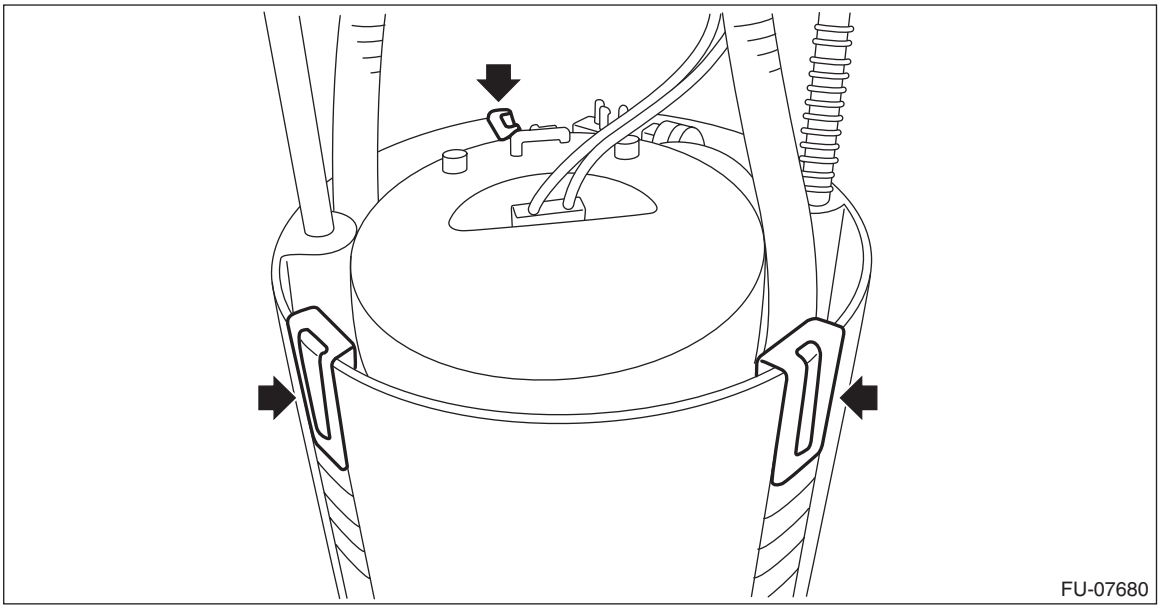
4) Push the fuel filter assembly in the direction of the arrow to compress, and detach the connecting clip.



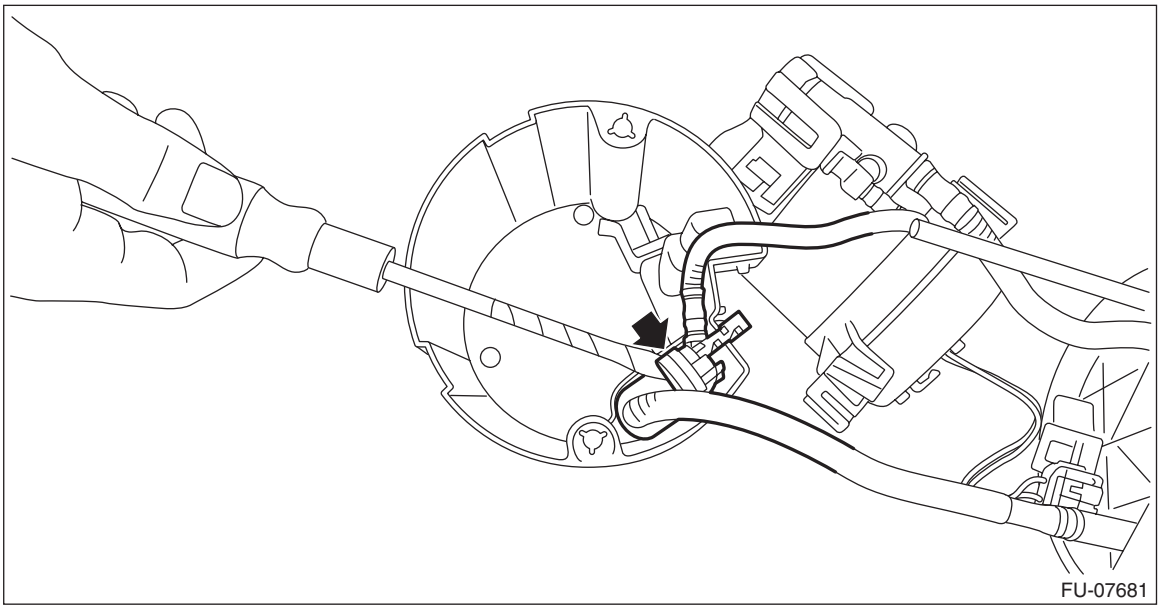
5) Release the claw using a flat tip screwdriver or similar tool wrapped with a protection tape, and remove the tube assembly from the fuel chamber assembly.



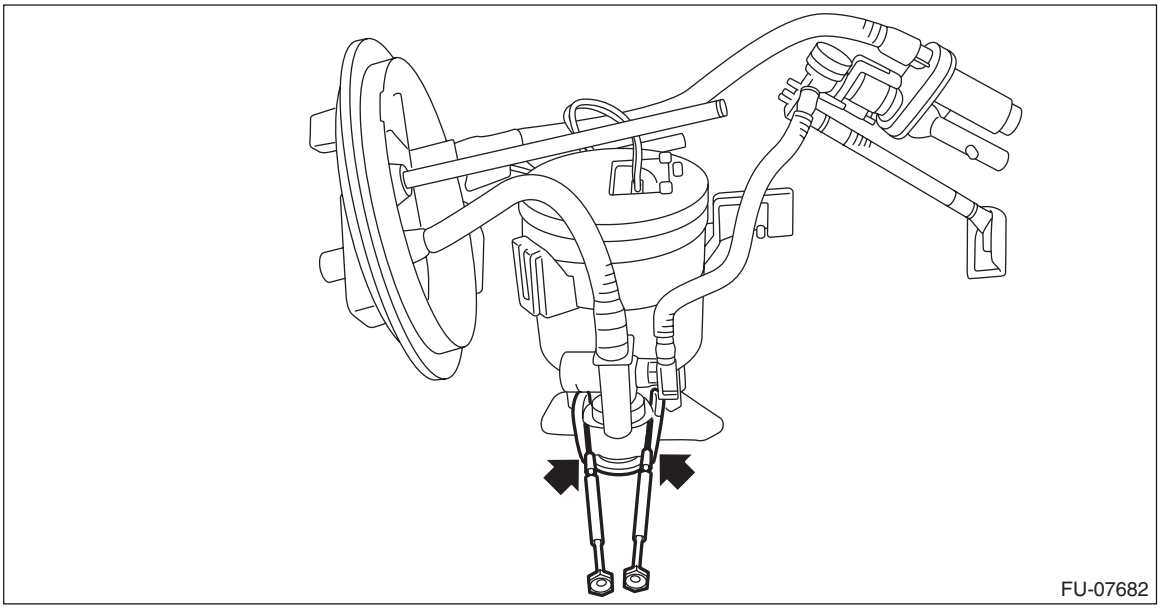
6) Release three claws on the fuel pump holder from the fuel chamber assembly, and raise the fuel filter assembly.



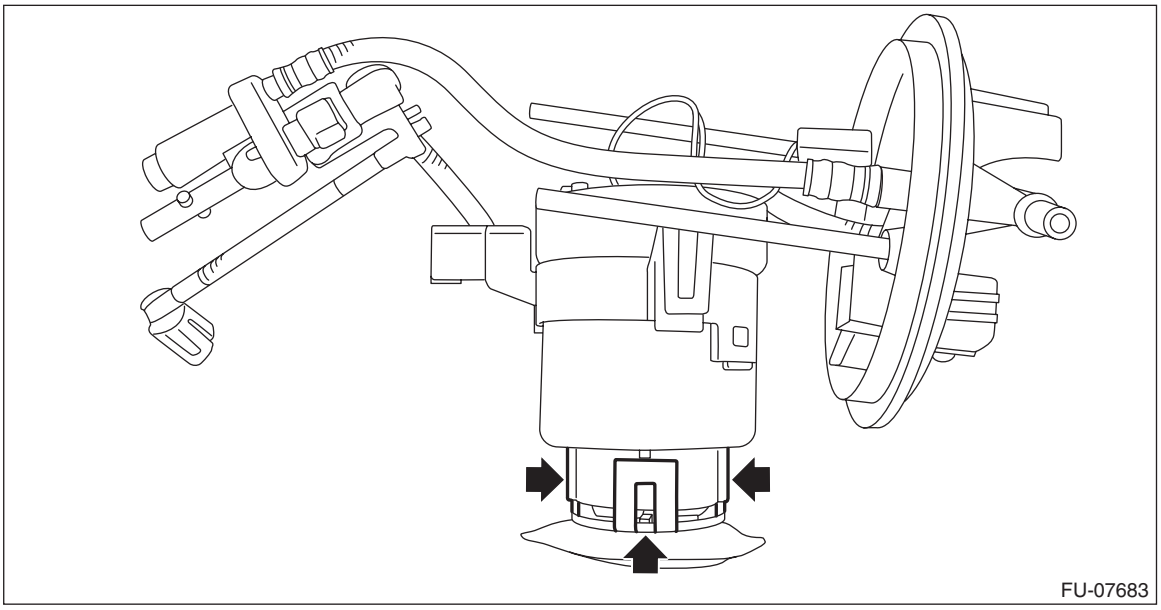
7) Using a flat tip screwdriver or similar tool wrapped with a protection tape, remove the tube assembly from the fuel chamber assembly, and separate the fuel filter assembly and fuel chamber assembly.



8) Using a precision driver or similar tool wrapped with a protection tape, expand the claws on the fuel pump.

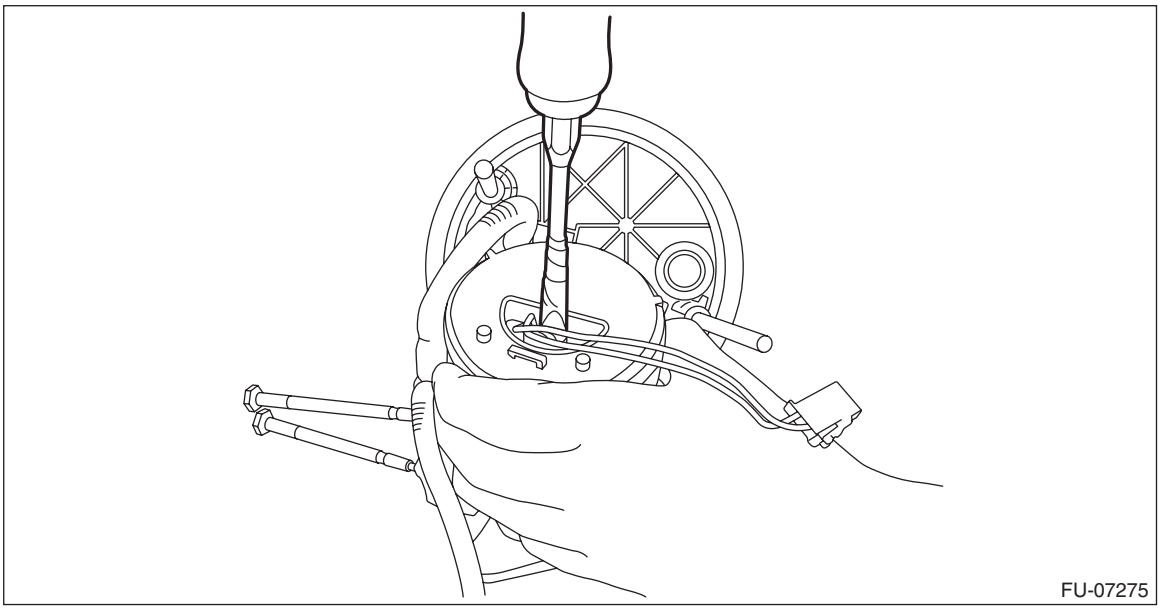


9) Release the claws on the fuel pump.

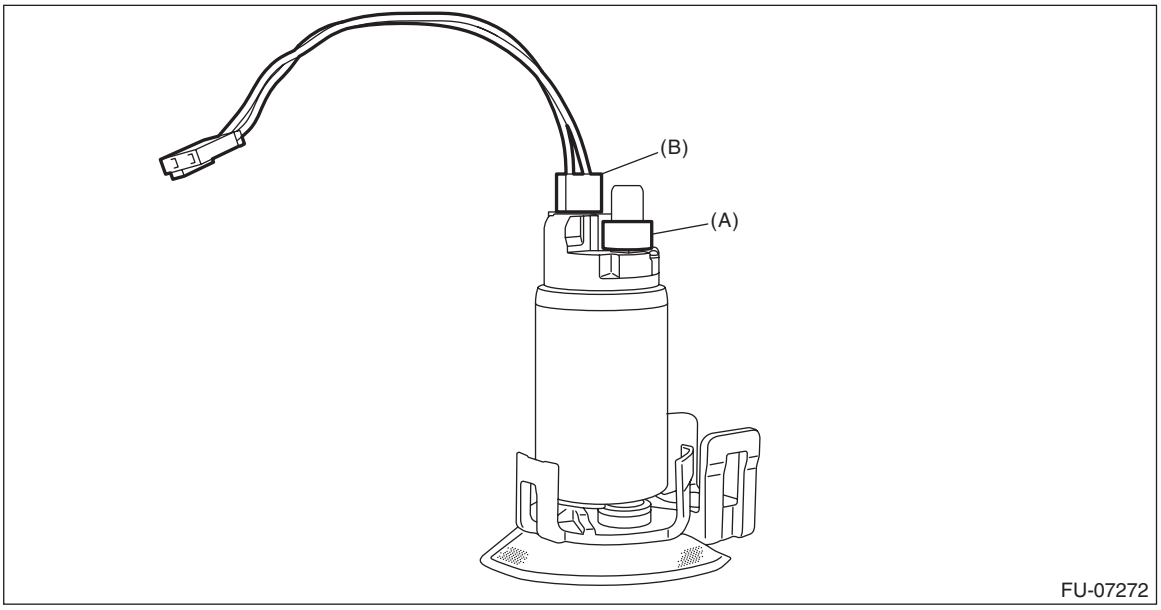


10) Using a flat tip screwdriver or similar tool wrapped with a protection tape, press on the fuel pump and remove the fuel pump together with the fuel pump holder from the fuel filter assembly.

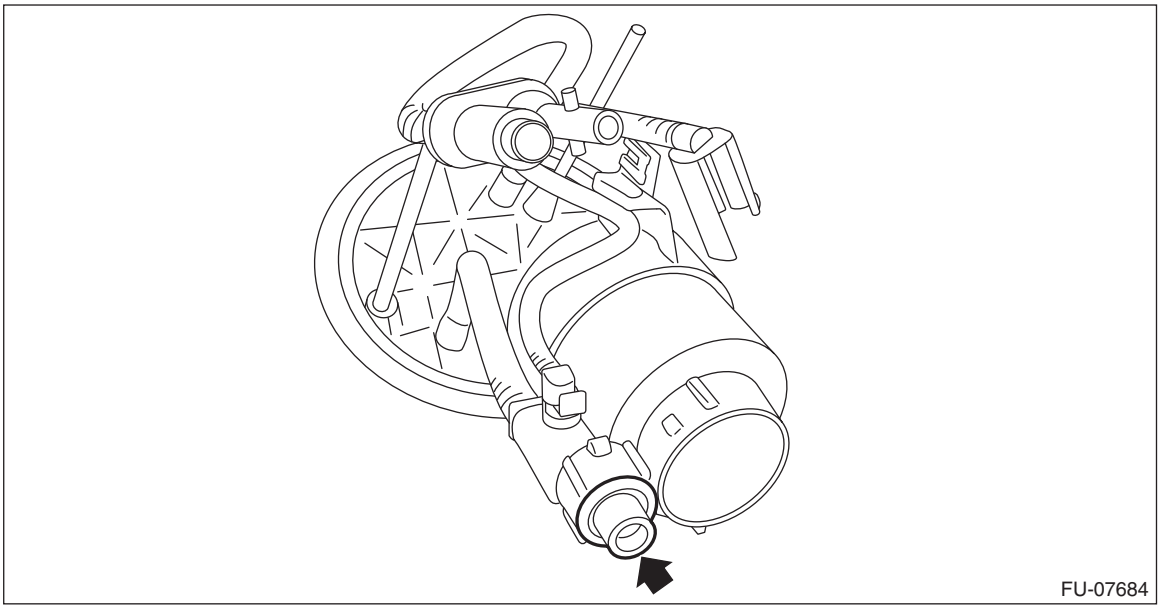
CAUTION:
If O-rings remain on the fuel filter assembly side, carefully remove them with a precision screwdriver or similar tool wrapped with a protection tape.



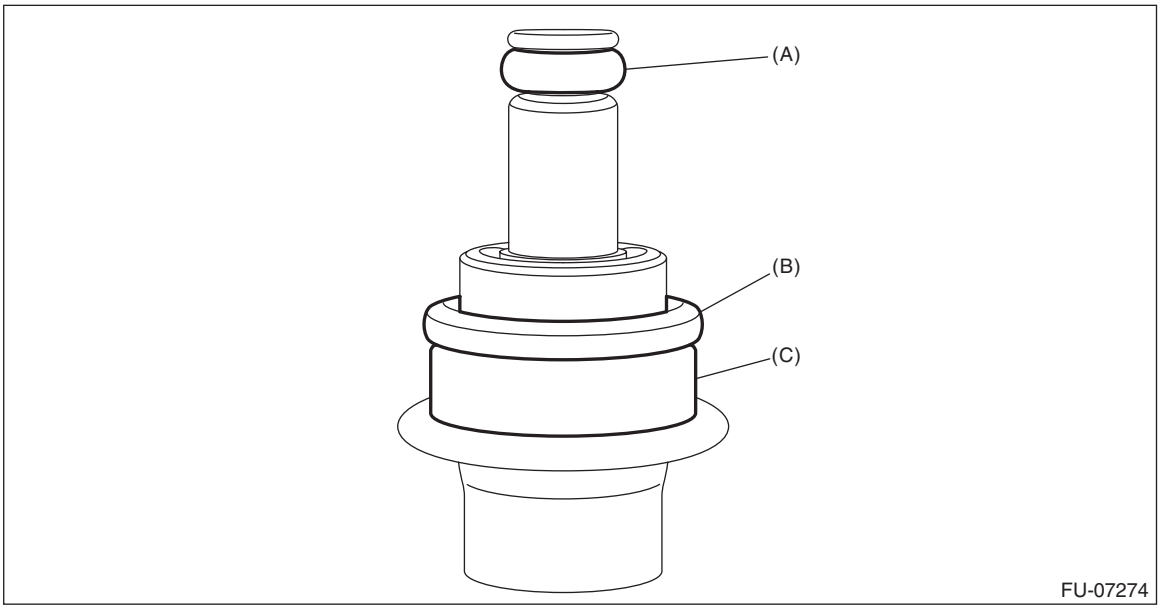
11) Remove the spacer (A) and connector cable (B) from the fuel pump.



12) Remove the pressure regulator from the fuel filter assembly.



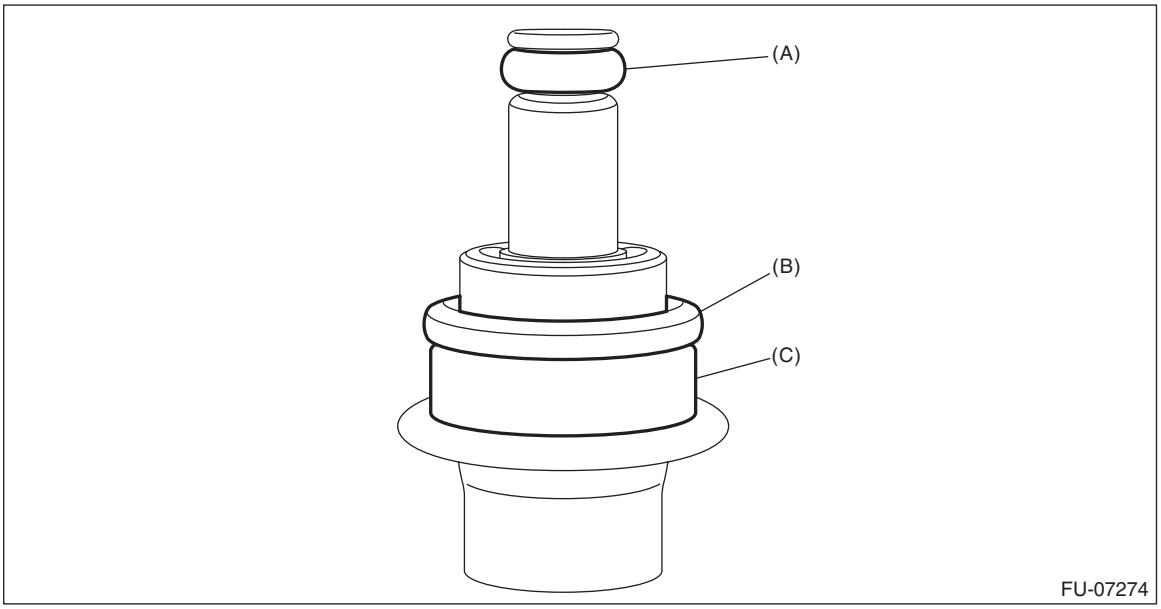
13) Remove O-ring (A), O-ring (B), and backup ring (C) from the pressure regulator.



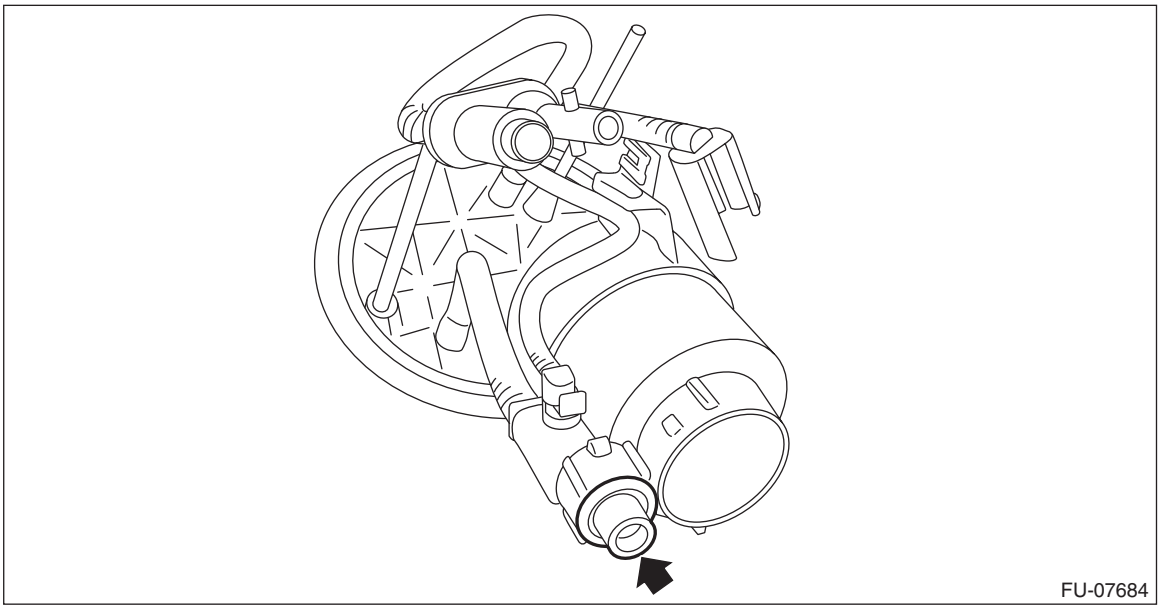
B: INSTALLATION

1) Install O-ring (A), O-ring (B), and backup ring (C) to the pressure regulator.

NOTE:
- Use new O-rings.
- Apply gasoline to the O-ring and backup ring.

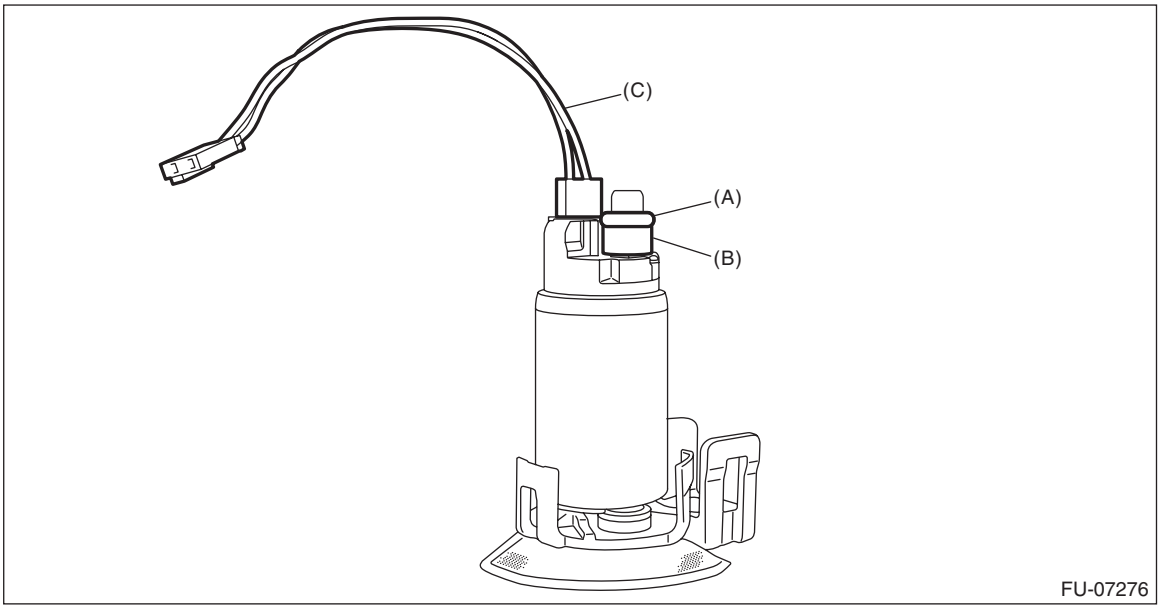


2) Install the pressure regulator to the fuel filter assembly.


FU-07684

3) Install O-ring (A), spacer (B), and connector cable (C) to the fuel pump.

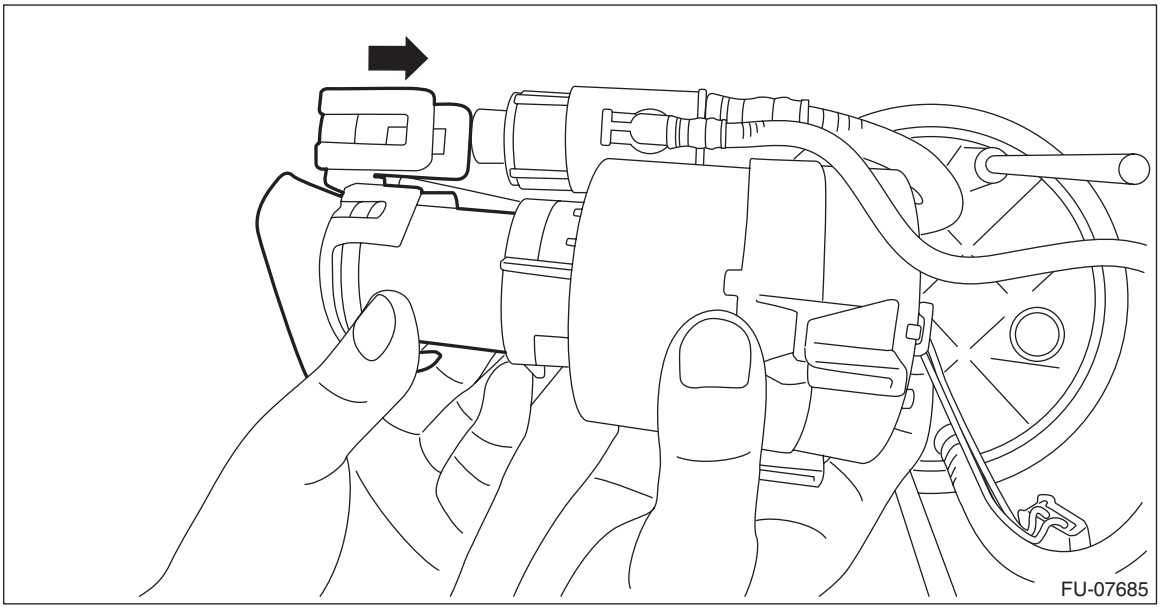
NOTE:
- Use new O-rings and the connector cable.
- Apply gasoline to the O-rings and the spacer.



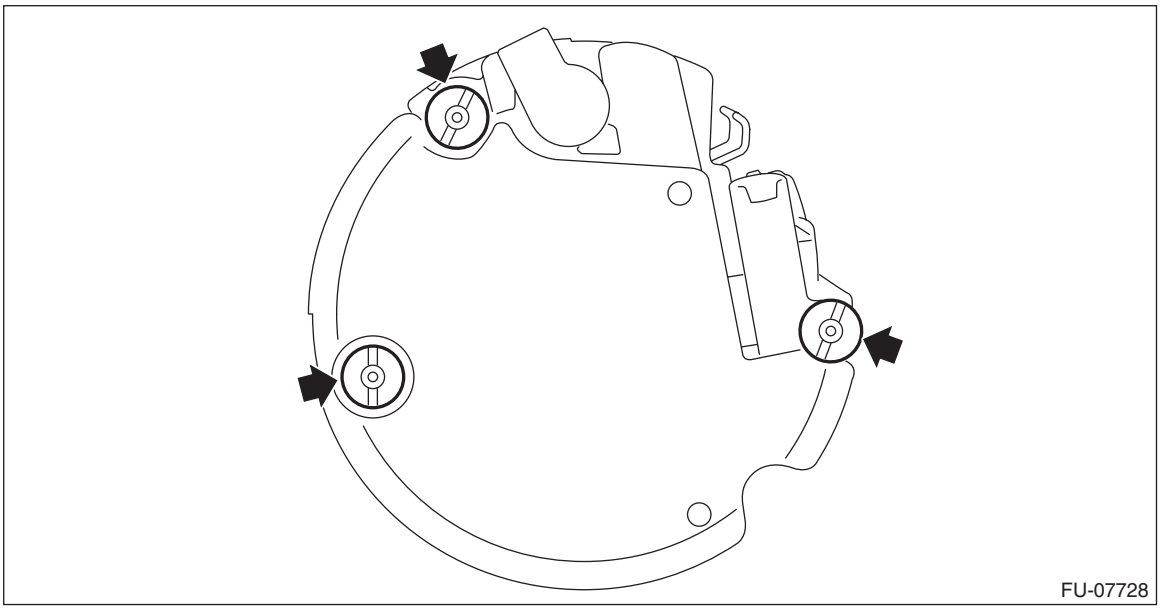
FU-07276

4) Install the fuel pump to the fuel filter assembly.

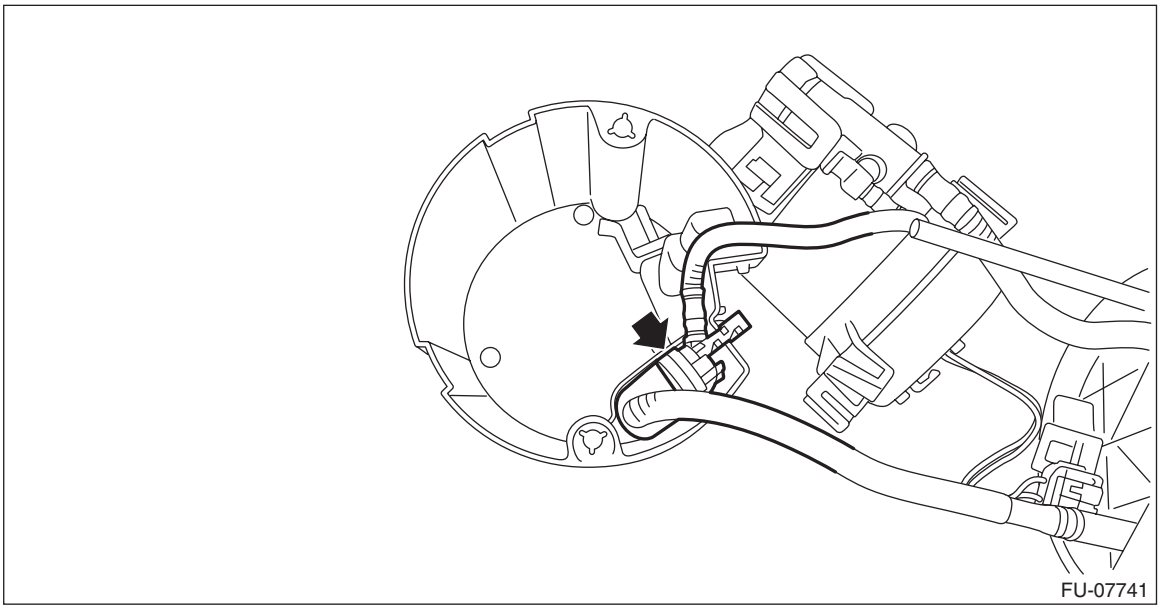
NOTE:
After installation, make sure five claws are correctly engaged in each position.



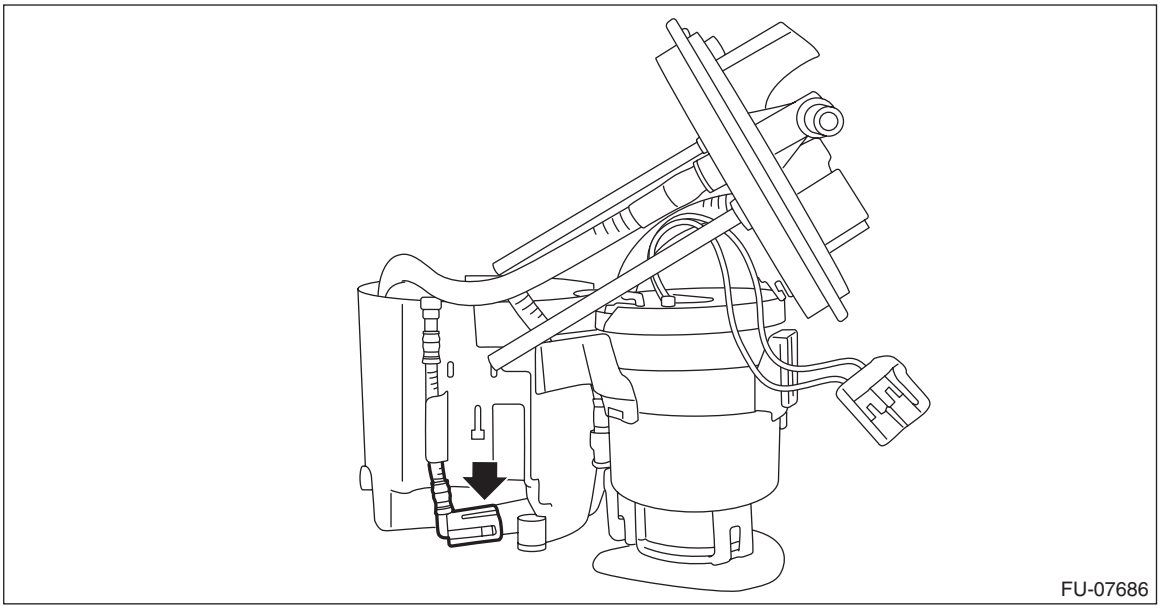
5) Check that the cushions of the fuel chamber assembly for dislocation. If any of them is dislocated, install a new cushion.



6) Slowly press in and install the tube assembly to the fuel chamber assembly until a clicking sound is heard.



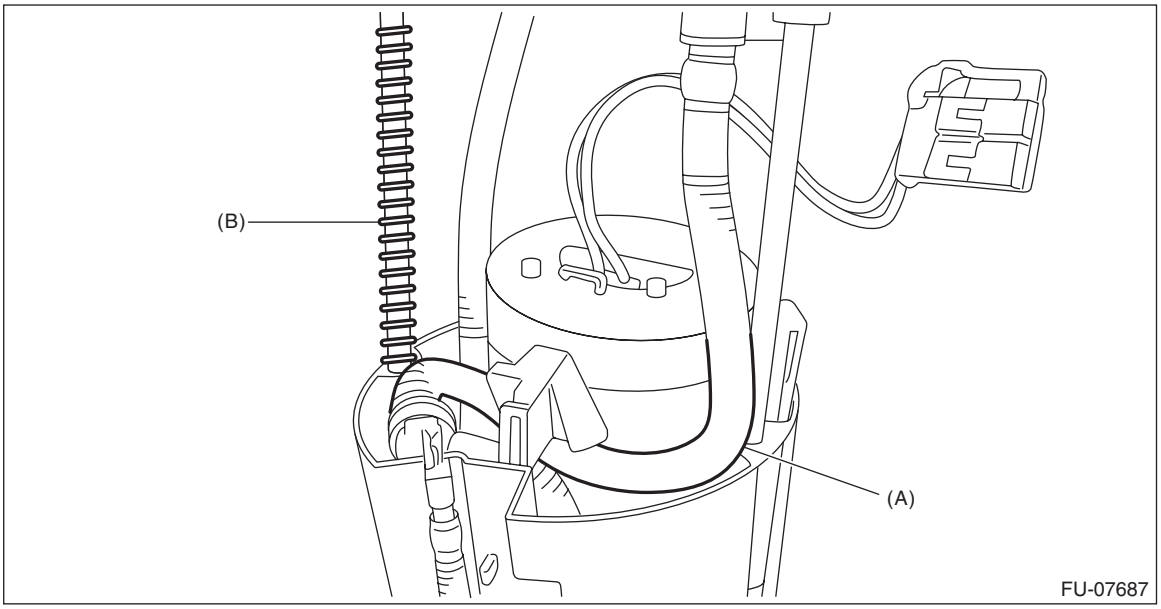
7) Connect the tube assembly to the fuel chamber assembly.



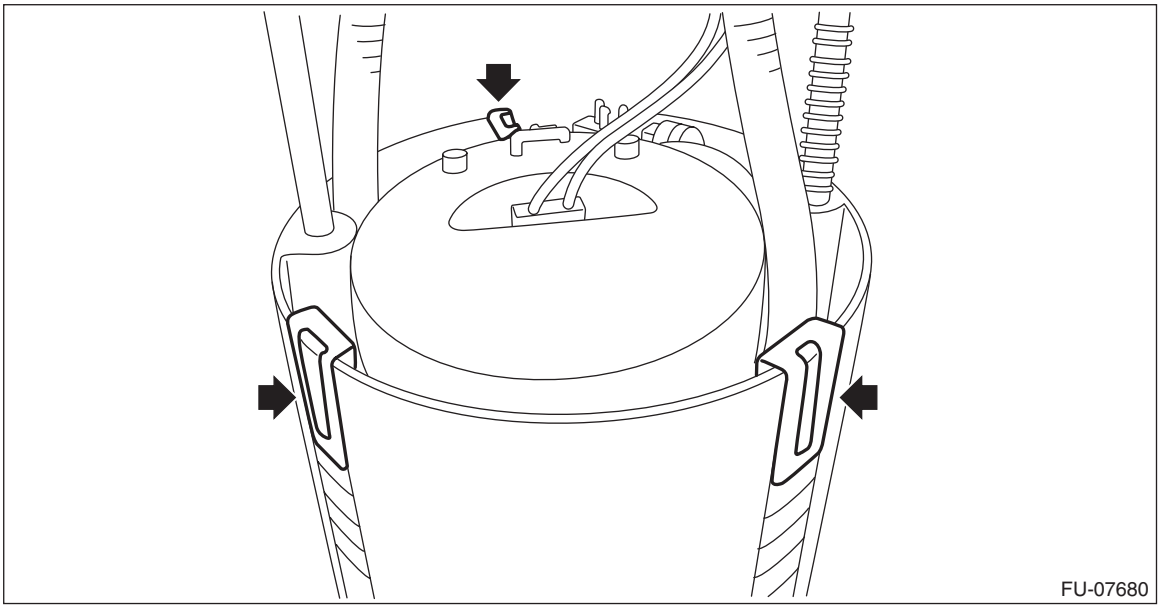
8) Install the fuel filter assembly to the fuel chamber assembly.

NOTE:

- Set the tube (A) and spring (B) for the fuel filter assembly as shown in the figure.

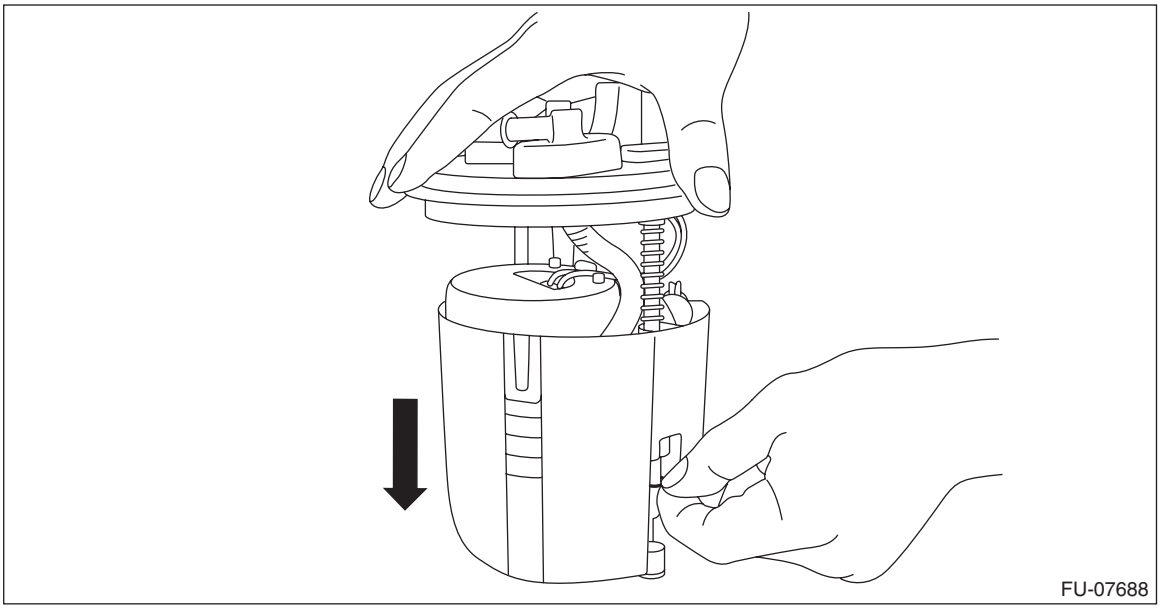


- Check that the claw connecting the fuel camber assembly and the fuel filter assembly is securely fastened.

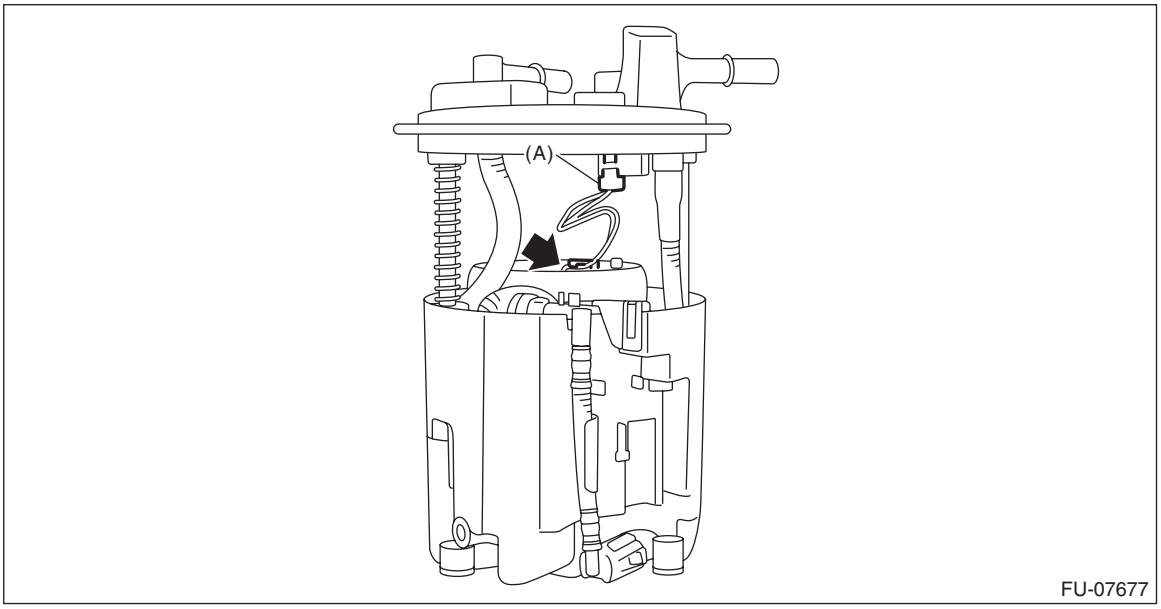


9) Push the fuel filter assembly in the direction of the arrow to compress, and attach the clip.

NOTE:
Use a new clip.



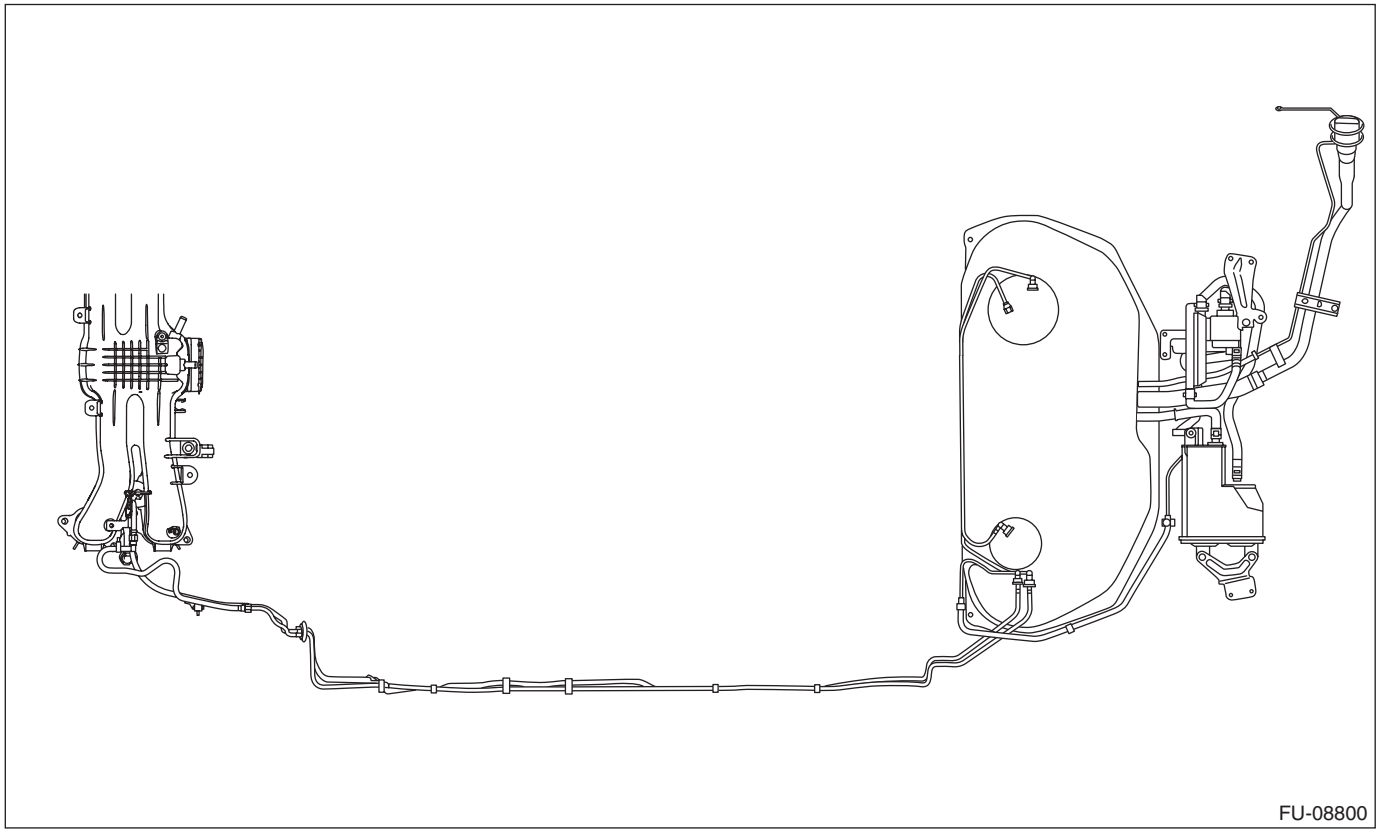
10) Secure the connector cable with the clip, and connect the connector (A) of the connector cable.



11) Install the fuel level sensor. <Ref. to FU(H4DO(w/o HEV))-144, INSTALLATION, Fuel Level Sensor.>
12) Inspect the fuel level sensor. <Ref. to FU(H4DO(w/o HEV))-145, INSPECTION, Fuel Level Sensor.>
13) Install the fuel pump assembly. <Ref. to FU(H4DO(w/o HEV))-141, INSTALLATION, Fuel Pump.>

32.Fuel Delivery and Evaporation Lines

A: REMOVAL



WARNING:
Place “NO OPEN FLAMES” signs near the working area.

CAUTION:
Be careful not to spill fuel.

1) Release the fuel pressure. <Ref. to FU(H4DO(w/o HEV))-109, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Open the fuel filler lid and remove the fuel filler cap.

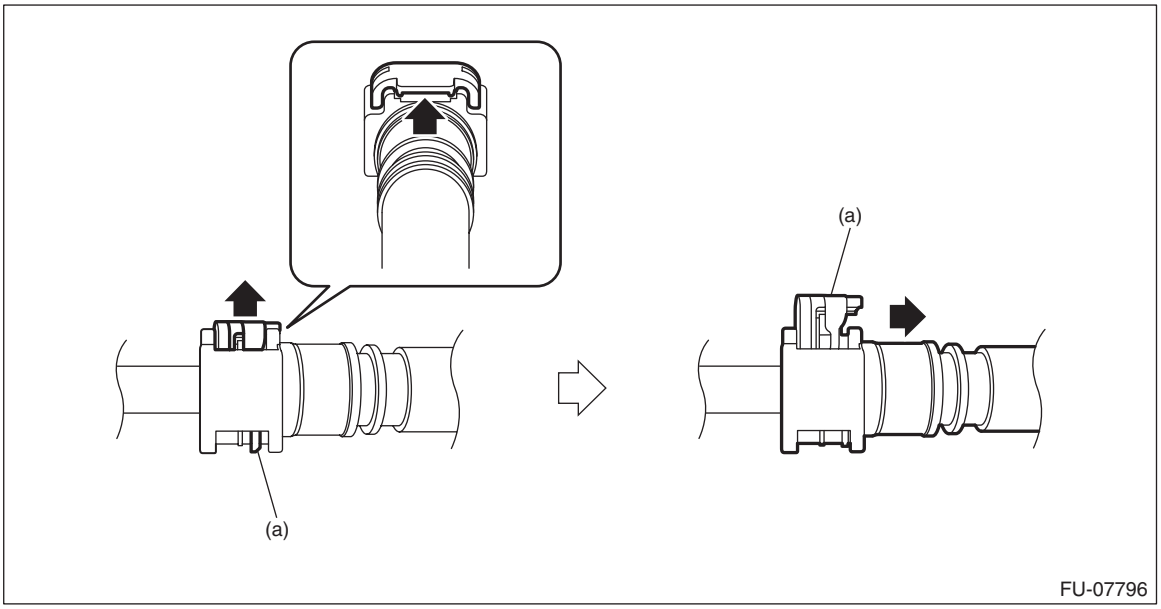
NOTE:
This operation is required to release the inner pressure of the fuel tank.

3) Remove the floor mat. <Ref. to EI-160, REMOVAL, Floor Mat.>

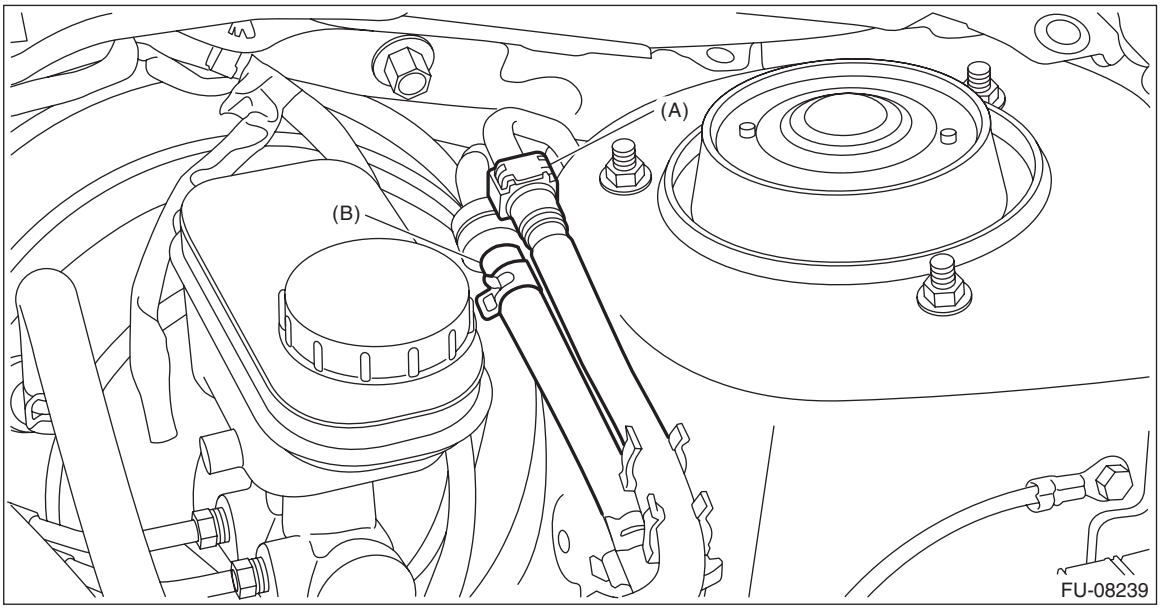
4) In the engine compartment, disconnect the fuel delivery tube (A) and evaporation hose (B).

CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from the tubes using a container or cloth.**

NOTE:
Disconnect the quick connector as shown in the figure.



(a) Slider

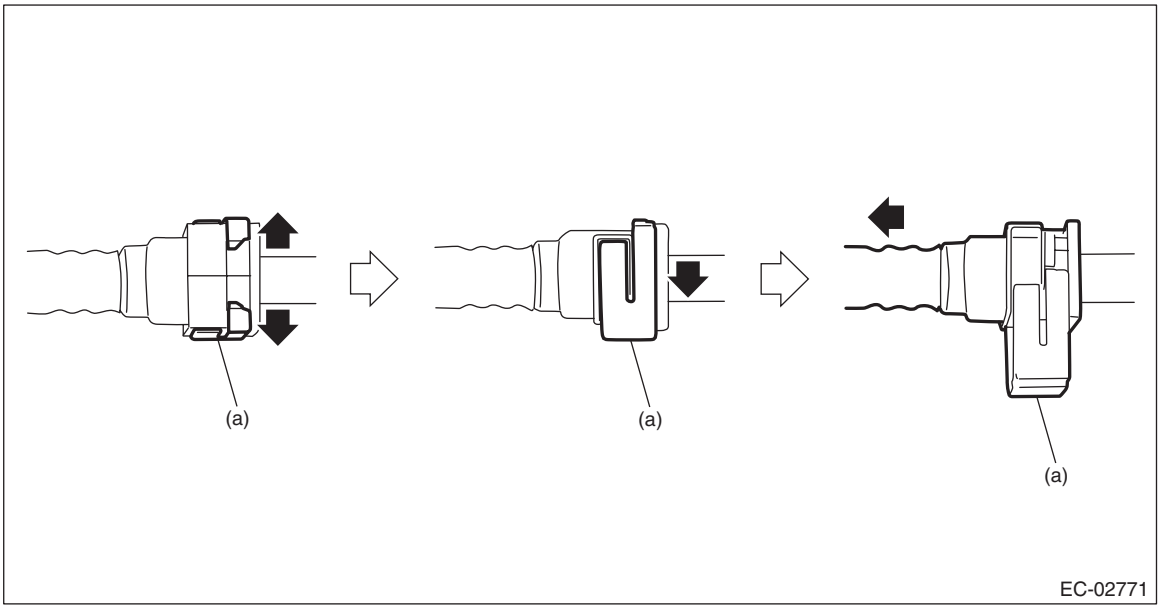


5) Remove the fuel tank. <Ref. to FU(H4DO(w/o HEV))-116, REMOVAL, Fuel Tank.>

6) Disconnect the quick connector, and remove the fuel delivery tube and jet pump tube from the fuel tank.

CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from the tubes using a container or cloth.**

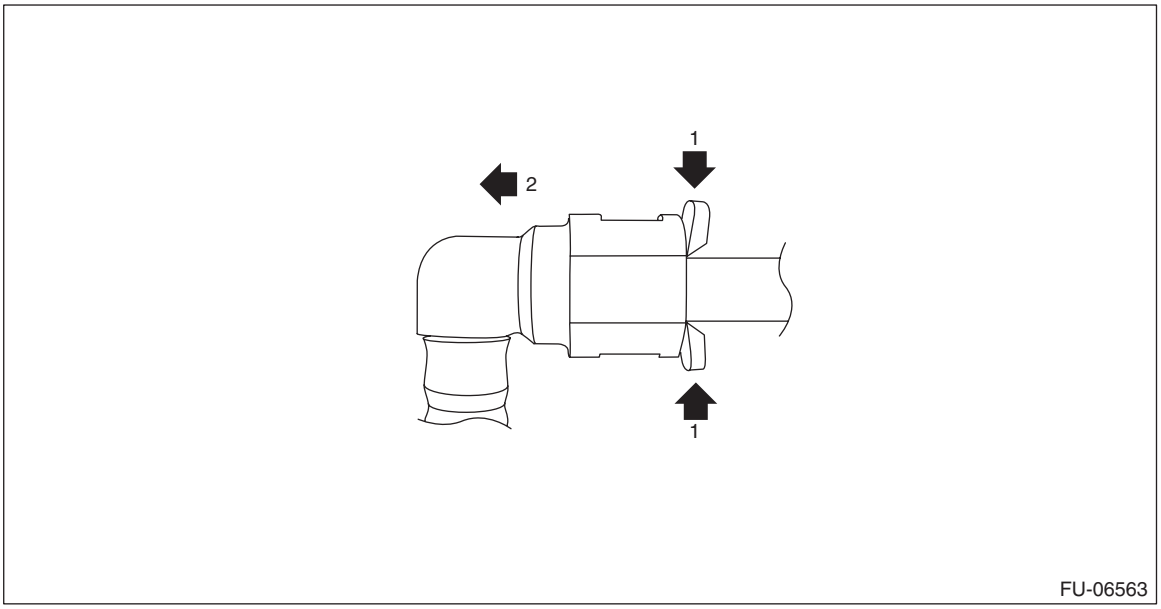
NOTE:
Disconnect the quick connector as shown in the figure.

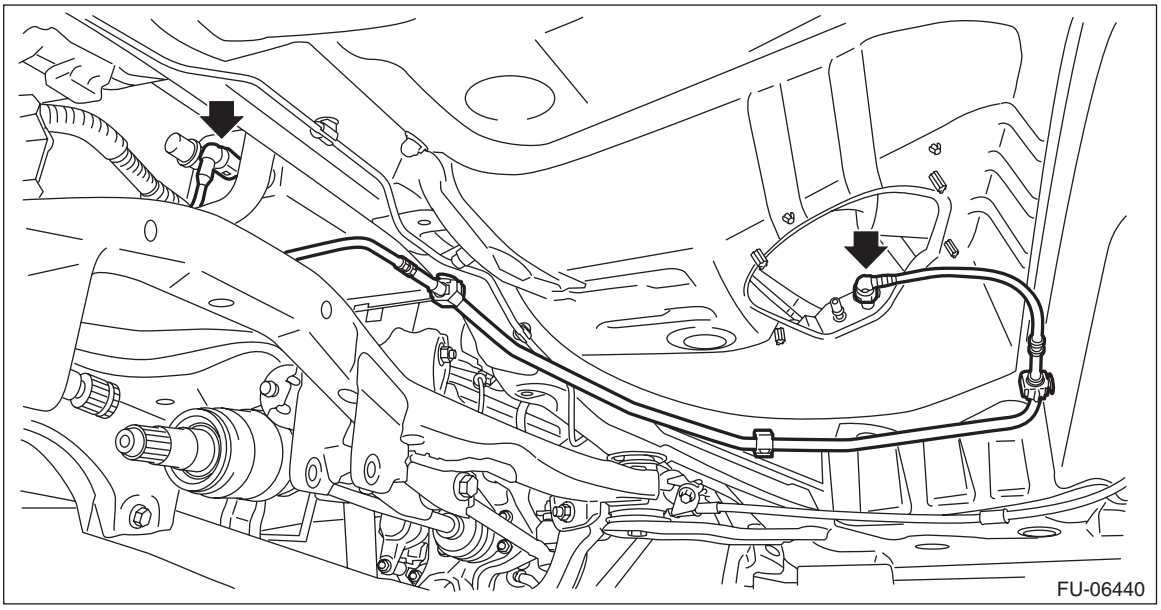


(a) Slider

7) Disconnect the quick connector and remove the purge pipe.

NOTE:
Disconnect the quick connector as shown in the figure.



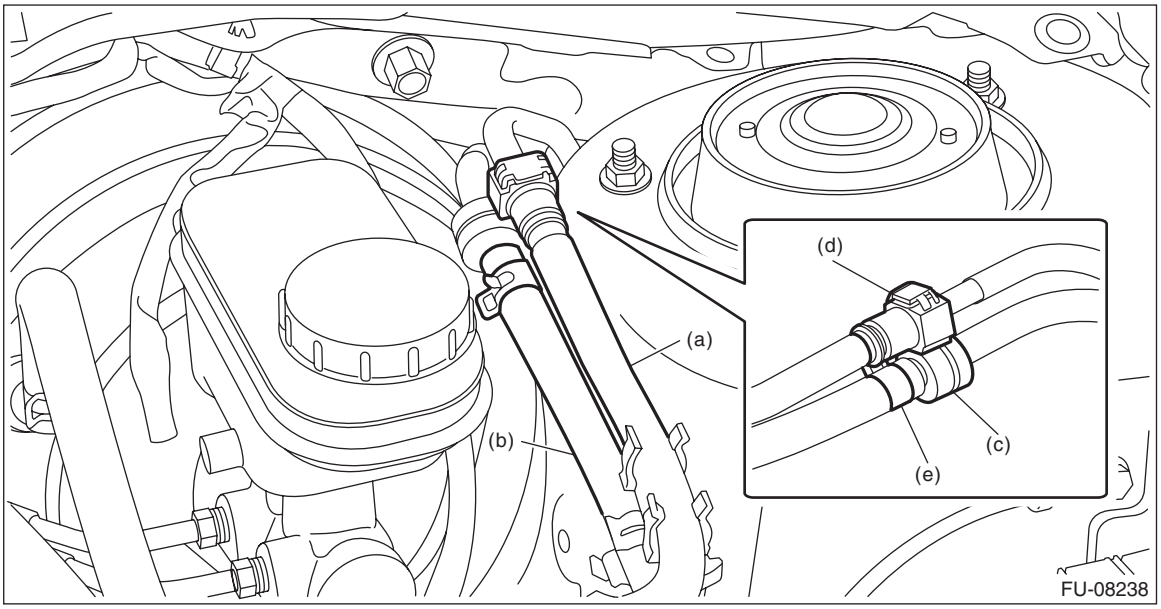


8) Remove the fuel pipe assembly from vehicle.

B: INSTALLATION

Install in the reverse order of removal while being careful of the following.

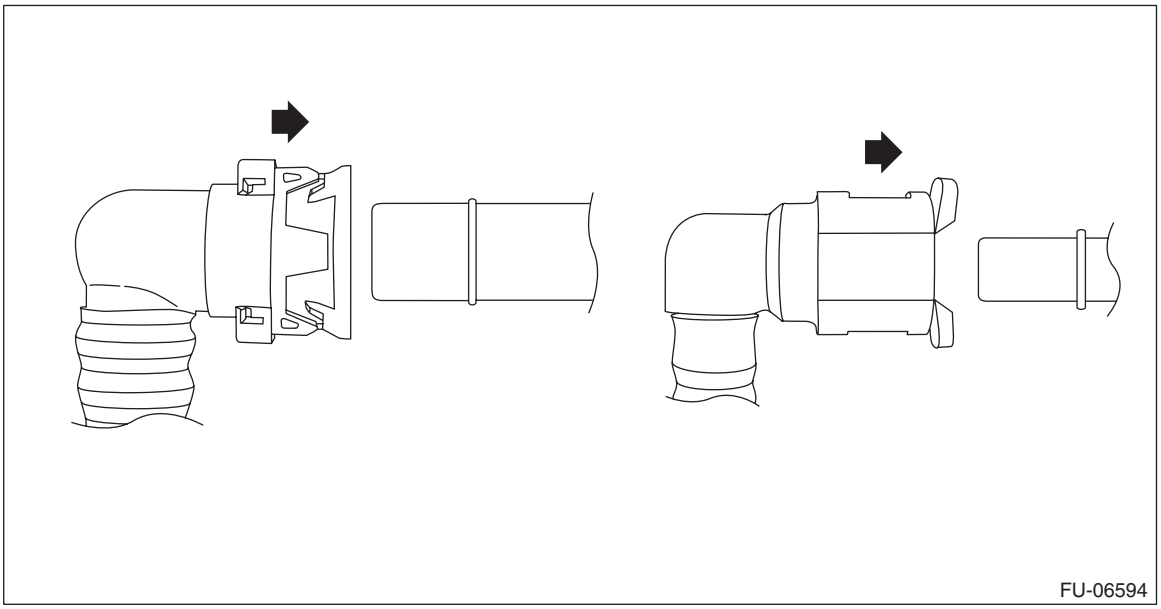
NOTE:
When connecting the fuel delivery tube (a) and evaporation hose (b), let the bushing (c) contact the quick connector (d) of fuel delivery tube to prevent the clip (e) from contacting the quick connector (d).



1. CONNECTING THE EVAPORATION LINE QUICK CONNECTOR

Connect the quick connector as shown in the figure.

CAUTION:
• Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
• Make sure that the quick connector is securely connected.

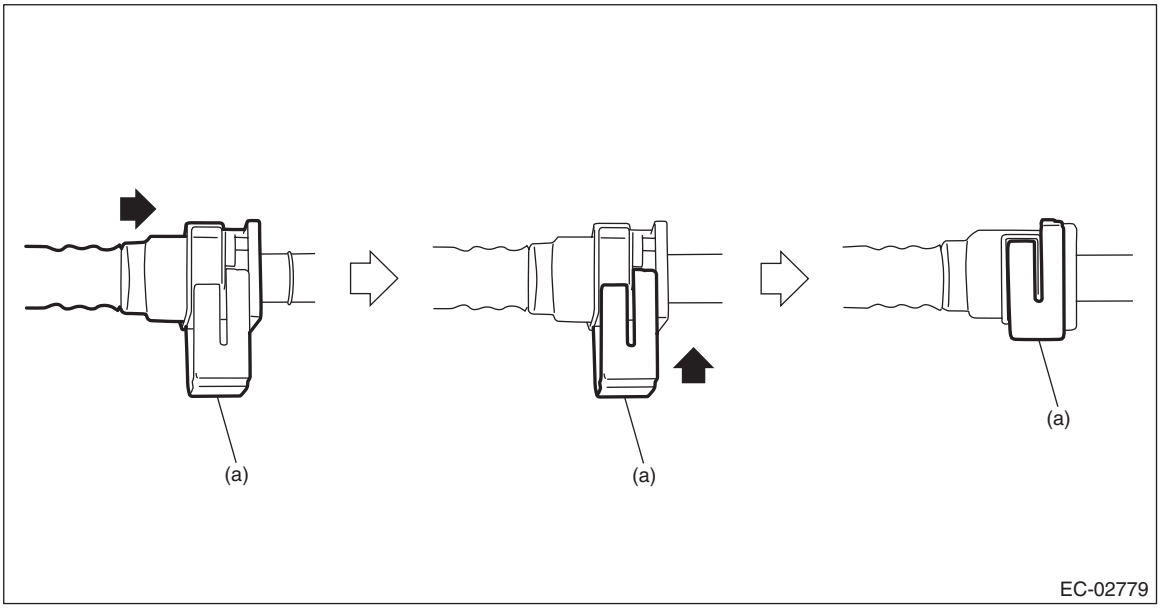


2. CONNECTING THE FUEL LINE QUICK CONNECTOR

Connect the quick connector as shown in the figure.

CAUTION:

- **Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.**
- **When connecting the quick connector, make sure to insert it all the way in before locking the slider.**
- **When it is difficult to lock the slider, check that the connector is fully inserted.**
- **After locking the slider, check again that the quick connector is securely connected.**

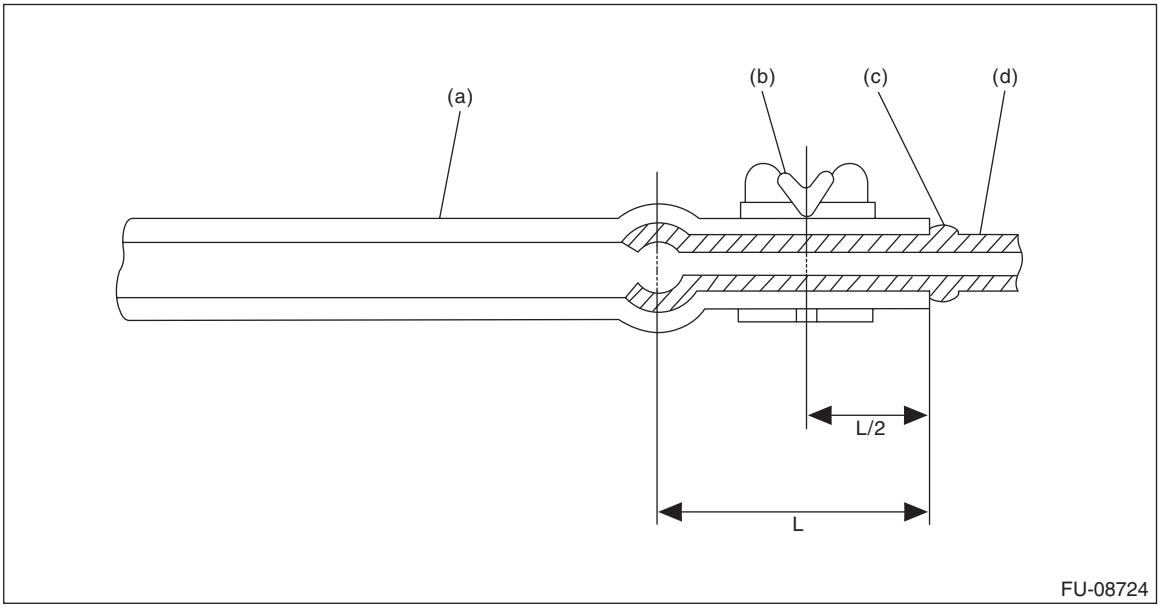


(a) Slider

3. EVAPORATION HOSE CONNECTION

Connect the evaporation hose by inserting it to the pipe until the hose reaches the spool or bump.

NOTE:
If there is no spool nor bump, connect the evaporation hose by inserting it at 28 mm (1.1 in) to the pipe.



(a) Hose
(b) Clip
(c) Spool or bump
(d) Pipe

C: INSPECTION

1) Check that the fuel pipe has no deformation, cracks or other damages.
2) Check that the hose and tube have no cracks, damage or loose part.

33.Fuel System Trouble in General

A: INSPECTION

Trouble	Possible cause	Corrective action
Insufficient fuel supply to fuel injector	a. Fuel pump does not operate.	
	❍ Defective terminal contact	Inspect contact, especially ground, and tighten it securely.
	❍ Trouble in electromagnetic or electronic circuit parts	Replace the faulty parts.
	b. Decline of fuel pump function	Replace the fuel pump.
	c. Clogged fuel filter	Replace the fuel filter. Clean or replace the fuel tank if necessary.
	d. Clogged or bent fuel line pipe, hose or tube	Clean, correct or replace the fuel line pipe, hose or tube.
	e. Air is mixed in fuel system.	Check the fuel line connections, correct or replace the defective part.
	f. Damaged diaphragm of pressure regulator	Replace the fuel filter assembly.
Leakage or blow out of fuel	a. Loose connections of fuel line pipe, hose or tube	Check the fuel line connections, correct or replace the defective part.
	b. Cracked fuel line pipe, hose or tube	Replace the fuel line pipe, hose or tube.
	c. Cracked fuel tank or defective welding part	Replace the fuel tank.
	d. Clogged or bent fuel line pipe, hose or tube	Clean, correct or replace the fuel line pipe, hose or tube.
Gasoline smell inside of compartment	a. Loose connections of fuel line pipe, hose or tube	Check the fuel line connections, correct or replace the defective part.
	b. Defective gasket of fuel saucer or fuel filler pipe assembly	Correct or replace the gasket.
	c. Defective canister	Replace the canister.
Defective fuel gauge	a. Defective operation of fuel level sensor	Replace the fuel level sensor.
	b. Defective operation of combination meter <Ref. to IDI(diag)-2, COMBINATION METER, PROCEDURE, Basic Diagnostic Procedure.>	Replace the combination meter.
Noise	a. Large operation noise or vibration of fuel pump	Replace the fuel pump.

NOTE:
• When the vehicle is left unattended for an extended period of time, water may accumulate in the fuel tank. Fill fuel fully to prevent the problem.
• In snow-covered areas, mountainous areas, skiing areas, etc. where ambient temperatures drop to 0°C (32°F) or less throughout the winter season, use a water removing agent in the fuel system to prevent freezing fuel system and accumulating water.
• When water is accumulated in fuel filter, fill the water removing agent in the fuel tank.
• Before using water removing agent, follow the cautions noted on the bottle.

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

EC(H4DO(w/o HEV))

		Page
1.	General Description	2
2.	Front Catalytic Converter	8
3.	Rear Catalytic Converter	9
4.	Canister	10
5.	Purge Control Solenoid Valve	18
6.	EGR Control Valve	23
7.	EGR Pipe	27
8.	EGR Cooler	32
9.	Fuel Level Sensor	40
10.	Fuel Sub Level Sensor	41
11.	Drain Filter	42
12.	Leak Check Valve Assembly	43
13.	Drain Separator	62
14.	PCV Hose	64
15.	PCV Valve	65

1. List of Diagnostic Trouble Code (DTC)

A: LIST

DTC	Item	Note
B1570	Antenna	<Ref. to GD(H4DO w/o HEV)-11, DTC B1570 ANTENNA, Diagnostic Trouble Code (DTC) Detecting Criteria.>
B1571	Reference Code Incompatibility	<Ref. to GD(H4DO w/o HEV)-12, DTC B1571 REFERENCE CODE INCOMPATIBILITY, Diagnostic Trouble Code (DTC) Detecting Criteria.>
B1572	IMM Circuit Failure (Except Antenna Circuit)	<Ref. to GD(H4DO w/o HEV)-12, DTC B1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
B1574	Key Communication Failure	<Ref. to GD(H4DO w/o HEV)-12, DTC B1574 KEY COMMUNICATION FAILURE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
B1575	Incorrect Immobilizer Key	<Ref. to GD(H4DO w/o HEV)-12, DTC B1575 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>
B1576	EGI Control Module EEPROM	<Ref. to GD(H4DO w/o HEV)-12, DTC B1576 EGI CONTROL MODULE EEPROM, Diagnostic Trouble Code (DTC) Detecting Criteria.>
B1577	IMM Control Module EEPROM	<Ref. to GD(H4DO w/o HEV)-12, DTC B1577 IMM CONTROL MODULE EEPROM, Diagnostic Trouble Code (DTC) Detecting Criteria.>
B1578	Meter Failure	<Ref. to GD(H4DO w/o HEV)-12, DTC B1578 METER FAILURE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P000A	A Camshaft Position Slow Response (Bank 1)	<Ref. to GD(H4DO w/o HEV)-13, DTC P000A A CAMSHAFT POSITION SLOW RESPONSE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P000B	B Camshaft Position Slow Response (Bank 1)	<Ref. to GD(H4DO w/o HEV)-14, DTC P000B B CAMSHAFT POSITION SLOW RESPONSE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P000C	A Camshaft Position Slow Response (Bank 2)	<Ref. to GD(H4DO w/o HEV)-14, DTC P000C A CAMSHAFT POSITION SLOW RESPONSE (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P000D	B Camshaft Position Slow Response (Bank 2)	<Ref. to GD(H4DO w/o HEV)-14, DTC P000D B CAMSHAFT POSITION SLOW RESPONSE (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0011	Intake Camshaft Position - Timing Over-Advanced or System Performance (Bank 1)	<Ref. to GD(H4DO w/o HEV)-16, DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0014	Exhaust AVCS System 1 (Range/Performance)	<Ref. to GD(H4DO w/o HEV)-18, DTC P0014 EXHAUST AVCS SYSTEM 1 (RANGE/PERFORMANCE), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0016	Crankshaft Position - Camshaft Position Correlation (Bank1)	<Ref. to GD(H4DO w/o HEV)-19, DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0017	Crank and Cam Timing B System Failure (Bank 1)	<Ref. to GD(H4DO w/o HEV)-20, DTC P0017 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0018	Crankshaft Position - Camshaft Position Correlation (Bank2)	<Ref. to GD(H4DO w/o HEV)-21, DTC P0018 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0019	Crank and Cam Timing B System Failure (Bank 2)	<Ref. to GD(H4DO w/o HEV)-21, DTC P0019 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0021	Intake Camshaft Position - Timing Over-Advanced or System Performance (Bank 2)	<Ref. to GD(H4DO w/o HEV)-21, DTC P0021 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0024	Exhaust AVCS System 2 (Range/Performance)	<Ref. to GD(H4DO w/o HEV)-21, DTC P0024 EXHAUST AVCS SYSTEM 2 (RANGE/PERFORMANCE), Diagnostic Trouble Code (DTC) Detecting Criteria.>

DTC	Item	Note
P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	<Ref. to GD(H4DO w/o HEV)-22, DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)	<Ref. to GD(H4DO w/o HEV)-23, DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0032	HO2S Heater Control Circuit High (Bank 1 Sensor 1)	<Ref. to GD(H4DO w/o HEV)-24, DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0037	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)	<Ref. to GD(H4DO w/o HEV)-25, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0038	HO2S Heater Control Circuit High (Bank 1 Sensor 2)	<Ref. to GD(H4DO w/o HEV)-26, DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0068	MAP/MAF - Throttle Position Correlation	<Ref. to GD(H4DO w/o HEV)-27, DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0071	Ambient Temperature Sensor Circuit "A" Range/Performance	<Ref. to GD(H4DO w/o HEV)-29, DTC P0071 AMBIENT TEMPERATURE SENSOR CIRCUIT "A" RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0072	Ambient Temperature Sensor Circuit "A" Low	<Ref. to GD(H4DO w/o HEV)-31, DTC P0072 AMBIENT TEMPERATURE SENSOR CIRCUIT "A" LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0073	Ambient Temperature Sensor Circuit "A" High	<Ref. to GD(H4DO w/o HEV)-32, DTC P0073 AMBIENT TEMPERATURE SENSOR CIRCUIT "A" HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0101	Mass or Volume Air Flow Circuit Range/Performance	<Ref. to GD(H4DO w/o HEV)-33, DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0102	Mass or Volume Air Flow Circuit Low Input	<Ref. to GD(H4DO w/o HEV)-35, DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0103	Mass or Volume Air Flow Circuit High Input	<Ref. to GD(H4DO w/o HEV)-36, DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	<Ref. to GD(H4DO w/o HEV)-37, DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	<Ref. to GD(H4DO w/o HEV)-38, DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0111	Intake Air Temperature Sensor Range/Performance Problem	<Ref. to GD(H4DO w/o HEV)-39, DTC P0111 INTAKE AIR TEMPERATURE SENSOR RANGE/PERFORMANCE PROBLEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0112	Intake Air Temperature Sensor 1 Circuit Low	<Ref. to GD(H4DO w/o HEV)-42, DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0113	Intake Air Temperature Sensor 1 Circuit High	<Ref. to GD(H4DO w/o HEV)-43, DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	<Ref. to GD(H4DO w/o HEV)-44, DTC P0116 ENGINE COOLANT TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0117	Engine Coolant Temperature Circuit Low	<Ref. to GD(H4DO w/o HEV)-46, DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0118	Engine Coolant Temperature Circuit High	<Ref. to GD(H4DO w/o HEV)-47, DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DTC	Item	Note
P0122	Throttle/Pedal Position Sensor/Switch “A” Circuit Low	<Ref. to GD(H4DO w/o HEV)-48, DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0123	Throttle/Pedal Position Sensor/Switch “A” Circuit High	<Ref. to GD(H4DO w/o HEV)-49, DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	<Ref. to GD(H4DO w/o HEV)-50, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0128	Coolant Thermostat (Engine Coolant Temperature Below Thermostat Regulating Temperature)	<Ref. to GD(H4DO w/o HEV)-51, DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	<Ref. to GD(H4DO w/o HEV)-54, DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	<Ref. to GD(H4DO w/o HEV)-55, DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0134	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	<Ref. to GD(H4DO w/o HEV)-56, DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0137	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	<Ref. to GD(H4DO w/o HEV)-57, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0138	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	<Ref. to GD(H4DO w/o HEV)-58, DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P013A	O2 Sensor Slow Response - Rich to Lean (Bank 1 Sensor 2)	<Ref. to GD(H4DO w/o HEV)-59, DTC P013A O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P013B	O2 Sensor Slow Response - Lean to Rich (Bank 1 Sensor 2)	<Ref. to GD(H4DO w/o HEV)-61, DTC P013B O2 SENSOR SLOW RESPONSE - LEAN TO RICH (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P013E	O2 Sensor Delayed Response - Rich to Lean (Bank 1 Sensor 2)	<Ref. to GD(H4DO w/o HEV)-63, DTC P013E O2 SENSOR DELAYED RESPONSE - RICH TO LEAN (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P013F	O2 Sensor Delayed Response - Lean to Rich (Bank 1 Sensor 2)	<Ref. to GD(H4DO w/o HEV)-65, DTC P013F O2 SENSOR DELAYED RESPONSE - LEAN TO RICH (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0141	O2 Sensor Heater Circuit (Bank1 Sensor2)	<Ref. to GD(H4DO w/o HEV)-67, DTC P0141 O2 SENSOR HEATER CIRCUIT (BANK1 SENSOR2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P014C	O2 Sensor Slow Response - Rich to Lean (Bank 1 Sensor 1)	<Ref. to GD(H4DO w/o HEV)-68, DTC P014C O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P014D	O2 Sensor Slow Response - Lean to Rich (Bank 1 Sensor 1)	<Ref. to GD(H4DO w/o HEV)-70, DTC P014D O2 SENSOR SLOW RESPONSE - LEAN TO RICH (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P015A	O2 Sensor Delayed Response - Rich to Lean (Bank 1 Sensor 1)	<Ref. to GD(H4DO w/o HEV)-71, DTC P015A O2 SENSOR DELAYED RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P015B	O2 Sensor Delayed Response - Lean to Rich (Bank 1 Sensor 1)	<Ref. to GD(H4DO w/o HEV)-75, DTC P015B O2 SENSOR DELAYED RESPONSE - LEAN TO RICH (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0171	System Too Lean (Bank 1)	<Ref. to GD(H4DO w/o HEV)-76, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

DTC	Item	Note
P0172	System Too Rich (Bank 1)	<Ref. to GD(H4DO w/o HEV)-77, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0196	Engine Oil Temperature Sensor Circuit Range/Performance	<Ref. to GD(H4DO w/o HEV)-78, DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0197	Engine Oil Temperature Sensor Low	<Ref. to GD(H4DO w/o HEV)-80, DTC P0197 ENGINE OIL TEMPERATURE SENSOR LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0198	Engine Oil Temperature Sensor High	<Ref. to GD(H4DO w/o HEV)-81, DTC P0198 ENGINE OIL TEMPERATURE SENSOR HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0201	Injector #1	<Ref. to GD(H4DO w/o HEV)-82, DTC P0201 INJECTOR #1, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0202	Injector #2	<Ref. to GD(H4DO w/o HEV)-82, DTC P0202 INJECTOR #2, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0203	Injector #3	<Ref. to GD(H4DO w/o HEV)-82, DTC P0203 INJECTOR #3, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0204	Injector #4	<Ref. to GD(H4DO w/o HEV)-82, DTC P0204 INJECTOR #4, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0222	Throttle/Pedal Position Sensor/Switch “B” Circuit Low	<Ref. to GD(H4DO w/o HEV)-83, DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0223	Throttle/Pedal Position Sensor/Switch “B” Circuit High	<Ref. to GD(H4DO w/o HEV)-84, DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0300	Random/Multiple Cylinder Misfire Detected	<Ref. to GD(H4DO w/o HEV)-84, DTC P0300 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0301	Cylinder 1 Misfire Detected	<Ref. to GD(H4DO w/o HEV)-85, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0302	Cylinder 2 Misfire Detected	<Ref. to GD(H4DO w/o HEV)-93, DTC P0302 CYLINDER 2 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0303	Cylinder 3 Misfire Detected	<Ref. to GD(H4DO w/o HEV)-93, DTC P0303 CYLINDER 3 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0304	Cylinder 4 Misfire Detected	<Ref. to GD(H4DO w/o HEV)-93, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0327	Knock Sensor 1 Circuit Low (Bank 1 or Single Sensor)	<Ref. to GD(H4DO w/o HEV)-94, DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0328	Knock Sensor 1 Circuit High (Bank 1 or Single Sensor)	<Ref. to GD(H4DO w/o HEV)-95, DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0335	Crankshaft Position Sensor “A” Circuit	<Ref. to GD(H4DO w/o HEV)-96, DTC P0335 CRANKSHAFT POSITION SENSOR “A” CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0336	Crankshaft Position Sensor “A” Circuit Range/Performance	<Ref. to GD(H4DO w/o HEV)-98, DTC P0336 CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0340	Camshaft Position Sensor “A” Circuit (Bank 1 or Single Sensor)	<Ref. to GD(H4DO w/o HEV)-100, DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0341	Camshaft Position Sensor "A" Circuit Range/Performance (Bank 1 or Single Sensor)	<Ref. to GD(H4DO w/o HEV)-102, DTC P0341 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0345	Camshaft Position Sensor “A” Circuit (Bank 2)	<Ref. to GD(H4DO w/o HEV)-103, DTC P0345 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

DTC	Item	Note
P0346	Camshaft Position Sensor "A" Circuit Range/Performance (Bank 2)	<Ref. to GD(H4DO w/o HEV)-103, DTC P0346 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0351	Ignition Coil A Primary/Secondary Circuit	<Ref. to GD(H4DO w/o HEV)-104, DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0352	Ignition Coil B Primary/Secondary Circuit	<Ref. to GD(H4DO w/o HEV)-104, DTC P0352 IGNITION COIL B PRIMARY/SECONDARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0353	Ignition Coil C Primary/Secondary Circuit	<Ref. to GD(H4DO w/o HEV)-104, DTC P0353 IGNITION COIL C PRIMARY/SECONDARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0354	Ignition Coil D Primary/Secondary Circuit	<Ref. to GD(H4DO w/o HEV)-104, DTC P0354 IGNITION COIL D PRIMARY/SECONDARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0365	Camshaft Position Sensor “B” Circuit (Bank 1)	<Ref. to GD(H4DO w/o HEV)-105, DTC P0365 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0366	Camshaft Position Sensor B Circuit Range/Performance (Bank 1)	<Ref. to GD(H4DO w/o HEV)-106, DTC P0366 CAMSHAFT POSITION SENSOR B CIRCUIT RANGE/PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0390	Camshaft Position Sensor “B” Circuit (Bank 2)	<Ref. to GD(H4DO w/o HEV)-107, DTC P0390 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0391	Camshaft Position Sensor B Circuit Range/Performance (Bank 2)	<Ref. to GD(H4DO w/o HEV)-107, DTC P0391 CAMSHAFT POSITION SENSOR B CIRCUIT RANGE/PERFORMANCE (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0400	Exhaust Gas Recirculation Flow	<Ref. to GD(H4DO w/o HEV)-108, DTC P0400 EXHAUST GAS RECIRCULATION FLOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	<Ref. to GD(H4DO w/o HEV)-110, DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0441	Evaporative Emission Cont. Sys. Incorrect Purge Flow	<Ref. to GD(H4DO w/o HEV)-112, DTC P0441 EVAPORATIVE EMISSION CONT. SYS. INCORRECT PURGE FLOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0451	Evaporative Emission System Pressure Sensor/Switch Range/Performance	<Ref. to GD(H4DO w/o HEV)-115, DTC P0451 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0452	Evaporative Emission System Pressure Sensor/Switch Low	<Ref. to GD(H4DO w/o HEV)-117, DTC P0452 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0453	Evaporative Emission System Pressure Sensor/Switch High	<Ref. to GD(H4DO w/o HEV)-118, DTC P0453 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0455	Evaporative Emission System Leak Detected (Large Leak)	<Ref. to GD(H4DO w/o HEV)-119, DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)	<Ref. to GD(H4DO w/o HEV)-124, DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0458	Evaporative Emission System Purge Control Valve Circuit Low	<Ref. to GD(H4DO w/o HEV)-125, DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0459	Evaporative Emission System Purge Control Valve Circuit High	<Ref. to GD(H4DO w/o HEV)-126, DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0461	Fuel Level Sensor “A” Circuit Range/Performance	<Ref. to GD(H4DO w/o HEV)-127, DTC P0461 FUEL LEVEL SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DTC	Item	Note
P0462	Fuel Level Sensor “A” Circuit Low	<Ref. to GD(H4DO w/o HEV)-128, DTC P0462 FUEL LEVEL SENSOR “A” CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0463	Fuel Level Sensor “A” Circuit High	<Ref. to GD(H4DO w/o HEV)-129, DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0500	Vehicle Speed Sensor “A”	<Ref. to GD(H4DO w/o HEV)-130, DTC P0500 VEHICLE SPEED SENSOR “A”, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0506	Idle Air Control System RPM Lower Than Expected	<Ref. to GD(H4DO w/o HEV)-131, DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0507	Idle Air Control System RPM Higher Than Expected	<Ref. to GD(H4DO w/o HEV)-132, DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P050A	Cold Start Idle Air Control System Performance	<Ref. to GD(H4DO w/o HEV)-133, DTC P050A COLD START IDLE AIR CONTROL SYSTEM PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P050B	Cold Start Ignition Timing Performance	<Ref. to GD(H4DO w/o HEV)-136, DTC P050B COLD START IGNITION TIMING PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0516	Battery Temperature Sensor Circuit Low	<Ref. to GD(H4DO w/o HEV)-137, DTC P0516 BATTERY TEMPERATURE SENSOR CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0517	Battery Temperature Sensor Circuit High	<Ref. to GD(H4DO w/o HEV)-138, DTC P0517 BATTERY TEMPERATURE SENSOR CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0560	System Voltage	<Ref. to GD(H4DO w/o HEV)-139, DTC P0560 SYSTEM VOLTAGE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0604	Internal Control Module Random Access Memory (RAM) Error	<Ref. to GD(H4DO w/o HEV)-140, DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0605	Internal Control Module Read Only Memory (ROM) Error	<Ref. to GD(H4DO w/o HEV)-141, DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0606	Control Module Processor	<Ref. to GD(H4DO w/o HEV)-142, DTC P0606 CONTROL MODULE PROCESSOR, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P060A	Internal Control Module Monitoring Processor Performance	<Ref. to GD(H4DO w/o HEV)-144, DTC P060A INTERNAL CONTROL MODULE MONITORING PROCESSOR PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P060B	Internal Control Module A/D Processing Performance	<Ref. to GD(H4DO w/o HEV)-146, DTC P060B INTERNAL CONTROL MODULE A/D PROCESSING PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0616	Starter Relay Circuit Low	<Ref. to GD(H4DO w/o HEV)-148, DTC P0616 STARTER RELAY CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0617	Starter Relay Circuit High	<Ref. to GD(H4DO w/o HEV)-149, DTC P0617 STARTER RELAY CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P062F	Internal Control Module EEPROM Error	<Ref. to GD(H4DO w/o HEV)-150, DTC P062F INTERNAL CONTROL MODULE EEPROM ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0685	ECM/PCM Power Relay Control Circuit/Open	<Ref. to GD(H4DO w/o HEV)-151, DTC P0685 ECM/PCM POWER RELAY CONTROL CIRCUIT/OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0700	Transmission Control System (MIL Request)	<Ref. to GD(H4DO w/o HEV)-152, DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0851	Park/Neutral Switch Input Circuit Low (AT Model)	<Ref. to GD(H4DO w/o HEV)-154, DTC P0851 PARK/NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0851	Neutral Switch Input Circuit Low (MT Model)	<Ref. to GD(H4DO w/o HEV)-155, DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>

DTC	Item	Note
P0852	Park/Neutral Switch Input Circuit High (AT Model)	<Ref. to GD(H4DO w/o HEV)-156, DTC P0852 PARK/NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0852	Neutral Switch Input Circuit High (MT Model)	<Ref. to GD(H4DO w/o HEV)-157, DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1160	Return Spring Failure	<Ref. to GD(H4DO w/o HEV)-158, DTC P1160 RETURN SPRING FAILURE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1449	Evaporative Emission Cont. Sys. Air Filter Clog	<Ref. to GD(H4DO w/o HEV)-159, DTC P1449 EVAPORATIVE EMISSION CONT. SYS. AIR FILTER CLOG, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1451	Evaporative Emission Cont. Sys.	<Ref. to GD(H4DO w/o HEV)-160, DTC P1451 EVAPORATIVE EMISSION CONT. SYS., Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1492	EGR Solenoid Valve Signal #1 Circuit Malfunction (Low Input)	<Ref. to GD(H4DO w/o HEV)-161, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1493	EGR Solenoid Valve Signal #1 Circuit Malfunction (High Input)	<Ref. to GD(H4DO w/o HEV)-162, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1494	EGR Solenoid Valve Signal #2 Circuit Malfunction (Low Input)	<Ref. to GD(H4DO w/o HEV)-163, DTC P1494 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1495	EGR Solenoid Valve Signal #2 Circuit Malfunction (High Input)	<Ref. to GD(H4DO w/o HEV)-163, DTC P1495 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1496	EGR Solenoid Valve Signal #3 Circuit Malfunction (Low Input)	<Ref. to GD(H4DO w/o HEV)-163, DTC P1496 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1497	EGR Solenoid Valve Signal #3 Circuit Malfunction (High Input)	<Ref. to GD(H4DO w/o HEV)-163, DTC P1497 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1498	EGR Solenoid Valve Signal #4 Circuit Malfunction (Low Input)	<Ref. to GD(H4DO w/o HEV)-163, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1499	EGR Solenoid Valve Signal #4 Circuit Malfunction (High Input)	<Ref. to GD(H4DO w/o HEV)-163, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1530	Battery Current Sensor Circuit Low	<Ref. to GD(H4DO w/o HEV)-164, DTC P1530 BATTERY CURRENT SENSOR CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1531	Battery Current Sensor Circuit High	<Ref. to GD(H4DO w/o HEV)-165, DTC P1531 BATTERY CURRENT SENSOR CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1532	Battery Charging System	<Ref. to GD(H4DO w/o HEV)-166, DTC P1532 BATTERY CHARGING SYSTEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2004	Intake Manifold Runner Control Stuck Open (Bank 1)	<Ref. to GD(H4DO w/o HEV)-168, DTC P2004 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2005	Intake Manifold Runner Control Stuck Open (Bank 2)	<Ref. to GD(H4DO w/o HEV)-169, DTC P2005 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2006	Intake Manifold Runner Control Stuck Closed (Bank 1)	<Ref. to GD(H4DO w/o HEV)-170, DTC P2006 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2007	Intake Manifold Runner Control Stuck Closed (Bank 2)	<Ref. to GD(H4DO w/o HEV)-171, DTC P2007 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

DTC	Item	Note
P2009	Intake Manifold Runner Control Circuit Low (Bank 1)	<Ref. to GD(H4DO w/o HEV)-172, DTC P2009 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2012	Intake Manifold Runner Control Circuit Low (Bank 2)	<Ref. to GD(H4DO w/o HEV)-173, DTC P2012 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2096	Post Catalyst Fuel Trim System Too Lean (Bank 1)	<Ref. to GD(H4DO w/o HEV)-174, DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2097	Post Catalyst Fuel Trim System Too Rich (Bank 1)	<Ref. to GD(H4DO w/o HEV)-175, DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2101	Throttle Actuator Control Motor Circuit Range/Performance	<Ref. to GD(H4DO w/o HEV)-176, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2102	Throttle Actuator Control Motor Circuit Low	<Ref. to GD(H4DO w/o HEV)-177, DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2103	Throttle Actuator Control Motor Circuit High	<Ref. to GD(H4DO w/o HEV)-178, DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2109	Throttle/Pedal Position Sensor “A” Minimum Stop Performance	<Ref. to GD(H4DO w/o HEV)-179, DTC P2109 THROTTLE/PEDAL POSITION SENSOR “A” MINIMUM STOP PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2119	Throttle Actuator Control Throttle Body Range/Performance	<Ref. to GD(H4DO w/o HEV)-180, DTC P2119 THROTTLE ACTUATOR CONTROL THROTTLE BODY RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2122	Throttle/Pedal Position Sensor/Switch “D” Circuit Low Input	<Ref. to GD(H4DO w/o HEV)-182, DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2123	Throttle/Pedal Position Sensor/Switch “D” Circuit High Input	<Ref. to GD(H4DO w/o HEV)-183, DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2127	Throttle/Pedal Position Sensor/Switch “E” Circuit Low Input	<Ref. to GD(H4DO w/o HEV)-184, DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2128	Throttle/Pedal Position Sensor/Switch “E” Circuit High Input	<Ref. to GD(H4DO w/o HEV)-185, DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2135	Throttle/Pedal Position Sensor/Switch “A”/“B” Voltage Correlation	<Ref. to GD(H4DO w/o HEV)-186, DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A”/“B” VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2138	Throttle/Pedal Position Sensor/Switch “D”/“E” Voltage Correlation	<Ref. to GD(H4DO w/o HEV)-188, DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2195	O2 Sensor Signal Biased/Stuck Lean (Bank 1 Sensor 1)	<Ref. to GD(H4DO w/o HEV)-190, DTC P2195 O2 SENSOR SIGNAL BIASED/STUCK LEAN (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2196	O2 Sensor Signal Biased/Stuck Rich (Bank 1 Sensor 1)	<Ref. to GD(H4DO w/o HEV)-192, DTC P2196 O2 SENSOR SIGNAL BIASED/STUCK RICH (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P219A	Bank 1 Air-Fuel Ratio Imbalance	<Ref. to GD(H4DO w/o HEV)-194, DTC P219A BANK 1 AIR-FUEL RATIO IMBALANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	<Ref. to GD(H4DO w/o HEV)-202, DTC P2401 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP CONTROL CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DTC	Item	Note
P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	<Ref. to GD(H4DO w/o HEV)-203, DTC P2402 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP CONTROL CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2404	Evaporative Emission System Leak Detection Pump Sense Circuit Range/ Performance	<Ref. to GD(H4DO w/o HEV)-204, DTC P2404 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP SENSE CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2419	Evaporative Emission System Switching Valve Control Circuit Low	<Ref. to GD(H4DO w/o HEV)-205, DTC P2419 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2420	Evaporative Emission System Switching Valve Control Circuit High	<Ref. to GD(H4DO w/o HEV)-206, DTC P2420 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2530	Ignition Switch Run Position Circuit	<Ref. to GD(H4DO w/o HEV)-207, DTC P2530 IGNITION SWITCH RUN POSITION CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2610	ECM/PCM Internal Engine Off Timer Performance	<Ref. to GD(H4DO w/o HEV)-208, DTC P2610 ECM/PCM INTERNAL ENGINE OFF TIMER PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
U0073	Control Module Communication Bus Off	<Ref. to GD(H4DO w/o HEV)-214, DTC U0073 CONTROL MODULE COMMUNICATION BUS OFF, Diagnostic Trouble Code (DTC) Detecting Criteria.>
U0101	Lost Communication With TCM	<Ref. to GD(H4DO w/o HEV)-215, DTC U0101 LOST COMMUNICATION WITH TCM, Diagnostic Trouble Code (DTC) Detecting Criteria.>
U0122	Lost Communication With Vehicle Dynamics Control Module	<Ref. to GD(H4DO w/o HEV)-216, DTC U0122 LOST COMMUNICATION WITH VEHICLE DYNAMICS CONTROL MODULE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
U0155	Lost Communication With Instrument Panel Cluster (IPC) Control Module	<Ref. to GD(H4DO w/o HEV)-217, DTC U0155 LOST COMMUNICATION WITH INSTRUMENT PANEL CLUSTER (IPC) CONTROL MODULE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
U0402	Invalid Data Received From TCM	<Ref. to GD(H4DO w/o HEV)-218, DTC U0402 INVALID DATA RECEIVED FROM TCM, Diagnostic Trouble Code (DTC) Detecting Criteria.>
U0416	Invalid Data Received From Vehicle Dynamics Control Module	<Ref. to GD(H4DO w/o HEV)-219, DTC U0416 INVALID DATA RECEIVED FROM VEHICLE DYNAMICS CONTROL MODULE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
U0423	Invalid Data Received From Instrument Panel Cluster Control Module	<Ref. to GD(H4DO w/o HEV)-220, DTC U0423 INVALID DATA RECEIVED FROM INSTRUMENT PANEL CLUSTER CONTROL MODULE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

2. Diagnostic Trouble Code (DTC) Detecting Criteria

A: DTC B1570 ANTENNA

1. OUTLINE OF DIAGNOSIS

DTC	Item	OUTLINE OF DIAGNOSIS
B1570	Antenna	Faulty antenna
B1571	Reference Code Incompatibility	Reference code incompatibility between body integrated unit and ECM
B1572	IMM Circuit Failure (Except Antenna Circuit)	Communication failure between body integrated unit and ECM
B1574	Key Communication Failure	The body integrated unit to confirm the key (transponder) ID code has malfunction, of the transponder is faulty.
B1575	Incorrect Immobilizer Key	Incorrect immobilizer key (Use of unregistered key in body integrated unit)
B1576	EGI Control Module EEPROM	ECM malfunctioning
B1577	IMM Control Module EEPROM	Body integrated unit malfunctioning
B1578	Meter Failure	Reference code incompatibility between combination meter and body integrated unit

2. ENABLE CONDITIONS

When starting the engine.

3. GENERAL DRIVING CYCLE

Perform the diagnosis only after starting the engine.

4. DIAGNOSTIC METHOD

Judge as NG when the conditions for the outline of the diagnosis of the top are established.

B: DTC B1571 REFERENCE CODE INCOMPATIBILITY

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC B1570. <Ref. to GD(H4DO w/o HEV)-11, DTC B1570 ANTENNA, Diagnostic Trouble Code (DTC) Detecting Criteria.>

C: DTC B1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC B1570. <Ref. to GD(H4DO w/o HEV)-11, DTC B1570 ANTENNA, Diagnostic Trouble Code (DTC) Detecting Criteria.>

D: DTC B1574 KEY COMMUNICATION FAILURE

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC B1570. <Ref. to GD(H4DO w/o HEV)-11, DTC B1570 ANTENNA, Diagnostic Trouble Code (DTC) Detecting Criteria.>

E: DTC B1575 INCORRECT IMMOBILIZER KEY

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC B1570. <Ref. to GD(H4DO w/o HEV)-11, DTC B1570 ANTENNA, Diagnostic Trouble Code (DTC) Detecting Criteria.>

F: DTC B1576 EGI CONTROL MODULE EEPROM

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC B1570. <Ref. to GD(H4DO w/o HEV)-11, DTC B1570 ANTENNA, Diagnostic Trouble Code (DTC) Detecting Criteria.>

G: DTC B1577 IMM CONTROL MODULE EEPROM

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC B1570. <Ref. to GD(H4DO w/o HEV)-11, DTC B1570 ANTENNA, Diagnostic Trouble Code (DTC) Detecting Criteria.>

H: DTC B1578 METER FAILURE

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC B1570. <Ref. to GD(H4DO w/o HEV)-11, DTC B1570 ANTENNA, Diagnostic Trouble Code (DTC) Detecting Criteria.>

I: DTC P000A A CAMSHAFT POSITION SLOW RESPONSE (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the AVCS system malfunction.
Judge NG when the amount of AVCS actual timing advance does not approach to the amount of AVCS target timing advance.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Time of establishing all secondary parameter conditions	≥ 1000 ms
Battery voltage	≥ 10.9 V
Engine speed	≥ 500 rpm
Engine oil temperature	≥ –40 °C (–40 °F)
AVCS control	Operation
Target timing advance change amount (per 64 ms)	< 3.2 °CA

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the engine speed increases and AVCS operates.

4. DIAGNOSTIC METHOD

When the differences of target timing advance amount and actual timing advance amount is calculated during AVCS control, and the difference per predetermined time is the specified value or larger.
Judge as NG when the following conditions are established within the predetermined time.

Malfunction Criteria	Threshold Value
Σ(Target position – Actual position)	> 4000 °CA (Bank 1) > 4000 °CA (Bank 2)
or	
Σ(Target position – Actual position)	< –4000 °CA (Bank 1) < –4000 °CA (Bank 2)

Time Needed for Diagnosis: 25000 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

J: DTC P000B B CAMSHAFT POSITION SLOW RESPONSE (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the exhaust AVCS system malfunction.
Judge NG when the amount of exhaust AVCS actual timing advance does not approach the amount of exhaust AVCS target timing advance.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Time of establishing all secondary parameter conditions	≥ 1000 ms
Battery voltage	≥ 10.9 V
Engine speed	≥ 500 rpm
Engine oil temperature	≥ –40 °C (–40 °F)
Exhaust AVCS control	Operation
Target timing advance change amount (per 64 ms)	< 3.2 °CA

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the engine speed increases and exhaust AVCS operates.

4. DIAGNOSTIC METHOD

When the differences of target timing advance amount and actual timing advance amount is calculated during exhaust AVCS control, and the difference per predetermined time is the specified value or larger.
Judge as NG when the following conditions are established within the predetermined time.

Malfunction Criteria	Threshold Value
Σ(Target position – Actual position)	> 4000 °CA (Bank 1) > 4000 °CA (Bank 2)
or	
Σ(Target position – Actual position)	< –4000 °CA (Bank 1) < –4000 °CA (Bank 2)

Time Needed for Diagnosis: 25000 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

K: DTC P000C A CAMSHAFT POSITION SLOW RESPONSE (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to P000A. <Ref. to GD(H4DO w/o HEV)-13, DTC P000A A CAMSHAFT POSITION SLOW RESPONSE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

L: DTC P000D B CAMSHAFT POSITION SLOW RESPONSE (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to P000B. <Ref. to GD(H4DO w/o HEV)-14, DTC P000B B CAMSHAFT POSITION SLOW RESPONSE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

M: DTC P0010 "A" CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect open circuit of the oil control solenoid.
Judge as NG when the current is small even though the duty signal is large.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Oil control solenoid control duty	≥ 99.61 %

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Oil control solenoid control present current	< 0.306 A

Time Needed for Diagnosis: 2000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

N: DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the AVCS system malfunction.
Judge as NG when the conditions during which the differences of AVCS target timing advance amount and AVCS actual timing advance amount is large continues.

2. ENABLE CONDITION

- Normal

Secondary Parameters	Enable Conditions
Time of establishing all secondary parameter conditions	≥ 10000 ms
Battery voltage	≥ 10.9 V
Engine speed	≥ 500 rpm
Engine oil temperature	≥ –40 °C (–40 °F)
AVCS control	Operation

- Intermediate lock

Secondary Parameters	Enable Conditions
Time of establishing all secondary parameter conditions	≥ 2000 ms
Battery voltage	≥ 10.9 V
Engine speed	≥ 500 rpm
Engine oil temperature	≥ –40 °C (–40 °F)
AVCS control	Intermediate lock
Elapsed time after starting the engine	> 500 ms

3. GENERAL DRIVING CYCLE

- Normal

Perform the diagnosis continuously when the engine speed increases and AVCS operates.

- Intermediate lock

Perform the diagnosis when the AVCS is carrying out the intermediate lock control at the engine start.

4. DIAGNOSTIC METHOD

When the conditions during which the differences of AVCS target timing advance amount and AVCS actual timing advance amount is large continues for certain amount of time.
Judge as NG when the following conditions are established within the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
• Normal (Target position – Actual position)	> 10 °CA or < –10 °CA
• Intermediate lock (Target position – Actual position)	> 10 °CA or < –10 °CA

Time Needed for Diagnosis:

- Normal: 10000 ms
- Intermediate lock: 2000 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

O: DTC P0013 B CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect open circuit of the oil control solenoid.
Judge as NG when the current is small even though the duty signal is large.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Oil control solenoid control duty	≥ 99.61 %

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Oil control solenoid control present current	< 0.306 A

Time Needed for Diagnosis: 2000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

P: DTC P0014 EXHAUST AVCS SYSTEM 1 (RANGE/PERFORMANCE)

1. OUTLINE OF DIAGNOSIS

Detect the exhaust AVCS system malfunction.
Judge as NG when the conditions during which the differences of exhaust AVCS target timing advance amount and exhaust AVCS actual timing advance amount is large continues.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Time of establishing all secondary parameter conditions	≥ 10000 ms
Battery voltage	≥ 10.9 V
Engine speed	≥ 500 rpm
Engine oil temperature	≥ –40 °C (–40 °F)
Exhaust AVCS control	Operation

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the engine speed increases and exhaust AVCS operates.

4. DIAGNOSTIC METHOD

When the conditions during which the differences of exhaust AVCS target timing advance amount and exhaust AVCS actual timing advance amount is large continues for certain amount of time.
Judge as NG when the following conditions are established within the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
(Target position – Actual position)	> 10 °CA or < –10 °CA

Time Needed for Diagnosis: 10000 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Q: DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1)

1. OUTLINE OF DIAGNOSIS

Detect the AVCS system malfunction.
Judge as NG when standard timing advance amount is far from learning angle.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Engine speed	≥ 1300 rpm and < 3000 rpm
Engine coolant temperature	≥ 50 °C (122 °F)
AVCS control	Not in operation
Target timing advance	0°CA

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting engine and while AVCS is not operating.

4. DIAGNOSTIC METHOD

Judge as NG when the absolute value of the difference between cam signal input position and learning value is out of specification.
If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
|Crankshaft position when camshaft position sensor signal is input – Learning value|	> 10 °CA

Time Needed for Diagnosis: 500 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

NOTE:
Initial standard learning value is the value of crank angle initially input at the production plant. And then it will be updated every time normal judgment has been completed. Learning value will not be updated if NG judgment occurs because timing belt or chain derails suddenly in process or because wrong assembly occurs during servicing.

R: DTC P0017 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the exhaust AVCS system malfunction.
Judge as NG when standard timing advance amount is far from learning angle.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Engine speed	≥ 500 rpm and < 1200 rpm
Engine coolant temperature	≥ 50 °C (122 °F)
Exhaust AVCS control	Not in operation
Target timing advance	0°CA

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously while the exhaust AVCS is not operating after warming up.

4. DIAGNOSTIC METHOD

Judge as NG when the absolute value of the difference between cam signal input position and learning value is out of specification.

S: DTC P0018 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK2)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0016. <Ref. to GD(H4DO w/o HEV)-19, DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

T: DTC P0019 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0017. <Ref. to GD(H4DO w/o HEV)-20, DTC P0017 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

U: DTC P0020 "A" CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0010. <Ref. to GD(H4DO w/o HEV)-15, DTC P0010 "A" CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

V: DTC P0021 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0011. <Ref. to GD(H4DO w/o HEV)-16, DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

W: DTC P0023 B CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0013. <Ref. to GD(H4DO HEV)-17, DTC P0013 B CAMSHAFT POSITION ACTUATOR CIRCUIT/OPEN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

X: DTC P0024 EXHAUST AVCS SYSTEM 2 (RANGE/PERFORMANCE)

1. OUTLINE OF DIAGNOSIS

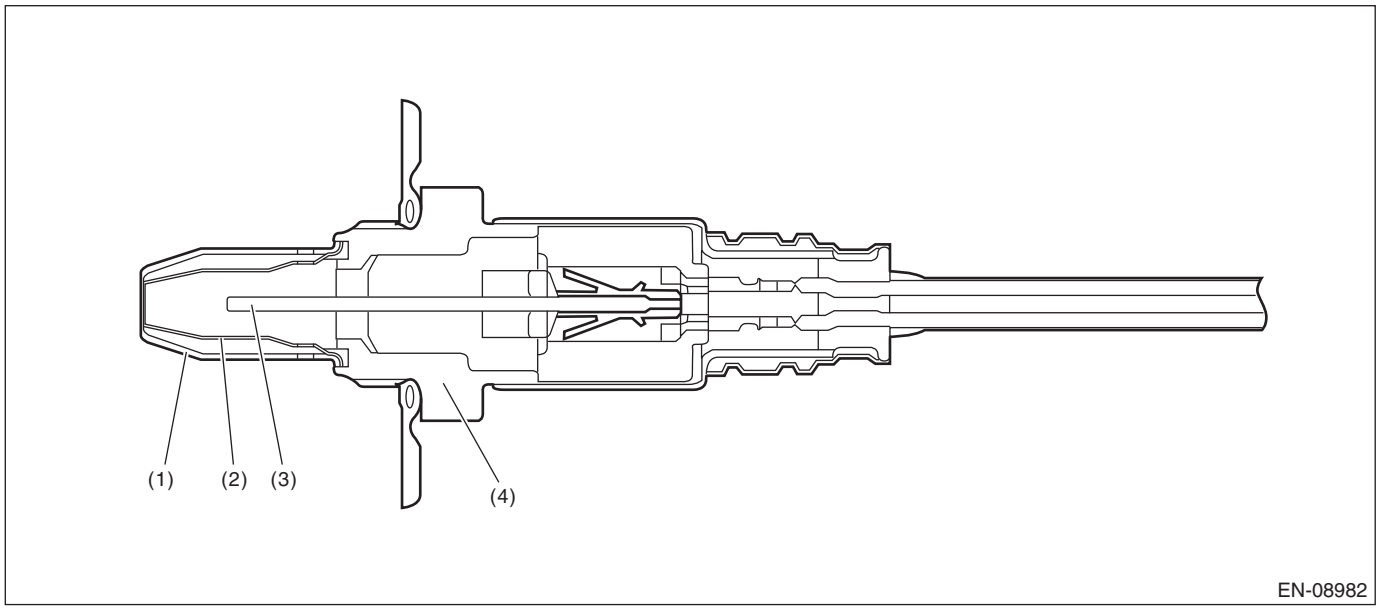
NOTE:
For the detection standard, refer to DTC P0014. <Ref. to GD(H4DO w/o HEV)-18, DTC P0014 EXHAUST AVCS SYSTEM 1 (RANGE/PERFORMANCE), Diagnostic Trouble Code (DTC) Detecting Criteria.>

Y: DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect functional errors of the front oxygen (A/F) sensor heater.
Judge as NG when it is determined that the front oxygen (A/F) sensor impedance is large when looking at engine status such as deceleration fuel cut.

2. COMPONENT DESCRIPTION



(1) Element cover (outer)
(2) Element cover (inner)
(3) Sensor element
(4) Sensor housing

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Condition established time	≥ 42000 ms
Battery voltage	≥ 10.9 V
Heater current	Permitted
A/F sensor heater final control	Main energization status
After fuel cut	≥ 20000 ms

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after 42000 ms seconds or more have passed since the engine started.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Front oxygen (A/F) sensor impedance	> 82 Ω

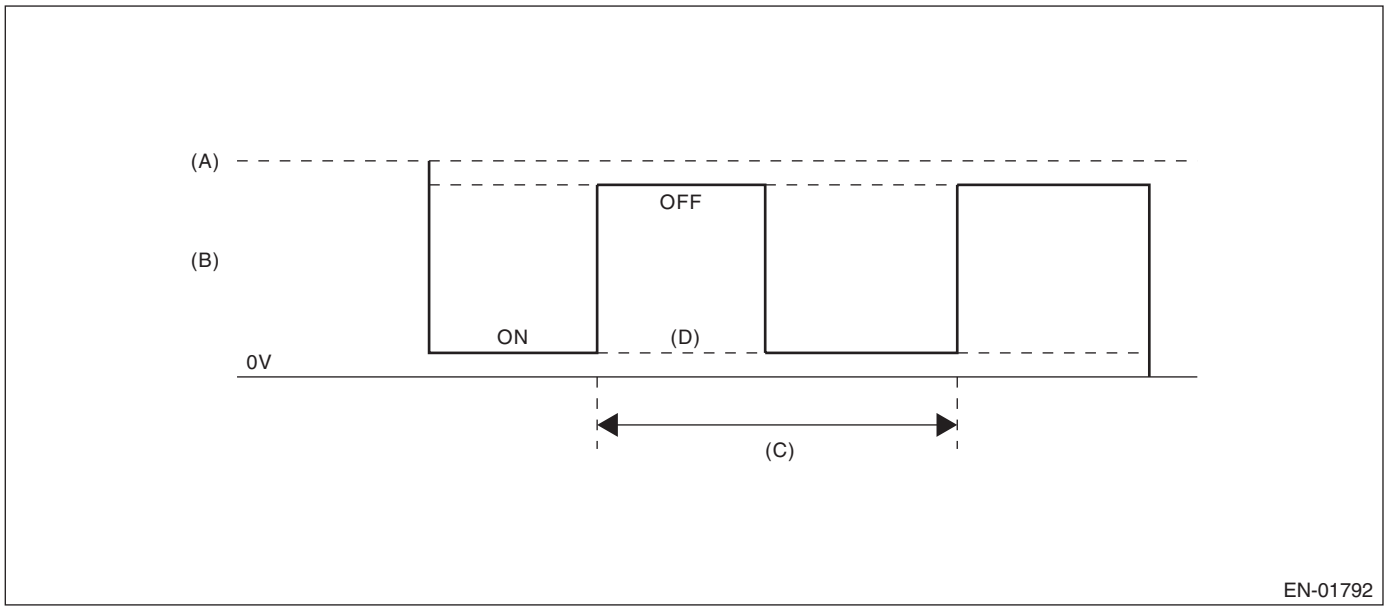
Time Needed for Diagnosis: 10000 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Z: DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect front oxygen (A/F) sensor heater open or short circuit.
The front oxygen (A/F) sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.
Judge as NG when the terminal voltage remains Low.

2. COMPONENT DESCRIPTION



(A) Battery voltage
(B) Front oxygen (A/F) sensor heater output voltage
(C) 128 ms
(D) Low error

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Primary oxygen sensor heater control duty	< 87.5 %

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Measured primary oxygen sensor heater control voltage	< 1.9 V

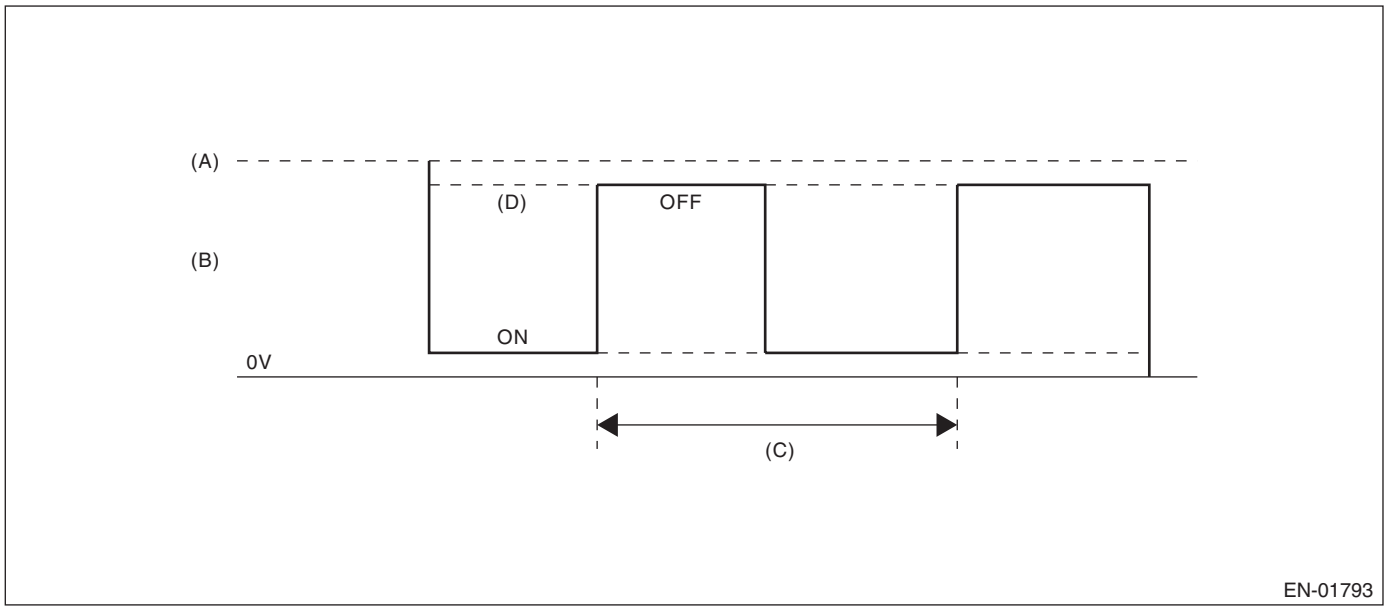
Time Needed for Diagnosis: 1 second
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

AA:DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect front oxygen (A/F) sensor heater open or short circuit.
The front oxygen (A/F) sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.
Judge as NG when the terminal voltage remains High.

2. COMPONENT DESCRIPTION



(A) Battery voltage
(B) Front oxygen (A/F) sensor heater output voltage
(C) 128 ms
(D) High error

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Primary oxygen sensor heater control duty	> 12.5 %

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Measured primary oxygen sensor heater control voltage	≥ 1.9 V

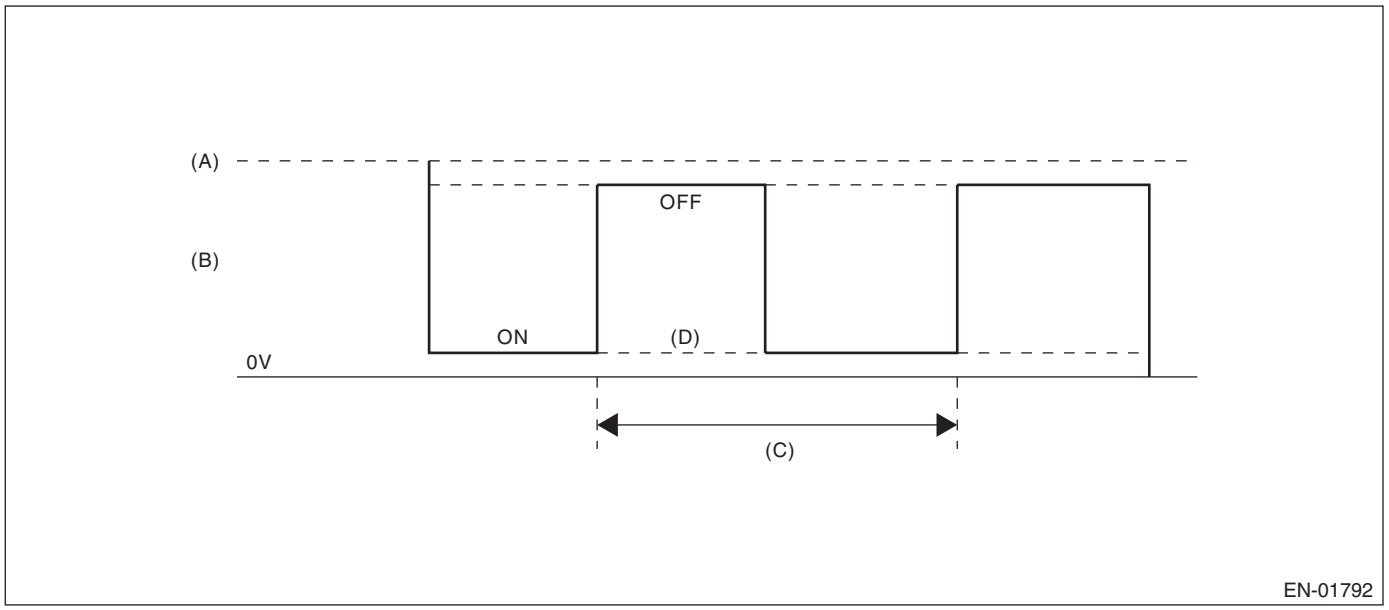
Time Needed for Diagnosis: 2 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

AB:DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

Detect the rear oxygen sensor heater open or short circuit.
The rear oxygen sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.
Judge as NG when the terminal voltage remains Low.

2. COMPONENT DESCRIPTION



(A) Battery voltage
(B) Output voltage of the rear oxygen sensor heater
(C) 256 ms (cycle)
(D) Low error

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 s
Secondary oxygen sensor heater control duty	< 75 %

4. GENERAL DRIVING CYCLE

After starting the engine, perform the diagnosis continuously when engine is low speed.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Measured secondary oxygen sensor heater control voltage	< 12 V battery system voltage × 0.20 V

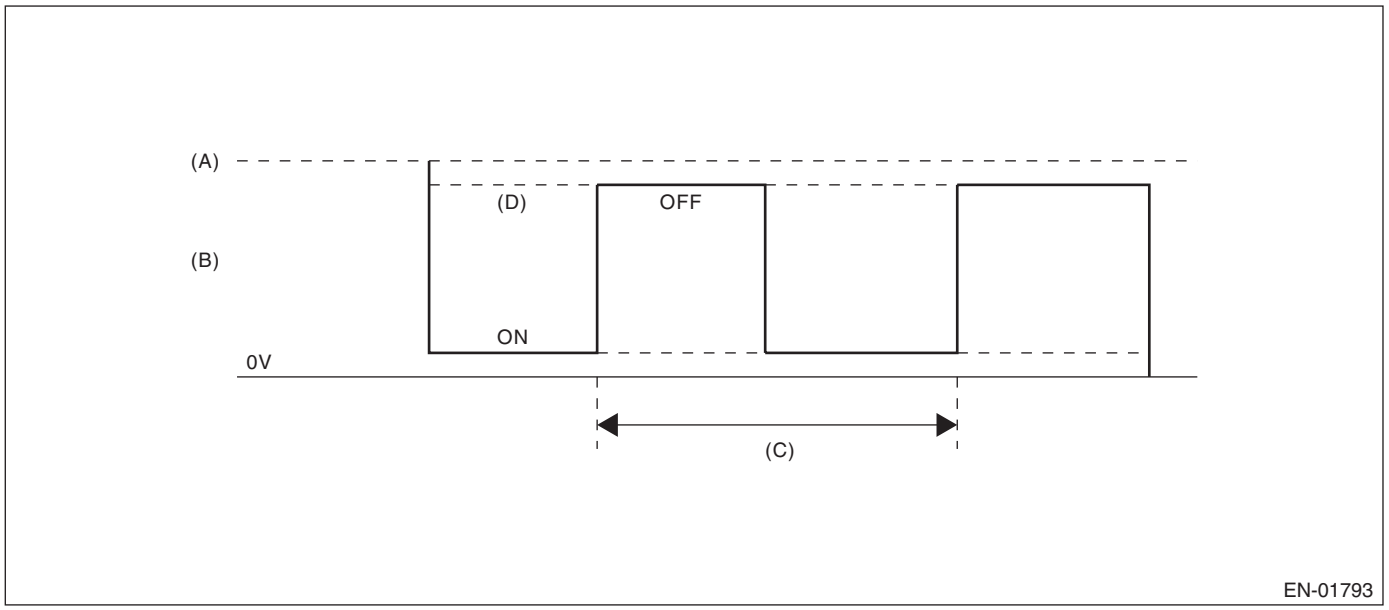
Time Needed for Diagnosis: 8 ms × 1250 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

AC:DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

Detect the rear oxygen sensor heater open or short circuit.
The rear oxygen sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.
Judge as NG when the terminal voltage remains High.

2. COMPONENT DESCRIPTION



(A) Battery voltage
(B) Output voltage of the rear oxygen sensor heater
(C) 256 ms (cycle)
(D) High error

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 s
Secondary oxygen sensor heater control duty	≥ 20 %

4. GENERAL DRIVING CYCLE

After starting the engine, perform the diagnosis continuously when engine is low speed.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Measured secondary oxygen sensor heater control voltage	12 V battery system voltage × 0.30 V

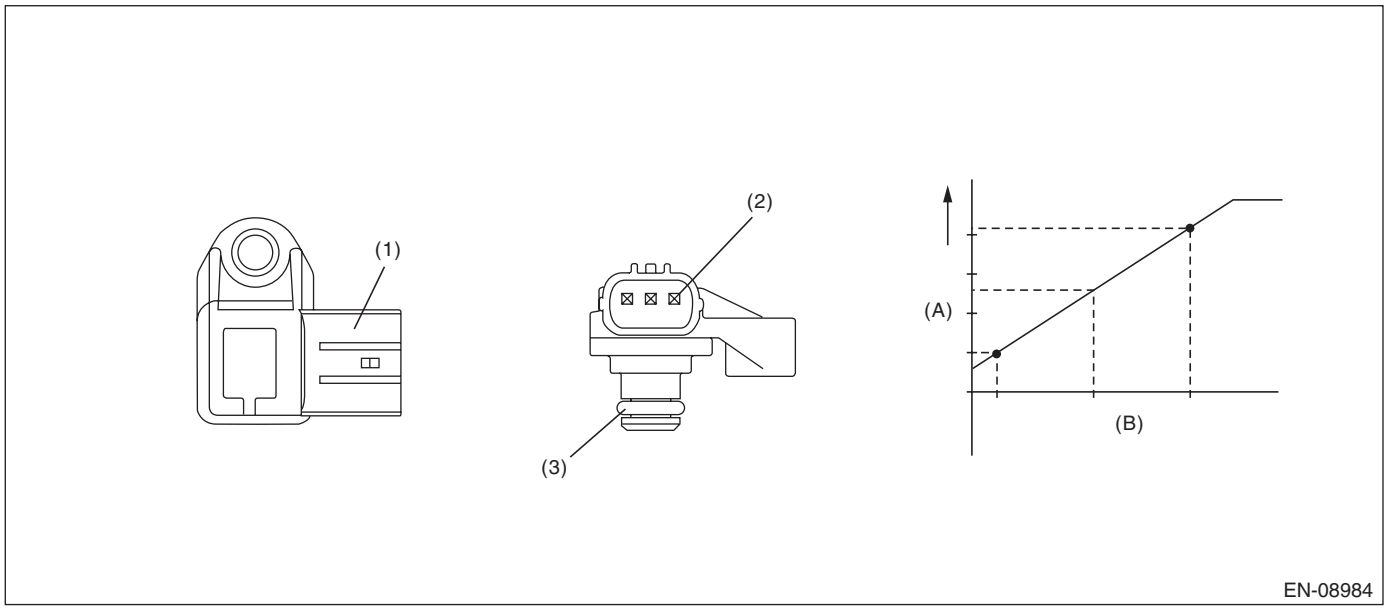
Time Needed for Diagnosis: 2.56 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

AD:DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION

1. OUTLINE OF DIAGNOSIS

Detect problems in the intake manifold pressure sensor output properties.
Judge as NG when the intake air pressure AD value is Low whereas it seemed to be High from the viewpoint of engine condition, or when it is High whereas it seemed to be Low from the engine condition.

2. COMPONENT DESCRIPTION



(A) Output voltage
(B) Absolute pressure
(1) Connector
(2) Terminals
(3) O-ring

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	≥ 60 °C (140 °F)

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after idling.

5. DIAGNOSTIC METHOD

Judge as NG when Low side or High side becomes NG.
If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Low	
Engine speed	< 3200 rpm
Throttle position	≥ 12 ° (CVT model) ≥ 9 ° (MT model)
Output voltage	< 1.4 V (CVT model) < 1.2 V (MT model)
Engine load	> 0.45 g/rev (0.02 oz/rev) (CVT model) > 0.36 g/rev (0.01 oz/rev) (MT model)
High	
Engine speed	500 rpm — 950 rpm (CVT model) 500 rpm — 950 rpm (MT model)
Throttle position	< 4.1 ° (CVT model) < 4.1 ° (MT model)
Output voltage	≥ 2.9 V
Engine load	< 0.36 g/rev (0.01 oz/rev) (CVT model) < 0.36 g/rev (0.01 oz/rev) (MT model)

Time Needed for Diagnosis:
Low side: 5000 ms
High side: 5000 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

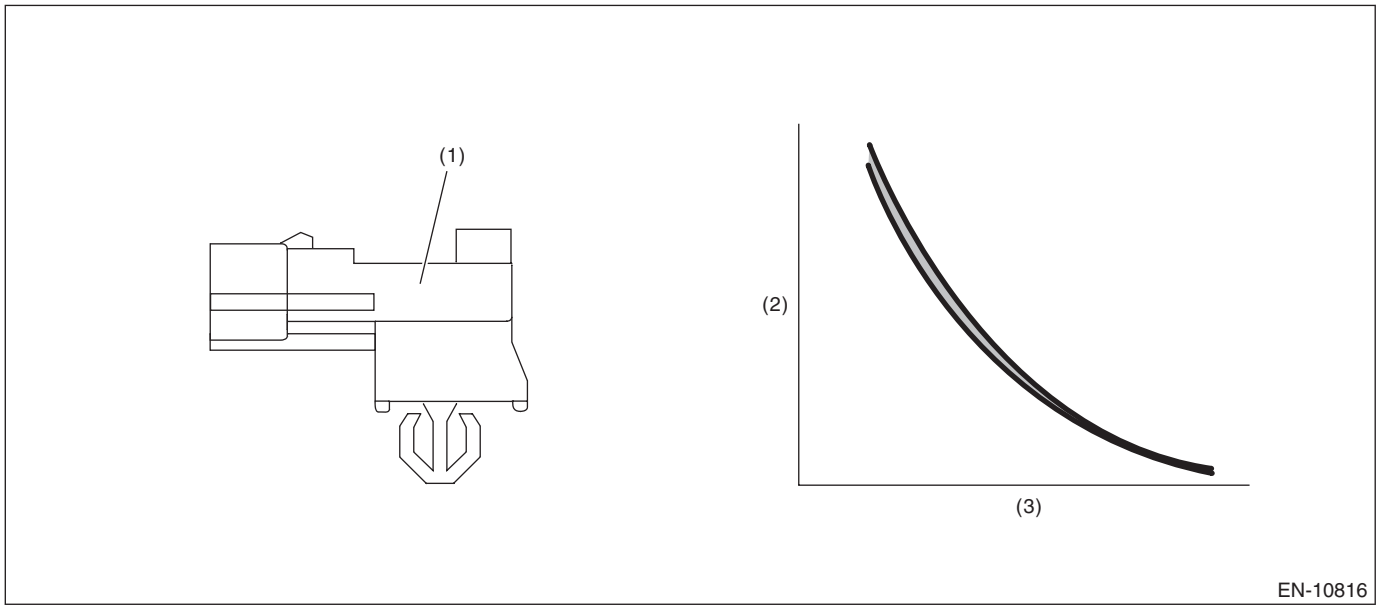
AE:DTC P0071 AMBIENT TEMPERATURE SENSOR CIRCUIT "A" RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the characteristic abnormality of the ambient air temperature sensor.
Perform diagnosis in reference to the ambient air temperature sensor value, intake air temperature sensor value and engine coolant temperature sensor value after engine start after predetermined time have passed in soak time. Judge as NG when the difference is more than the specific value in comparison respectively between ambient and intake air temperature, ambient and engine coolant temperature.

2. COMPONENT DESCRIPTION

Ambient temperature sensor is connected to combination meter. ECM receives the data of ambient temperature sensor via CAN communication with combination meter.



(1) Ambient air temperature sensor (2) Resistance value (kΩ) (3) Ambient air temperature (°C (°F)

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Soaking time	≥ 21600 s
Block heater judgment	Completed
Block heater activation	not activate

4. GENERAL DRIVING CYCLE

Perform diagnosis only once after engine start after constant soak time.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
|Ambient air temperature 30 s after engine start – Intake air temperature 30 s after engine start|	> Value from Map
|Ambient air temperature at engine start – Engine coolant temperature at engine start|	> 25 °C (45°F)

Map

Ambient air temperature °C (°F)	-30 (-22)	30 (86)	45 (113)	60 (140)
|Ambient air temperature 30 s after engine start – Intake air temperature 30 s after engine start| °C (°F)	20 (36°F)	20 (36°F)	32 (57.6°F)	32 (57.6°F)

Time Needed for Diagnosis: Less than 1 second
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

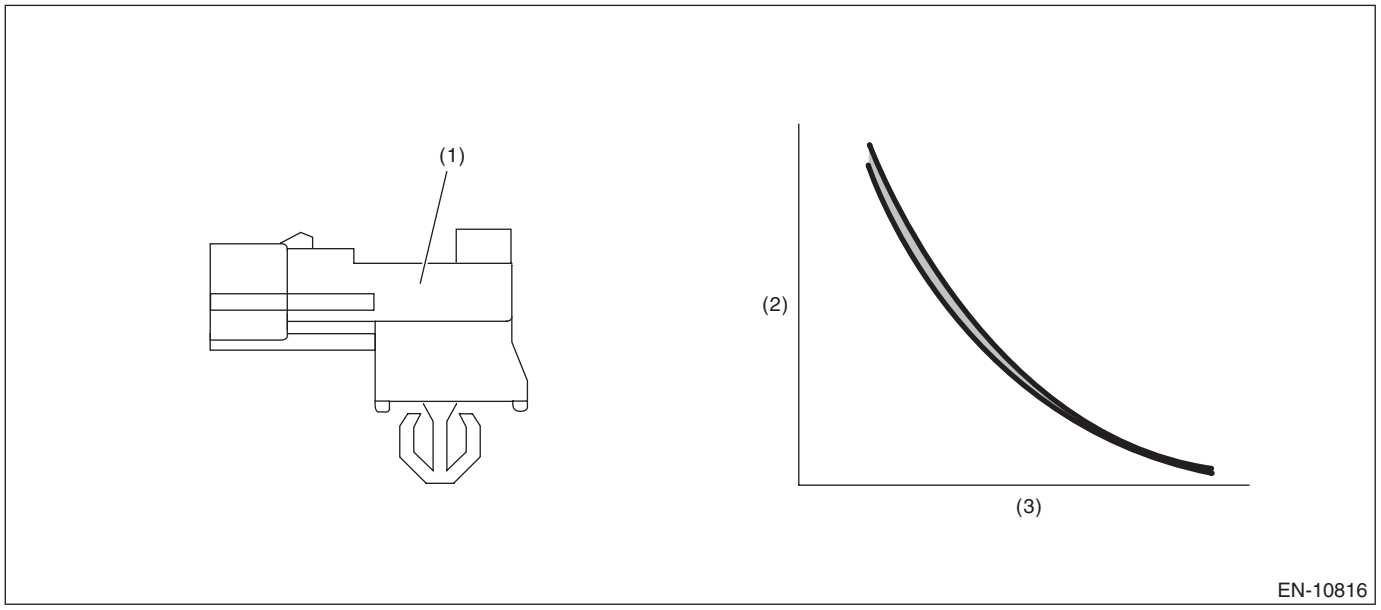
AF:DTC P0072 AMBIENT TEMPERATURE SENSOR CIRCUIT "A" LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of ambient temperature sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION

Ambient temperature sensor is connected to combination meter. ECM receives the data of ambient temperature sensor via CAN communication with combination meter.



(1) Ambient air temperature sensor (2) Resistance value (kΩ) (3) Ambient air temperature (°C (°F)

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.42 V

Time Needed for Diagnosis: 2500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

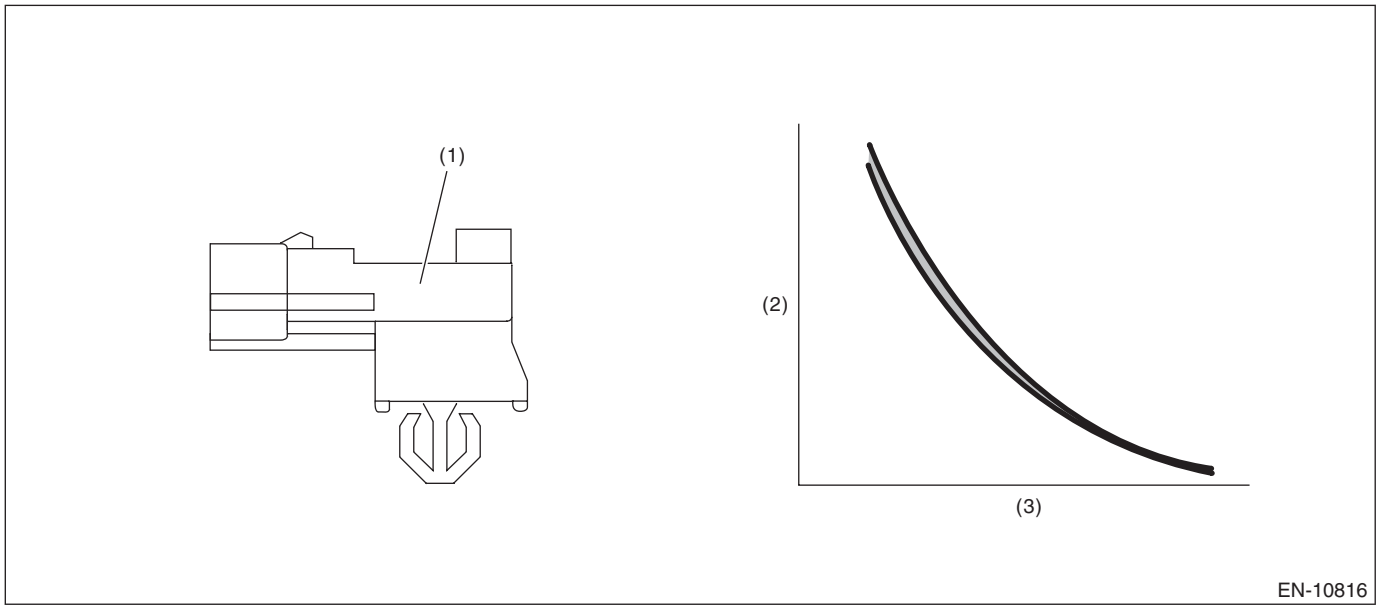
AG:DTC P0073 AMBIENT TEMPERATURE SENSOR CIRCUIT "A" HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of ambient temperature sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION

Ambient temperature sensor is connected to combination meter. ECM receives the data of ambient temperature sensor via CAN communication with combination meter.



(1) Ambient air temperature sensor (2) Resistance value (kΩ) (3) Ambient air temperature (°C (°F)

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	> 4.88 V

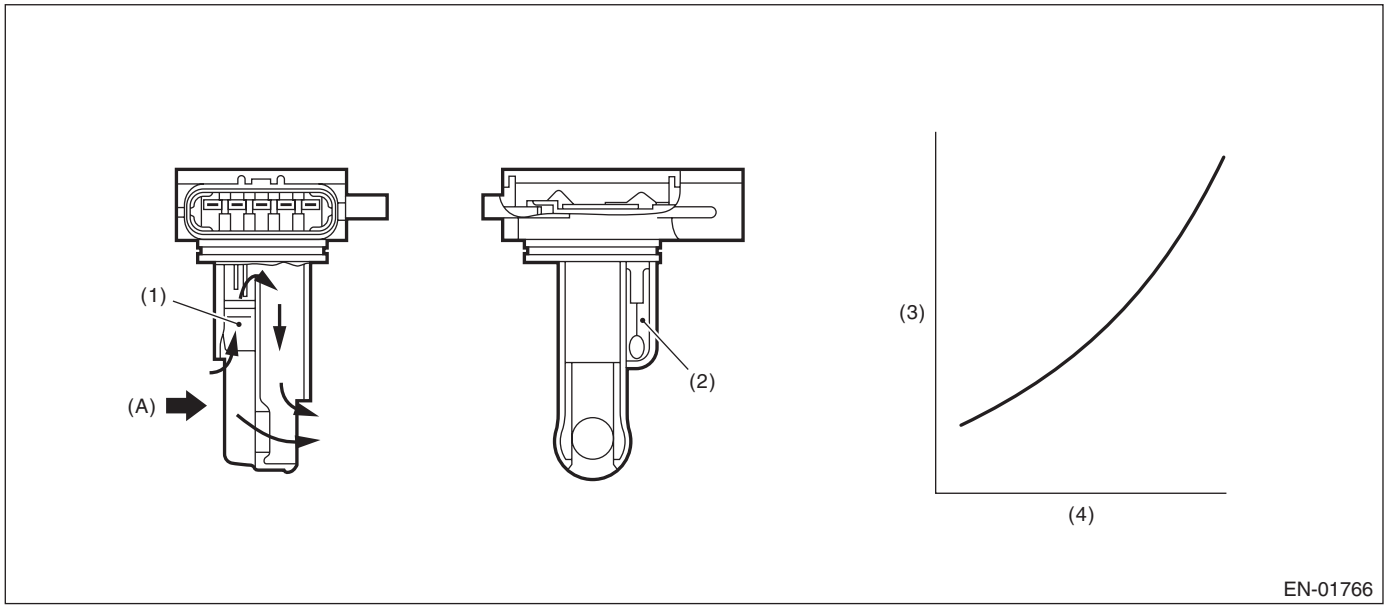
Time Needed for Diagnosis: 2500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

AH:DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of air flow sensor output properties.
Judge as a low side NG when the air flow voltage indicates a small value regardless of running in a state where the air flow voltage increases. Judge as a high side NG when the air flow voltage indicates a large value regardless of running in a state where the air flow voltage decreases. Judge air flow sensor property NG when the Low side or High side becomes NG.

2. COMPONENT DESCRIPTION



(A) Air

(1) Air flow sensor
(2) Intake air temperature sensor
(3) Voltage (V)
(4) Amount of intake air (kg (lb)/s)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	≥ 60 °C (140 °F)

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after idling.

5. DIAGNOSTIC METHOD

Judge as NG when Low side or High side becomes NG.
If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Low	
Output voltage	< 1.2 V
Engine speed	≥ 1400 rpm
Throttle opening angle	≥ 12 ° (CVT model) ≥ 9 ° (MT model)
Intake manifold pressure	≥ 66.7 kPa (500 mmHg, 19.7 inHg)
High (1)	
Output voltage	≥ 1.8 V
Engine speed	500 rpm — 950 rpm (CVT model) 500 rpm — 950 rpm (MT model)
Throttle opening angle	< 4.1 ° (CVT model) < 4.1 ° (MT model)
Intake manifold pressure	≥ 47.3 kPa (355 mmHg, 14 inHg) (CVT model) ≥ 47.3 kPa (355 mmHg, 14 inHg) (MT model)
High (2)	
Output voltage	≥ 1.8 V
Engine speed	500 rpm — 950 rpm (CVT model) 500 rpm — 950 rpm (MT model)
Throttle opening angle	< 4.1 ° (CVT model) < 4.1 ° (MT model)
Intake manifold pressure	≥ 47.3 kPa (355 mmHg, 14 inHg) (CVT model) ≥ 47.3 kPa (355 mmHg, 14 inHg) (MT model)
Fuel system diagnosis	Rich side malfunction

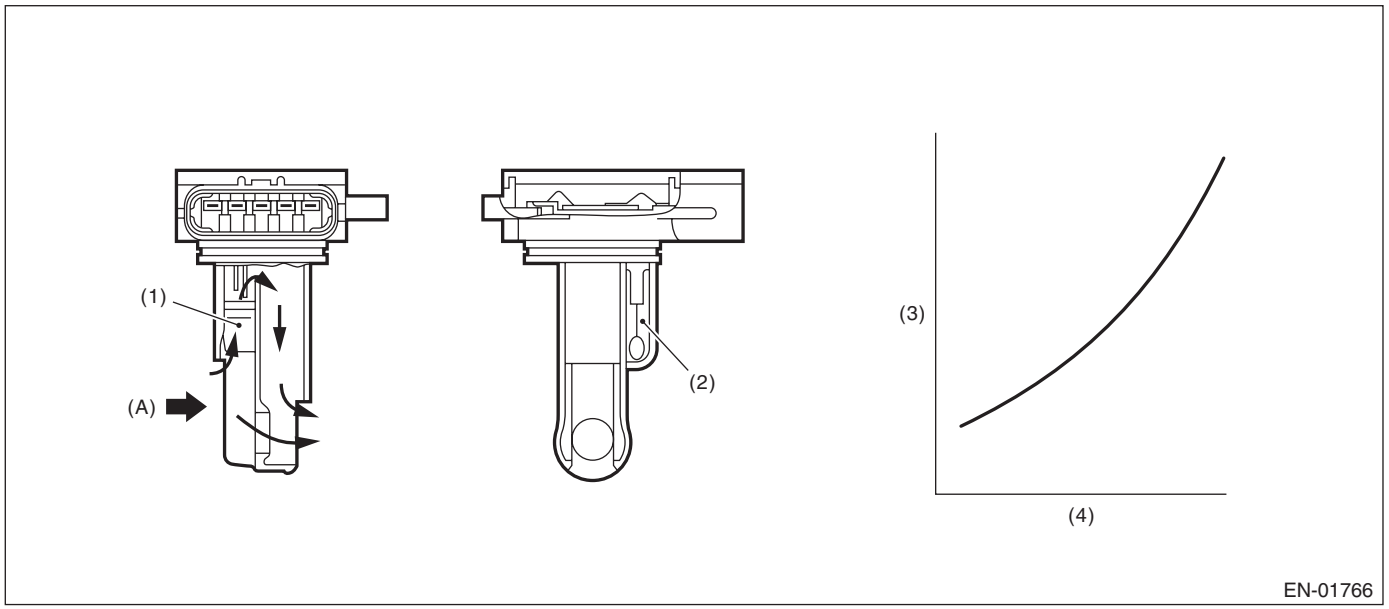
Time Needed for Diagnosis:
Low: 5000 ms
High: 5000 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

AI: DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT

1. OUTLINE OF DIAGNOSIS

Detect open or short circuits of the air flow sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) Air

(1) Air flow sensor
(2) Intake air temperature sensor
(3) Voltage (V)
(4) Amount of intake air (kg (lb)/s)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≤ 0.127 V

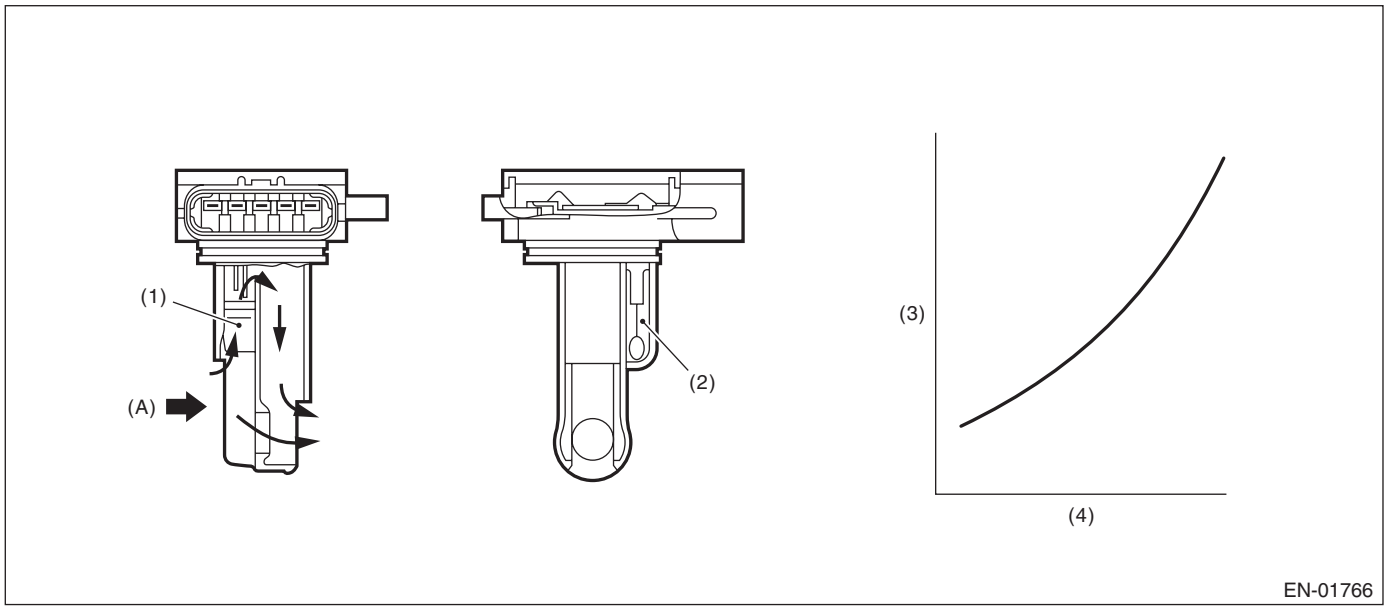
Time Needed for Diagnosis: 500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

AJ:DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT

1. OUTLINE OF DIAGNOSIS

Detect open or short circuits of the air flow sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) Air

(1) Air flow sensor
(2) Intake air temperature sensor
(3) Voltage (V)
(4) Amount of intake air (kg (lb)/s)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.43 V

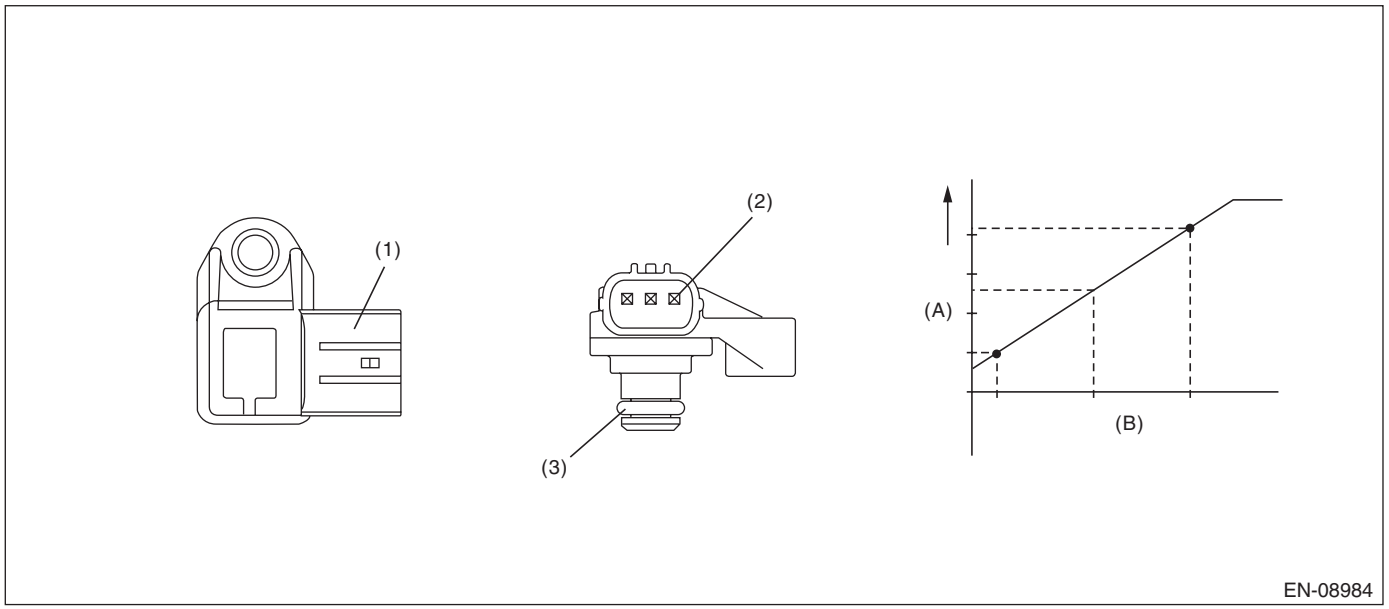
Time Needed for Diagnosis: 500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

AK:DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of intake manifold pressure sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) Output voltage
(B) Absolute pressure
(1) Connector
(2) Terminals
(3) O-ring

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≤ 0.608 V

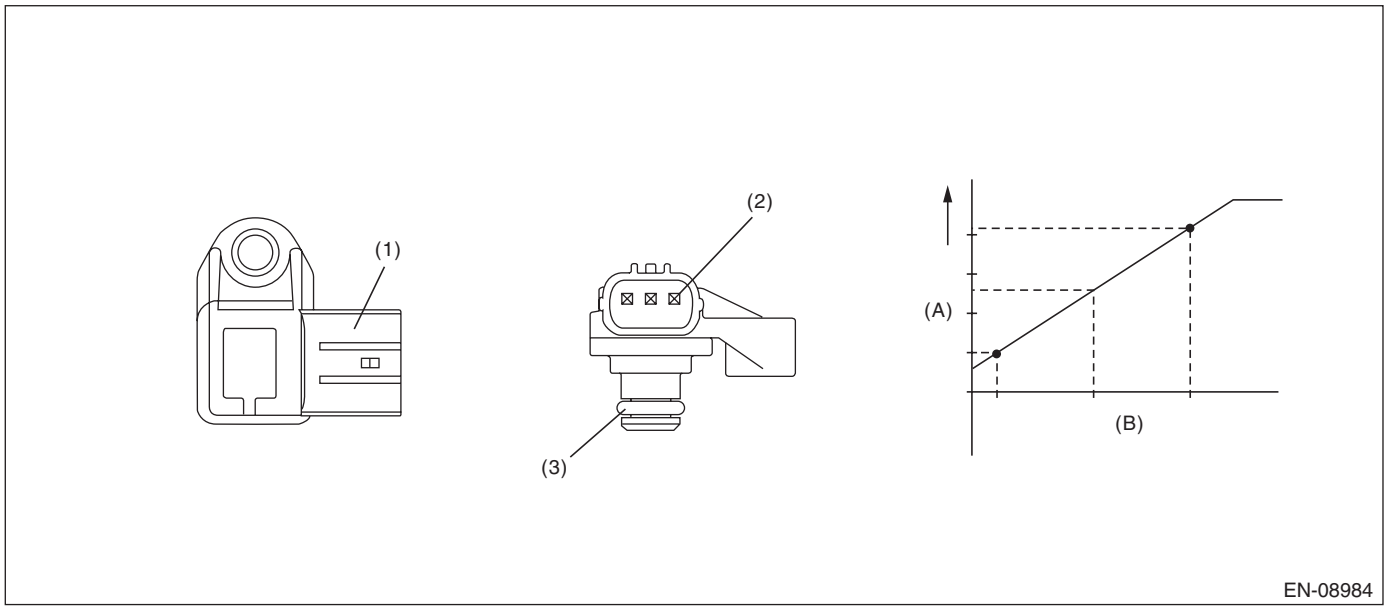
Time Needed for Diagnosis: 2000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

AL:DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of intake manifold pressure sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) Output voltage
(B) Absolute pressure
(1) Connector
(2) Terminals
(3) O-ring

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 3.906 V

Time Needed for Diagnosis: 2000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

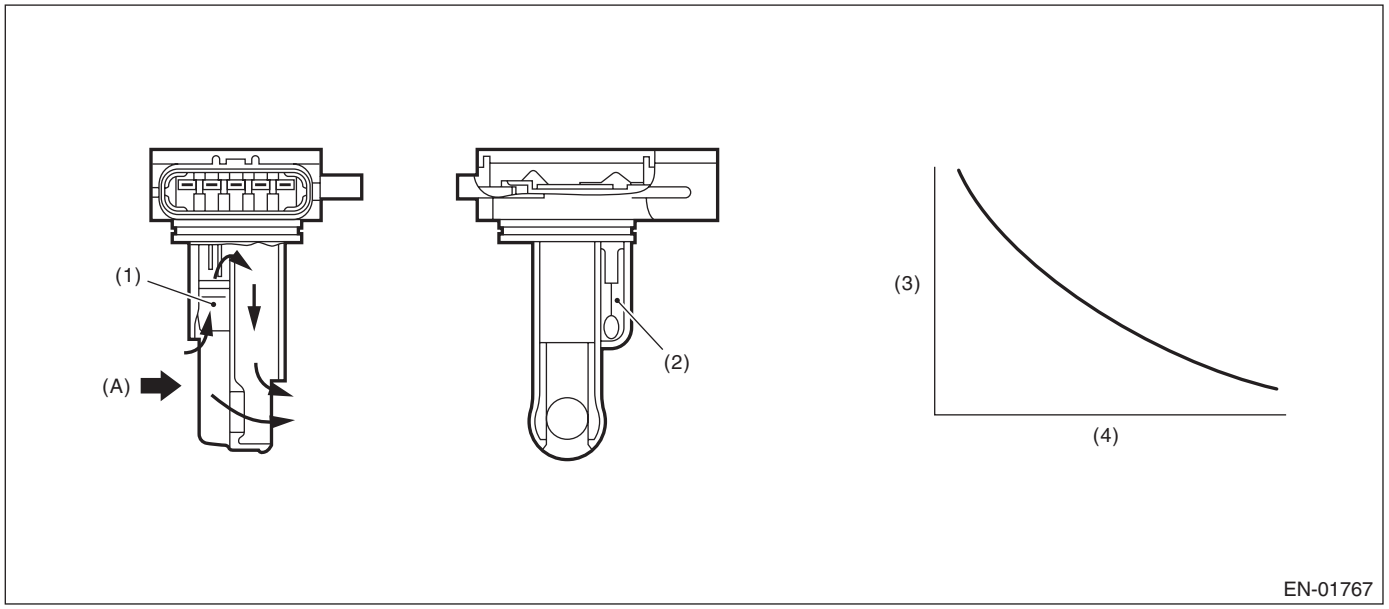
AM:DTC P0111 INTAKE AIR TEMPERATURE SENSOR RANGE/PERFORMANCE PROBLEM

1. OUTLINE OF DIAGNOSIS

Detect the abnormality of the intake air temperature sensor output characteristics. Perform the following two diagnosis, and judge as NG if either is NG.

- **Diagnosis 1 (relative diagnosis):** Perform diagnosis in reference to the intake air temperature sensor value, engine coolant temperature sensor value and ambient air temperature sensor value after engine start after predetermined time have passed in soak time. Judge as NG when the difference is more than the specific value in comparison respectively between intake air and engine coolant temperature, intake air and ambient air temperature.
- **Diagnosis 2 (stuck diagnosis):** Observe the engine condition, and if there is no variation in the driving condition under which the intake air temperature is considered to change, judge as NG.

2. COMPONENT DESCRIPTION



(A) Air

(1) Air flow sensor
(2) Intake air temperature sensor
(3) Resistance value (Ω)
(4) Intake air temperature °C (°F)

3. ENABLE CONDITION

Diagnosis 1

Secondary Parameters	Enable Conditions
Soaking time	≥ 21600 s
Block heater judgment	Completed
Block heater activation	not activate

Diagnosis 2

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ 60 °C (140 °F)
Intake air amount sum value	≥ Value of Map 1
Number of experiences under conditions below	≥ 3 time(s)
• Continuous time when vehicle speed is less than 4 km/h (2.5 MPH)	≥ Value from Map 2
• Continuous time when vehicle speed is 40 km/h (24.9 MPH) or more, and intake air amount is 10 g/s (0.35 oz/s) or more	≥ 15 s

Map 1

Engine coolant temperature °C (°F)	-30 (-22)	-10 (14)	0 (32)	10 (50)	20 (68)
Intake air amount sum value (g (oz))	60000 (2116.2)	8500 (299.8)	7500 (264.53)	7000 (246.89)	6500 (229.26)

Map 2

Engine coolant temperature °C (°F)	-30 (-22)	-10 (14)	0 (32)	10 (50)
Continuous time (s) when vehicle speed is less than 4 km/h (2.5 MPH)	180	100	70	45

4. GENERAL DRIVING CYCLE

- **Diagnosis 1:** Perform diagnosis only once after engine start after constant soak time.
- **Diagnosis 2:** Perform the diagnosis when the vehicle speed condition is met after warming up from a cold condition.

5. DIAGNOSTIC METHOD

Judge as NG when diagnosis 1 or diagnosis 2 becomes NG.

Diagnosis 1

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
|Intake air temperature 30 s after engine start – engine coolant temperature at engine start|	> Value of Map 3
|Intake air temperature 30 s after engine start – Ambient air temperature 30 s after engine start|	> Value of Map 4

Map 3

Ambient air temperature °C (°F)	-30 (-22)	30 (86)	45 (113)	60 (140)
|Intake air temperature 30 s after engine start – engine coolant temperature at engine start| °C (°F)	12 (21.6°F)	12 (21.6°F)	22 (39.6°F)	22 (39.6°F)

Map 4

Ambient air temperature °C (°F)	-30 (-22)	30 (86)	45 (113)	60 (140)
|Intake air temperature 30 s after engine start – Ambient air temperature 30 s after engine start| °C (°F)	20 (36°F)	20 (36°F)	32 (57.6°F)	32 (57.6°F)

Time Needed for Diagnosis: Less than 1 second

Diagnosis 2

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage difference between Max. and Min.	< 0.02 V (Equivalent to approximately 0.5°C (0.9°F) near 25°C (77°F)) (Equivalent to approximately 0.9°C (1.6°F) near –7°C (19.4°F))

Time Needed for Diagnosis: Less than 1 second

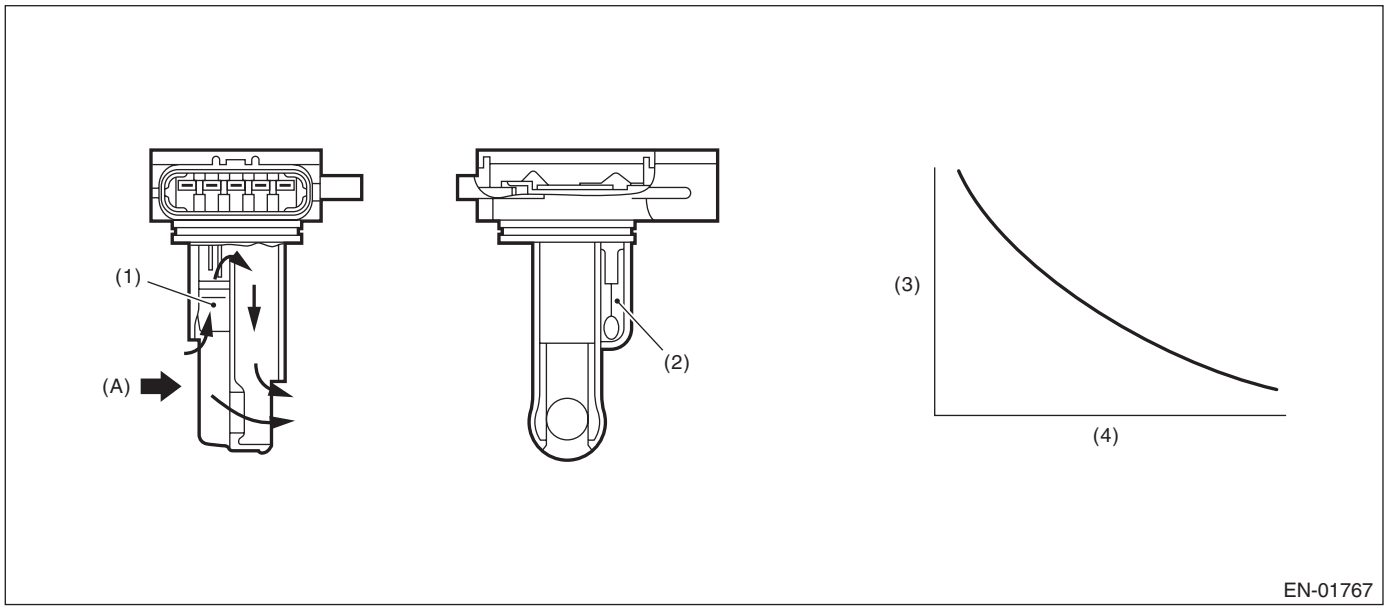
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

AN:DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the intake air temperature sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) Air

(1) Air flow sensor
(2) Intake air temperature sensor
(3) Resistance value (Ω)
(4) Intake air temperature °C (°F)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.4 V

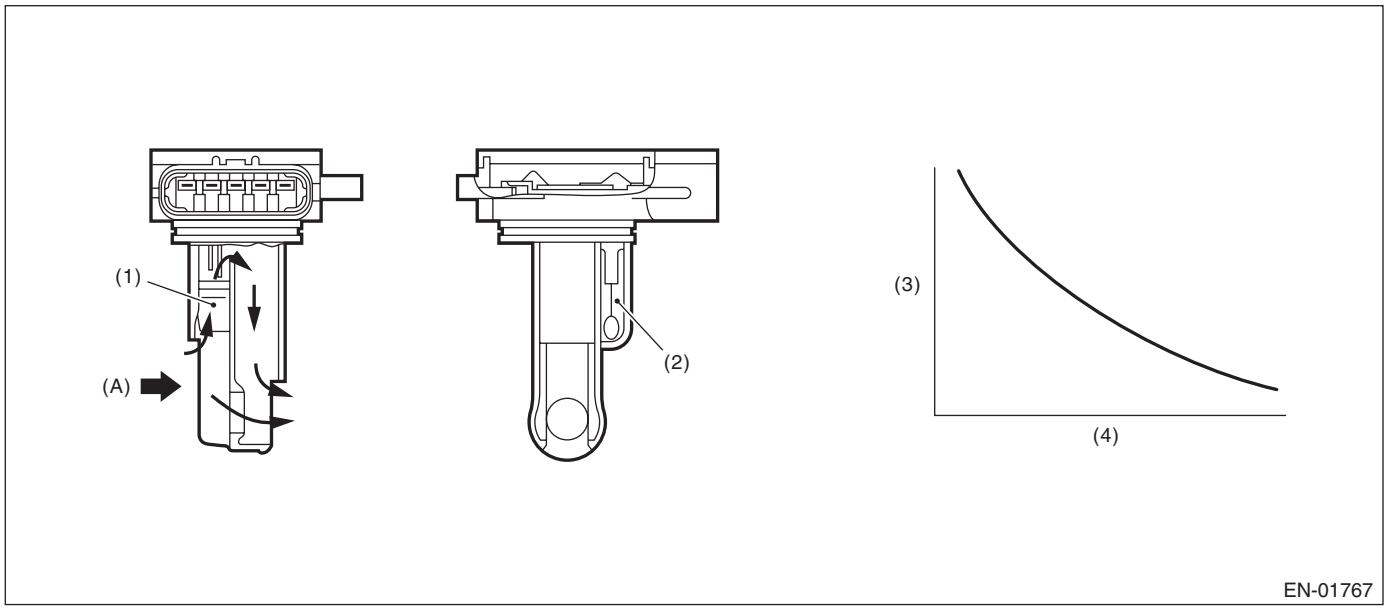
Time Needed for Diagnosis: 500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

AO:DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the intake air temperature sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) Air

(1) Air flow sensor
(2) Intake air temperature sensor
(3) Resistance value (Ω)
(4) Intake air temperature °C (°F)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.707 V

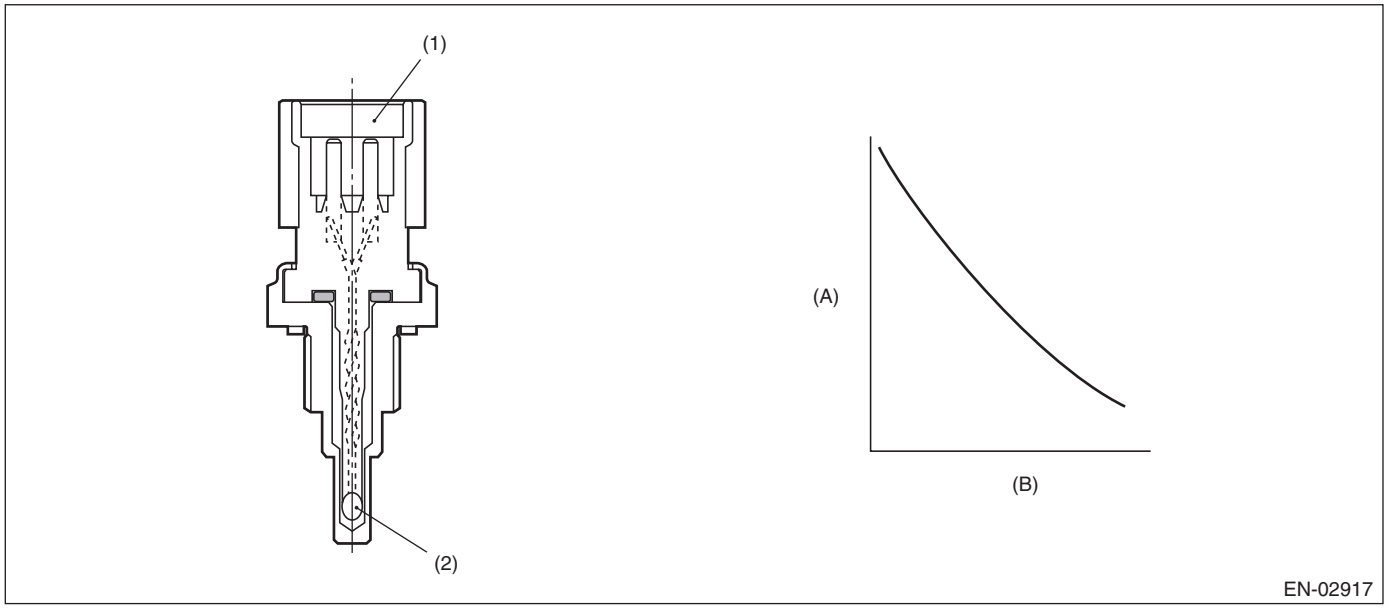
Time Needed for Diagnosis: 500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

AP:DTC P0116 ENGINE COOLANT TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of the engine coolant temperature sensor characteristics.
Perform diagnosis in reference to the engine coolant temperature sensor value, intake air temperature sensor value and ambient air temperature sensor value after engine start after predetermined time have passed in soak time. Judge as NG when the difference is more than the specific value in comparison respectively between engine coolant and ambient air temperature, engine coolant and intake air temperature.

2. COMPONENT DESCRIPTION



(A) Resistance value (kΩ)
(B) Temperature °C (°F)
(1) Connector
(2) Thermistor element

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Soaking time	≥ 21600 s
Block heater judgment	Completed
Block heater activation	not activate

4. GENERAL DRIVING CYCLE

Perform diagnosis only once after engine start after constant soak time.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
|Engine coolant temperature at engine start – Intake air temperature 30 s after engine start|	> Value from Map
|Engine coolant temperature at engine start – ambient air temperature at engine start|	> 25 °C (45°F)

Map

Ambient air temperature °C (°F)	-30 (-22)	30 (86)	45 (113)	60 (140)
|Engine coolant temperature at engine start – Intake air temperature 30 s after engine start| °C (°F)	12 (21.6°F)	12 (21.6°F)	22 (39.6°F)	22 (39.6°F)

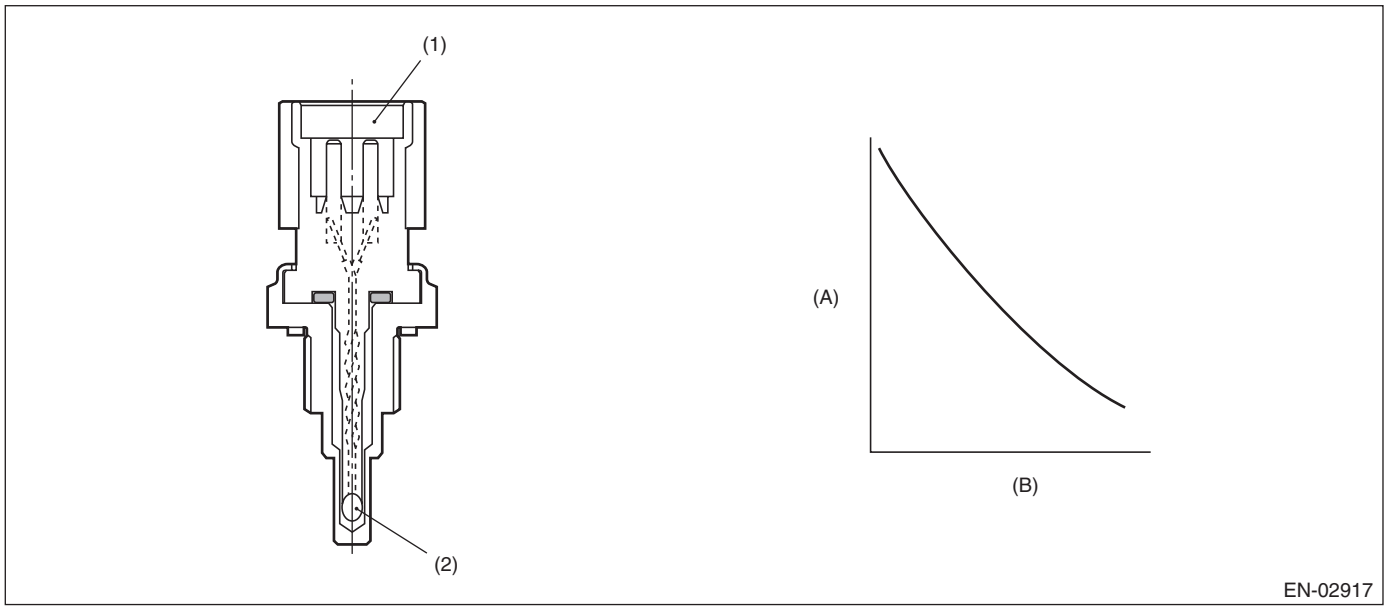
Time Needed for Diagnosis: Less than 1 second
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

AQ:DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the engine coolant temperature sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) Resistance value (kΩ)
(B) Temperature °C (°F)
(1) Connector
(2) Thermistor element

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.349 V

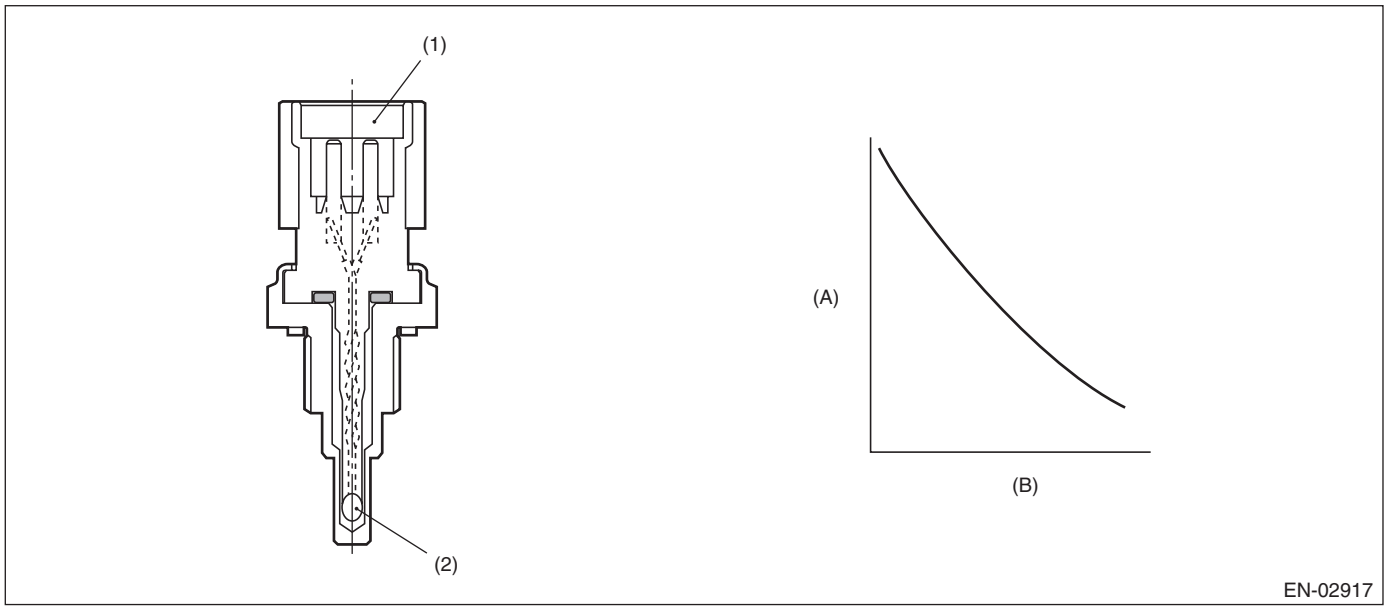
Time Needed for Diagnosis: 500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

AR:DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the engine coolant temperature sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) Resistance value (kΩ)
(B) Temperature °C (°F)
(1) Connector
(2) Thermistor element

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.698 V

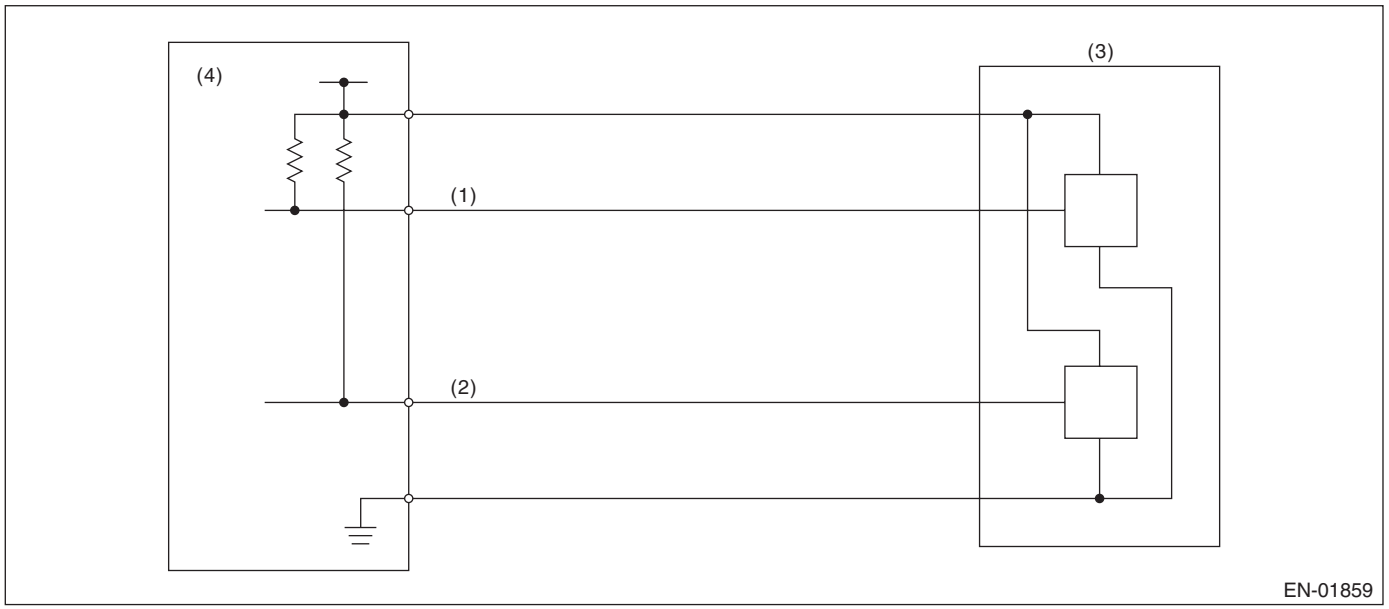
Time Needed for Diagnosis: 500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

AS:DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 1.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) Throttle position sensor 1 signal
(2) Throttle position sensor 2 signal
(3) Throttle position sensor
(4) Engine control module (ECM)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	≤ 0.267 V

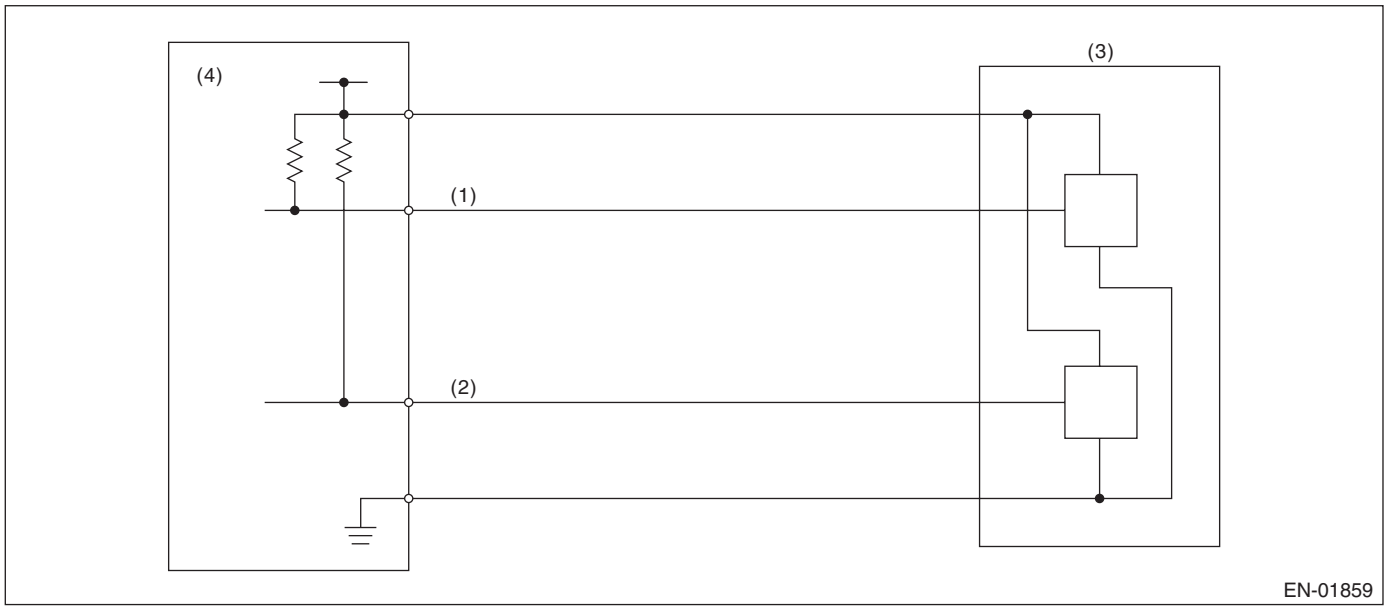
Time Needed for Diagnosis: 24 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

AT:DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 1.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) Throttle position sensor 1 signal
(2) Throttle position sensor 2 signal
(3) Throttle position sensor
(4) Engine control module (ECM)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	≥ 4.727 V

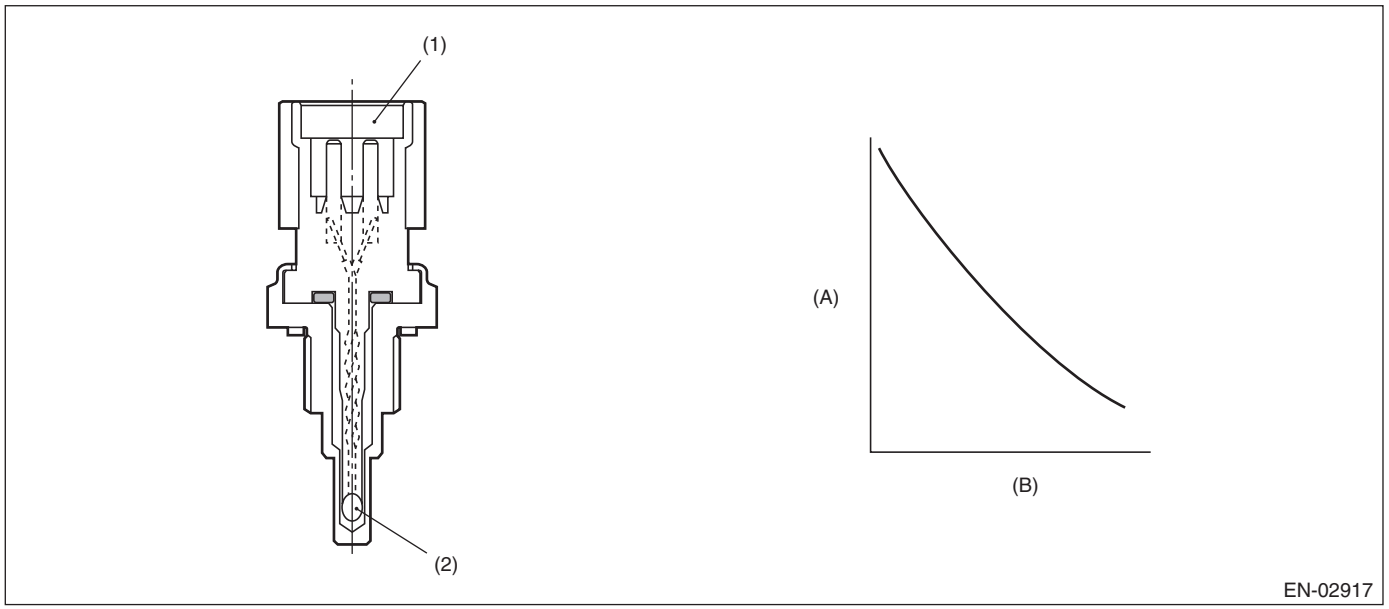
Time Needed for Diagnosis: 24 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

AU:DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of engine coolant temperature sensor output property.
Judge as NG when the engine coolant temperature has not risen to the specific value after the predetermined time has passed since engine start.

2. COMPONENT DESCRIPTION



(A) Resistance value (kΩ)
(B) Temperature °C (°F)
(1) Connector
(2) Thermistor element

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature at engine starting	< –15 °C (5 °F)
Engine speed	> 500 rpm

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once after starting the engine in cold condition.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature	< –15 °C (5 °F)
Elapsed time after starting the engine (At the time of (The smaller value of either Engine coolant temperature or Intake air temperature at engine start) ≥ –23.3°C (–9.9°F)) or (At the time of (The smaller value of either Engine coolant temperature or Intake air temperature at engine start) < –23.3°C (–9.9°F))	≥ 120 s ≥ 300 s

Time Needed for Diagnosis: 120 s or 300 s
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

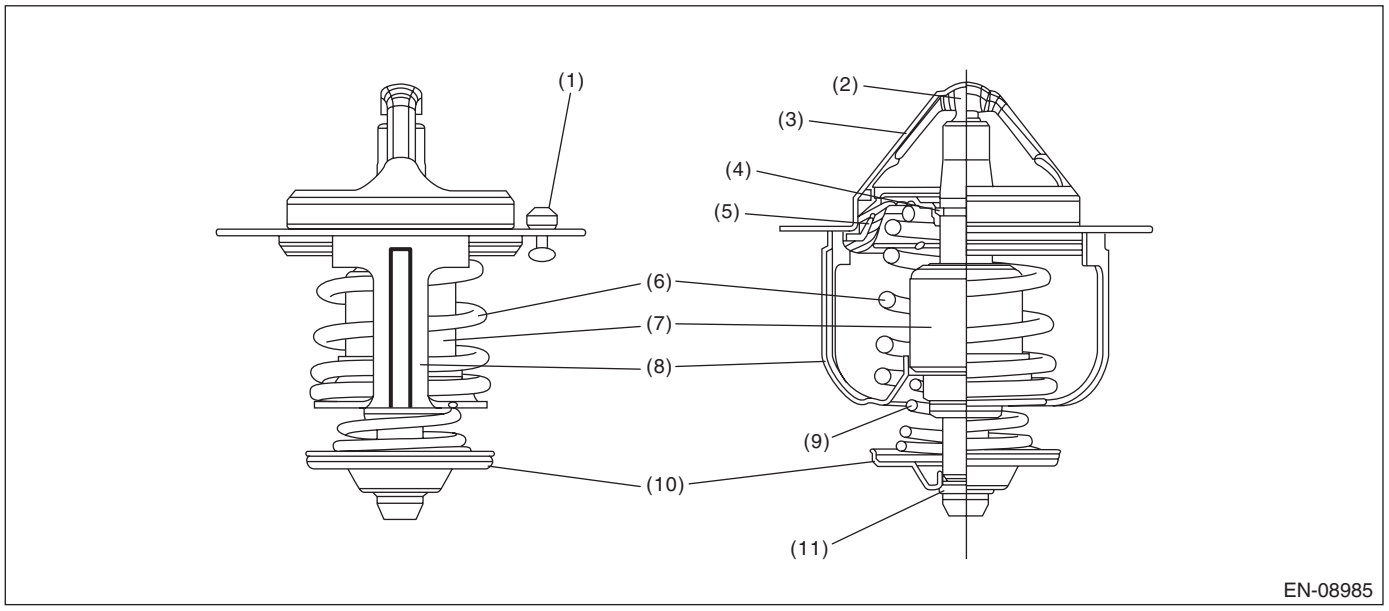
AV:DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE)

1. OUTLINE OF DIAGNOSIS

Detect malfunctions of the thermostat function.
Judge as NG when any one of the following conditions is established.

- When the actual engine coolant temperature does not reach the maximum temperature necessary to perform other OBDII diagnosis and Σ (Estimated engine coolant temperature – actual engine coolant temperature) exceeded the predetermined value. (Judgment 1)
- When the actual engine coolant temperature does not reach the range within –11°C (–19.8°F) from the regulated temperature and Σ (Estimated engine coolant temperature – actual engine coolant temperature) exceeded the predetermined value. (Judgment 2)
- When the difference between the estimated coolant temperature and the actual engine coolant temperature exceeds the predetermined value, and Σ (Estimated engine coolant temperature – actual engine coolant temperature) exceeded the predetermined value. (Judgment 3)

2. COMPONENT DESCRIPTION



(1) Jiggle valve
(2) Piston
(3) Flange
(4) Stop ring
(5) Dust seal
(6) Main spring
(7) Wax element
(8) Frame
(9) Bypass spring
(10) Bypass valve
(11) Stop ring

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
<Judgment 1>	
Battery voltage	≥ 10.9 V
Estimate ambient temperature	≥ –7 °C (19.4 °F)
Vehicle speed	≥ 30 km/h (18.6 MPH)
Estimated coolant temperature	≥ Value of Map 1
<Judgment 2>	
Battery voltage	≥ 10.9 V
Estimate ambient temperature	≥ –7 °C (19.4 °F)
Vehicle speed	≥ 30 km/h (18.6 MPH)
Estimated coolant temperature	≥ Value from Map 2
<Judgment 3>	
Battery voltage	≥ 10.9 V
Estimate ambient temperature	≥ –7 °C (19.4 °F)
Vehicle speed	≥ 30 km/h (18.6 MPH)
Estimated coolant temperature	≥ Value from Map 3

Map 1

Engine coolant temperature at engine starting °C (°F)	-7 (19.4)	8 (46.4)	10 (50)	25 (77)
Estimated coolant temperature °C (°F)	60 (140)	60 (140)	60 (140)	60 (140)

Map 2

Engine coolant temperature at engine starting °C (°F)	-7 (19.4)	8 (46.4)	10 (50)	25 (77)
Estimated coolant temperature °C (°F)	70.2 (158.4)	75.8 (168.4)	75.8 (168.4)	75.8 (168.4)

Map 3

Engine coolant temperature at engine starting °C (°F)	-7 (19.4)	10 (50)	25 (77)	49.6 (121.3)
Estimated coolant temperature °C (°F)	52.3 (126.1)	59.4 (138.9)	65.5 (149.9)	75.8 (168.4)

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once after starting the engine.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
When any one of the followings is established:	
<Judgment 1>	
Actual engine coolant temperature and Σ (Estimated engine coolant temperature – actual engine coolant temperature)	< Value of Map 4 > Value of Map 5
<Judgment 2>	
Actual engine coolant temperature and Σ (Estimated engine coolant temperature – actual engine coolant temperature)	< Regulated temperature – Value of Map 6 > Value of Map 7
<Judgment 3>	
Estimated engine coolant temperature – actual engine coolant temperature and Σ (Estimated engine coolant temperature – actual engine coolant temperature)	> Value of Map 8 > Value of Map 9

Map 4

Estimate ambient temperature °C (°F)	-7 (19.4)	8 (46.4)	10 (50)	25 (77)
Threshold Value °C (°F)	60 (140)	60 (140)	60 (140)	60 (140)

Map 5

Engine coolant temperature at engine starting °C (°F)	-7 (19.4)	0 (32)	8 (46.4)	10 (50)	30 (86)	40 (104)
Threshold Value °C (°F)	31200 (3116.9)	31200 (3116.9)	31200 (3116.9)	31200 (3116.9)	31200 (3116.9)	31200 (2160)

Map 6

Estimate ambient temperature °C (°F)	-7 (19.4)	8 (46.4)	10 (50)	25 (77)
Threshold Value °C (°F)	16.7 (30.1)	11.1 (20)	11.1 (20)	11.1 (20)

Map 7

Engine coolant temperature at engine starting °C (°F)	-7 (19.4)	0 (32)	8 (46.4)	10 (50)	30 (86)	35 (95)
Threshold Value °C (°F)	31200 (3116.9)	31200 (3116.9)	31200 (3116.9)	31200 (3116.9)	31200 (3116.9)	31200 (2700)

Map 8

Estimate ambient temperature °C (°F)	-7 (19.4)	8 (46.4)	10 (50)	25 (77)
Threshold Value °C (°F)	11.1 (20)	11.1 (20)	11.1 (20)	11.1 (20)

Map 9

Engine coolant temperature at engine starting °C (°F)	-7 (19.4)	8 (46.4)	10 (50)	25 (77)
Threshold Value °C (°F)	31200 (3116.9)	31200 (3116.9)	31200 (3116.9)	31200 (3116.9)

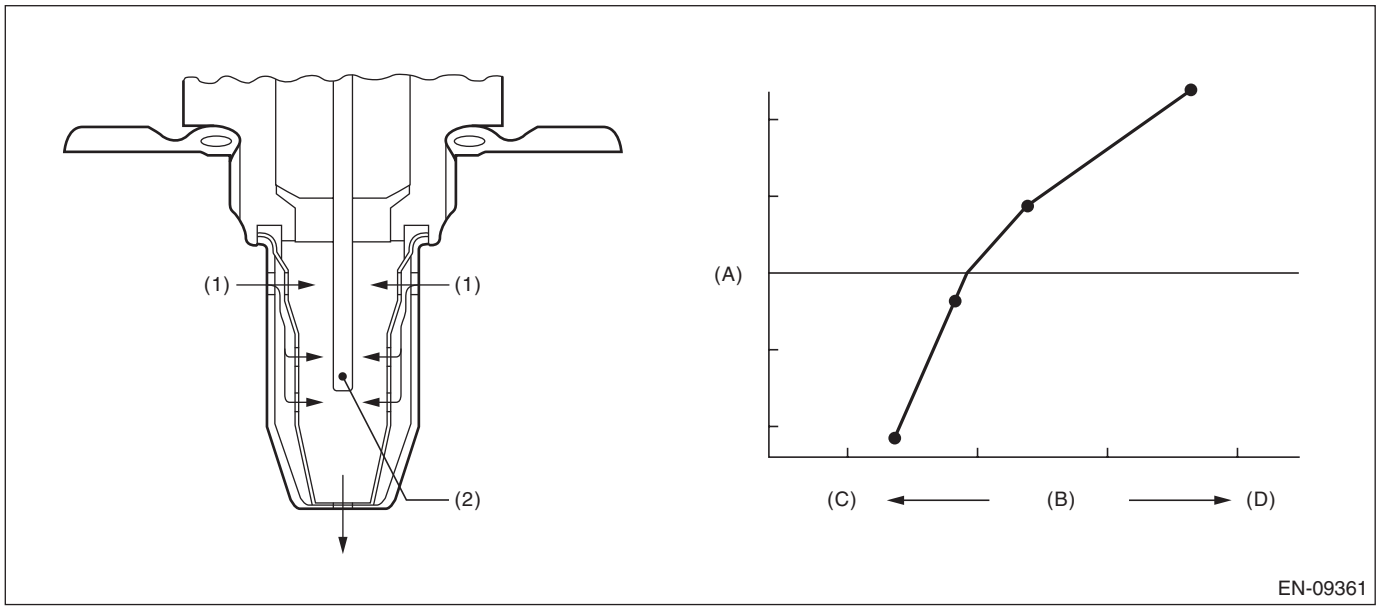
Time Needed for Diagnosis: 300 — 700 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

AW:DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of sensor.
Judge as NG, when the element voltage is out of the specified range.

2. COMPONENT DESCRIPTION



(A) Electromotive force (B) Air fuel ratio (C) Rich
(D) Lean

(1) Exhaust gas (2) ZrO_2

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Input voltage (+)	< 0.4 V
or	
Input voltage (–)	< 0.4 V
or	
|Input voltage (+) – Input voltage (–)|	< 0.1 V
ECM input voltage (–)	> 3.8 V and < 4.7 V

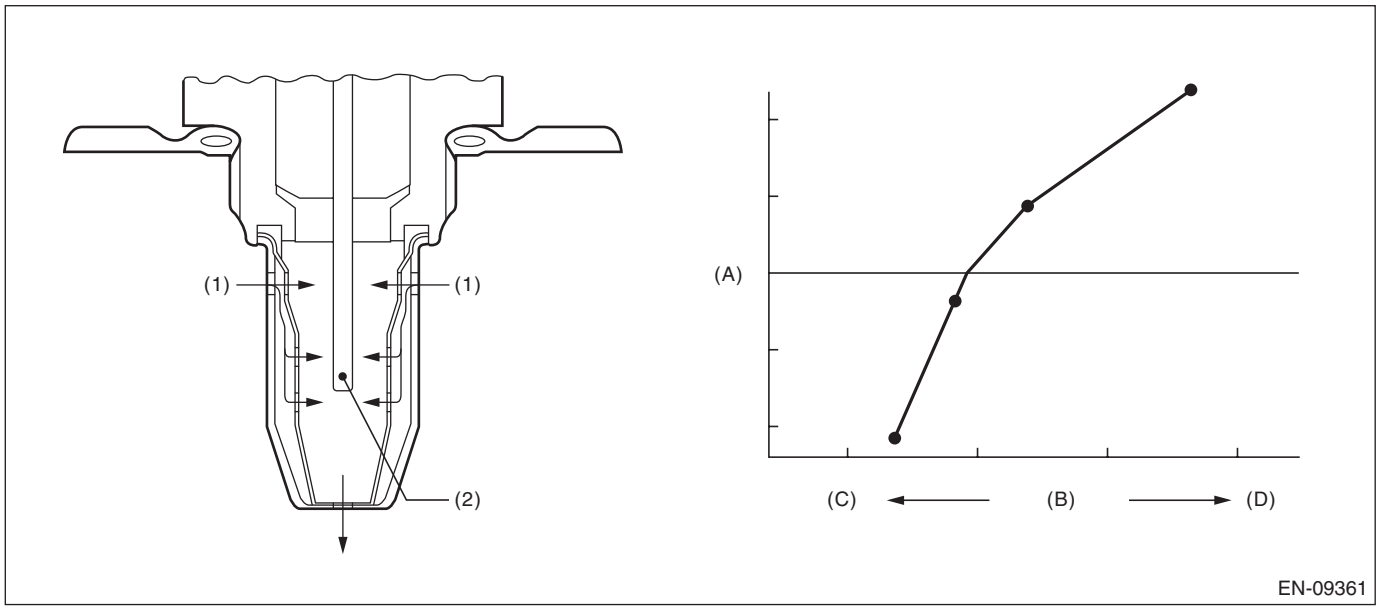
Time Needed for Diagnosis:
Input voltage (+): 1000 ms
Input voltage (–): 1000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

AX:DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of sensor.
Judge as NG, when the element voltage is out of the specified range.

2. COMPONENT DESCRIPTION



(A) Electromotive force (B) Air fuel ratio (C) Rich
(D) Lean

(1) Exhaust gas (2) ZrO_2

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Input voltage (+) or Input voltage (–)	> 4.7 V > 4.7 V

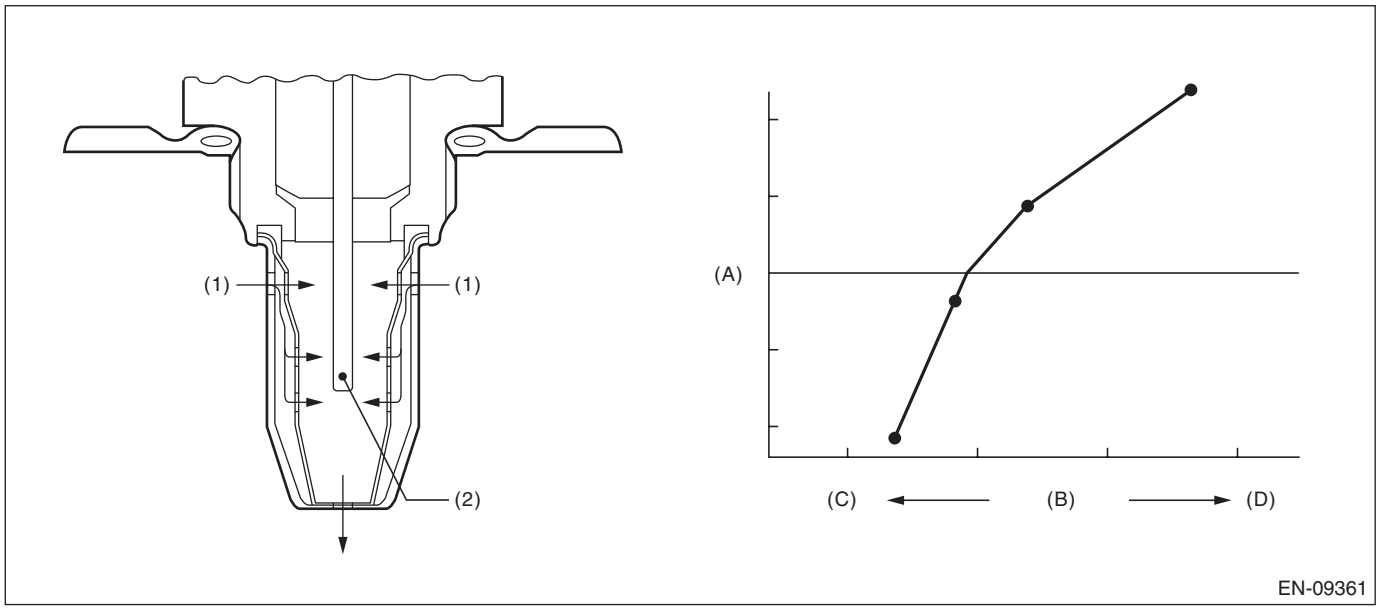
Time Needed for Diagnosis:
Input voltage (+): 1000 ms
Input voltage (–): 1000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

AY:DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect open circuits of the sensor.
Judge as NG when the impedance of the element is large.

2. COMPONENT DESCRIPTION



(A) Electromotive force (B) Air fuel ratio (C) Rich
(D) Lean

(1) Exhaust gas (2) ZrO_2

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Time of heater control duty at 70 % or more	≥ 36000 ms

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Front oxygen (A/F) sensor impedance	> 450 Ω

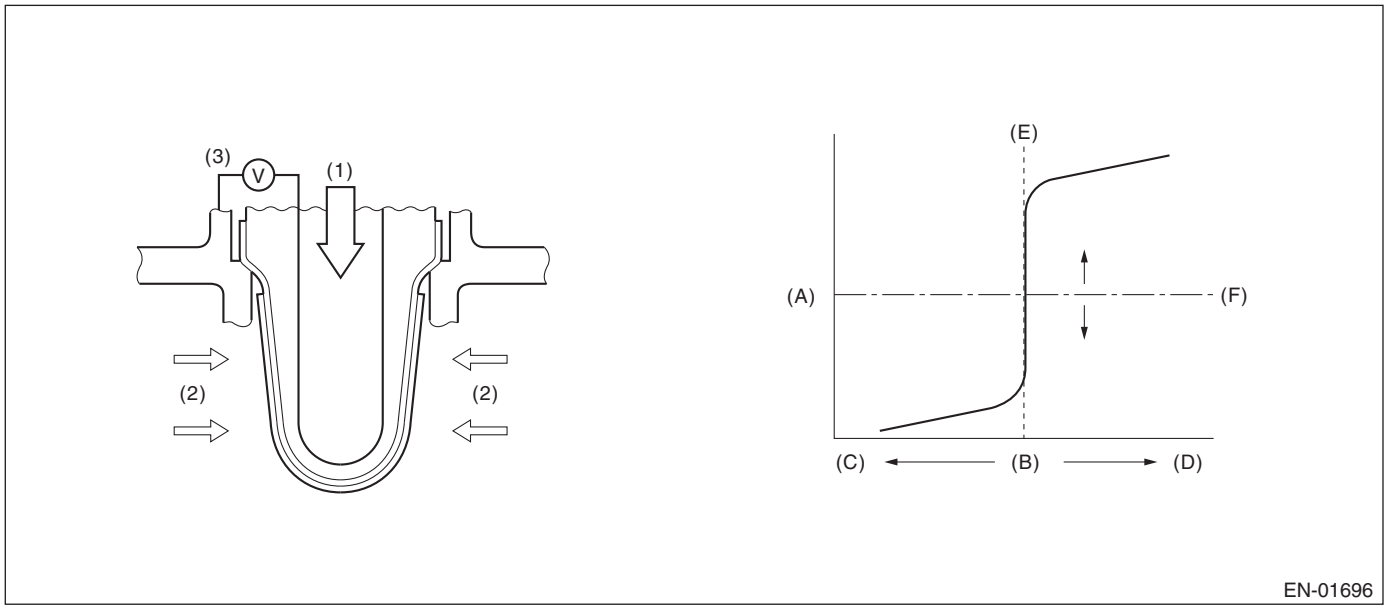
Time Needed for Diagnosis: 5000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

AZ:DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

Detect continuity NG of the oxygen sensor. If the oxygen sensor voltage reading is not within the probable range considering the operating conditions, judge as NG.

2. COMPONENT DESCRIPTION



(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich
(E) Theoretical air fuel ratio
(F) Comparative voltage

(1) Atmosphere
(2) Exhaust gas
(3) Electromotive force

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
High	
Secondary air system	Not in operation
Closed loop control at the oxygen sensor	In operation
Misfire detection every 200 rotations	< 65535 time(s)
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ 60 °C (140 °F)
Low (1)	
Secondary air system	Not in operation
Closed loop control at the oxygen sensor	In operation
Misfire detection every 200 rotations	< 65535 time(s)
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ 60 °C (140 °F)
Amount of intake air	≥ 10 g/s (0.35 oz/s)

Secondary Parameters	Enable Conditions
Low (2)	
Secondary air system	Not in operation
Closed loop control at the oxygen sensor	In operation
Misfire detection every 200 rotations	< 65535 time(s)
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ 60 °C (140 °F)
Amount of intake air	< 10 g/s (0.35 oz/s)
Current continuation time of the rear oxygen sensor heater	≥ 30000 ms
Low (3)	
Secondary air system	Not in operation
Closed loop control at the oxygen sensor	In operation
Misfire detection every 200 rotations	< 65535 time(s)
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ 60 °C (140 °F)
Amount of intake air	< 10 g/s (0.35 oz/s)
Current continuation time of the rear oxygen sensor heater	≥ 30000 ms
Fuel cut	Experienced

4. GENERAL DRIVING CYCLE

After starting the engine, continuously perform the diagnosis with the same engine condition.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
High		P0138
Sensor output voltage	> 1.2 V	
Low		P0137
Sensor output voltage	< 0.03 V	

Time Needed for Diagnosis:

High: 2500 ms
Low (1): 20000 ms
Low (2): 40000 ms
Low (3): Value from Map

Map

Fuel cut time (ms)	0	2000	10000
Time Needed for Diagnosis (ms)	40000	40000	60000

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

BA:DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

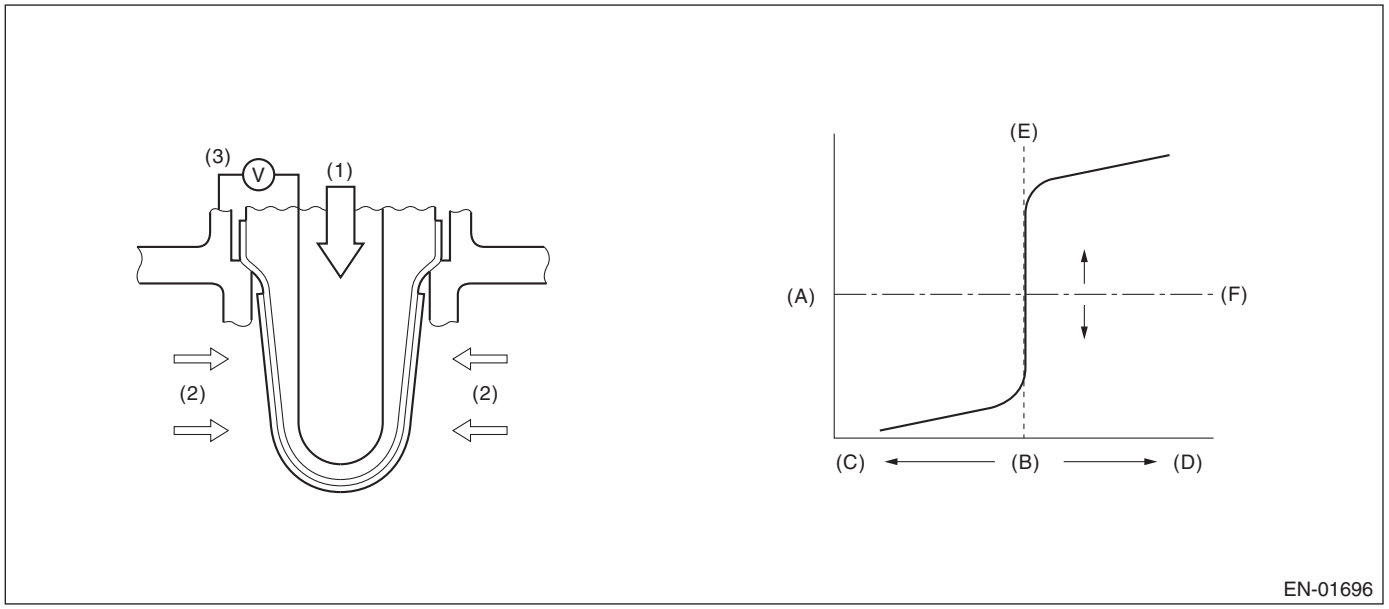
NOTE:
For the detection standard, refer to DTC P0137. <Ref. to GD(H4DO w/o HEV)-57, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

BB:DTC P013A O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

Detect the slow response of rich → lean for rear oxygen sensor output.
When the deceleration fuel cut has occurred, detect the trouble by calculating the time when the rear oxygen sensor output passes through the predetermined range of voltages.
Judge as NG when the response time is larger than the threshold value.

2. COMPONENT DESCRIPTION



(A)	Electromotive force	(B)	Air fuel ratio	(C)	Lean
(D)	Rich	(E)	Theoretical air fuel ratio	(F)	Comparative voltage
(1)	Atmosphere	(2)	Exhaust gas	(3)	Electromotive force

3. ENABLE CONDITIONS

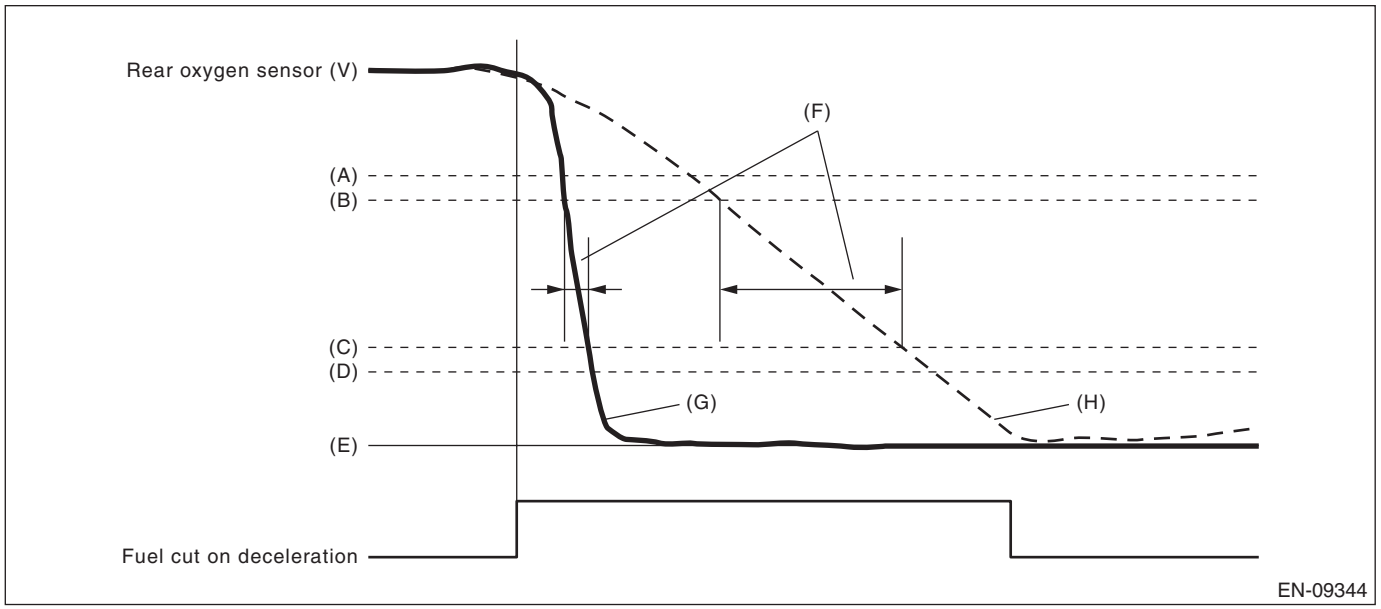
Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Rear oxygen sensor closed loop control	Operation
Current calculation time of the rear oxygen sensor heater after starting	≥ 180000 ms
Engine speed when fuel cut starts	≥ 1000 rpm
Rear oxygen sensor voltage when fuel cut starts	≥ 0.55 V
Fuel cut time	≥ 5000 ms
Engine coolant temperature when fuel cut starts	≥ –40 °C (–40 °F)
Estimated temperature of rear oxygen sensor element when fuel cut starts	≥ 500 °C (932 °F)

4. GENERAL DRIVING CYCLE

Perform diagnosis once during deceleration fuel cut from a constant and high speed driving, when rear oxygen sensor is warmed up sufficiently.

5. DIAGNOSTIC METHOD

Detect the trouble by calculating the response time of the rear oxygen sensor during fuel cut.



(A) 0.55 V
(B) 0.50 V
(C) 0.20 V
(D) 0.15 V
(E) 0 V
(F) Diagnostic parameter
(G) Normal
(H) Malfunction

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Time when rear oxygen sensor voltage changed from 0.5 V to 0.2 V	> 491 ms

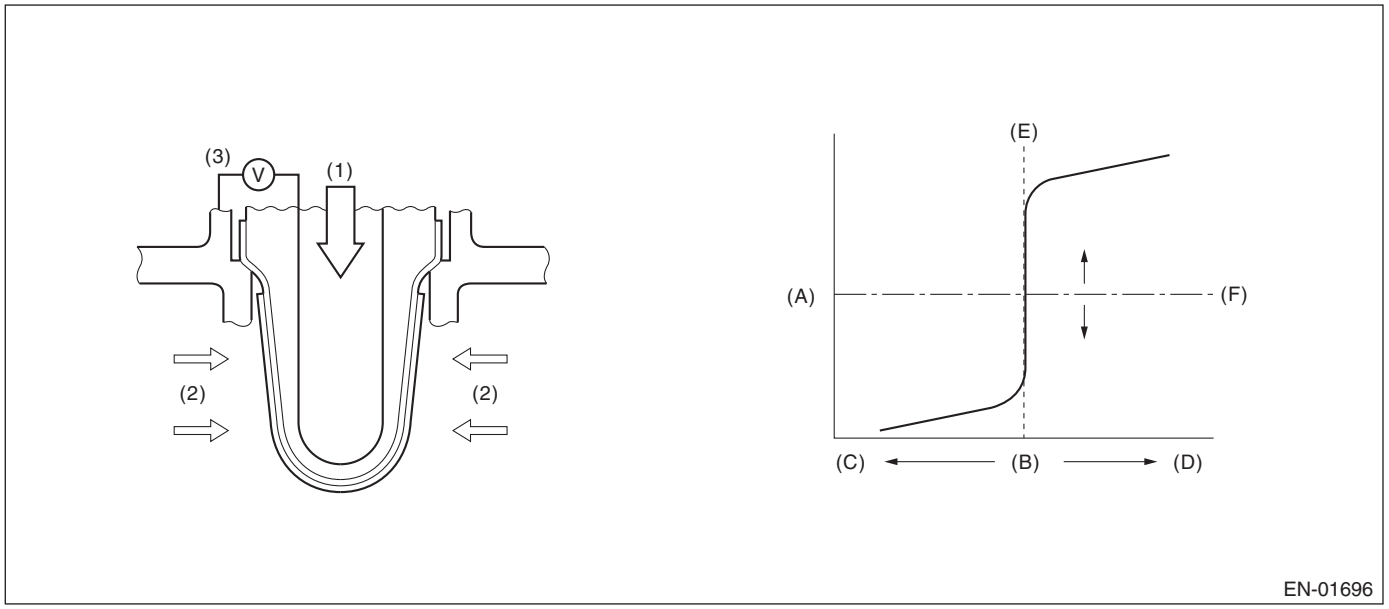
Time Needed for Diagnosis: 10 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

BC:DTC P013B O2 SENSOR SLOW RESPONSE - LEAN TO RICH (BANK 1 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

Detect the slow response of lean → rich for rear oxygen sensor output.
After the deceleration fuel cut has occurred, detect the trouble by calculating the time when the rear oxygen sensor output passes through the predetermined range of voltages.
Judge as NG when the response time is larger than the threshold value.

2. COMPONENT DESCRIPTION



(A)	Electromotive force	(B)	Air fuel ratio	(C)	Lean
(D)	Rich	(E)	Theoretical air fuel ratio	(F)	Comparative voltage
(1)	Atmosphere	(2)	Exhaust gas	(3)	Electromotive force

3. ENABLE CONDITIONS

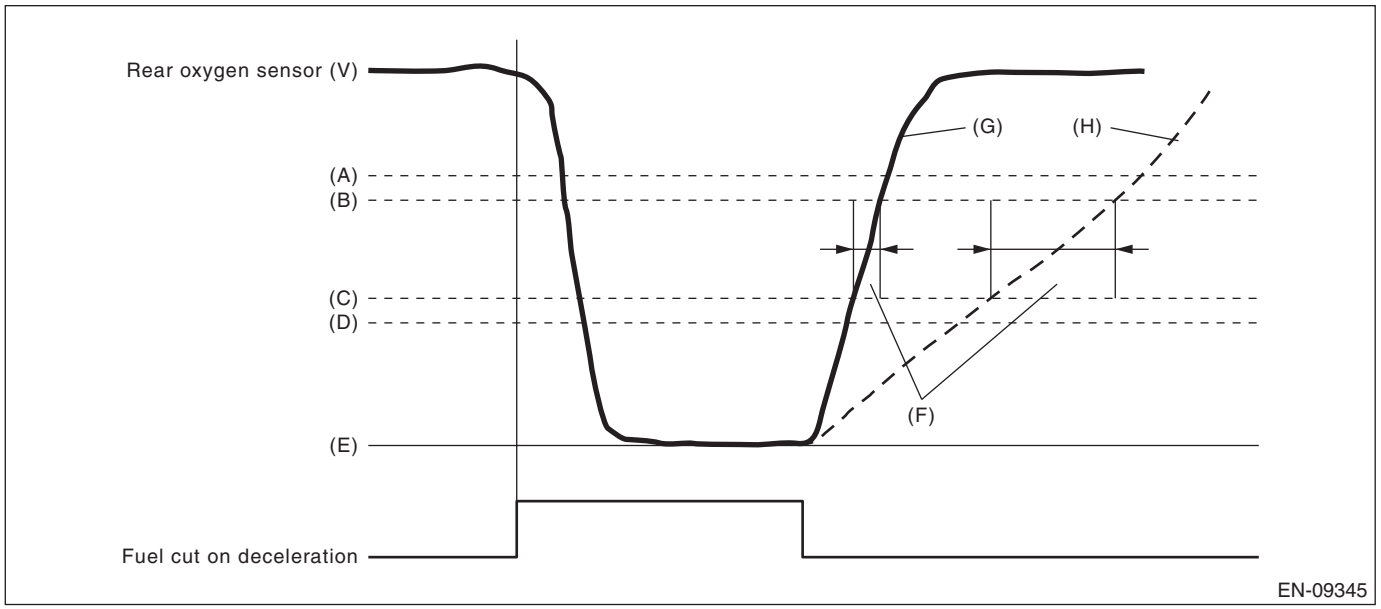
Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Front oxygen (A/F) sensor closed loop control	Operation
Fuel cut time	≥ 5000 ms

4. GENERAL DRIVING CYCLE

Perform diagnosis only once after recovering from a deceleration fuel cut continued for more than predetermined time.

5. DIAGNOSTIC METHOD

Detect the trouble by calculating the response time of the rear oxygen sensor after fuel cut.



(A) 0.55 V
(B) 0.50 V
(C) 0.30 V
(D) 0.25 V
(E) 0 V
(F) Diagnostic parameter
(G) Normal
(H) Malfunction

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Time when rear oxygen sensor voltage changed from 0.3 V to 0.5 V	> 4000 ms

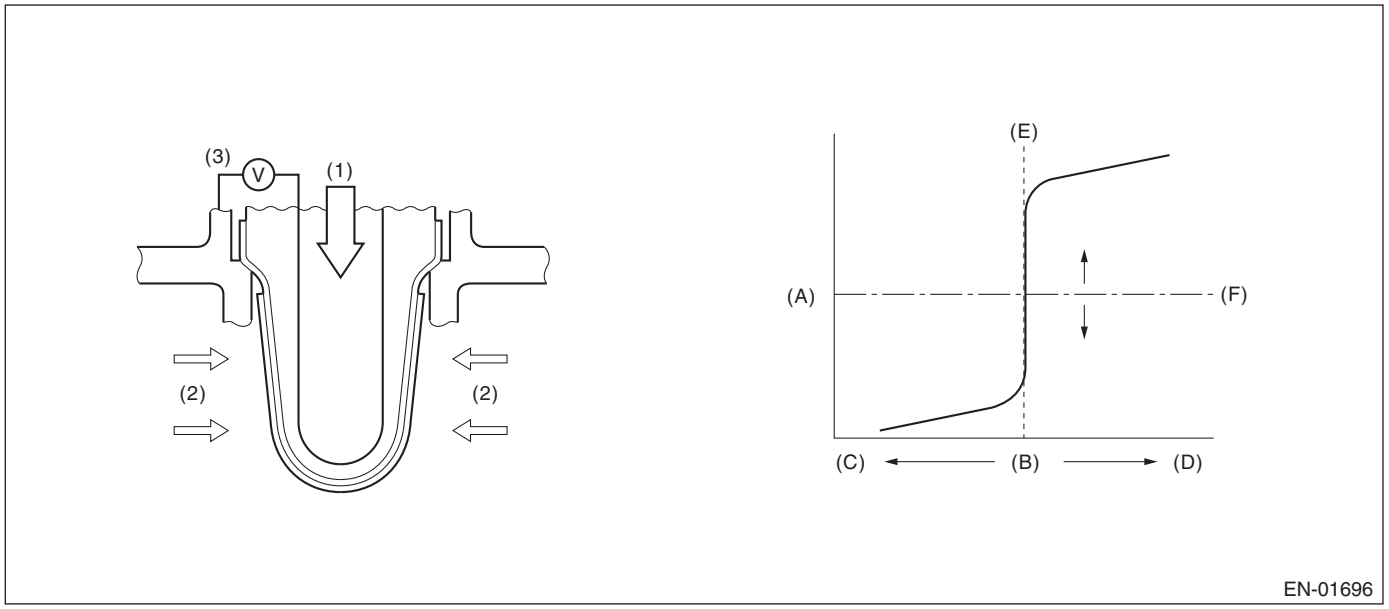
Time Needed for Diagnosis: 10 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

BD:DTC P013E O2 SENSOR DELAYED RESPONSE - RICH TO LEAN (BANK 1 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

Detect the delayed response of rear oxygen sensor output for rich → lean.
After the deceleration fuel cut has started, detect the trouble by calculating the time when the rear oxygen sensor output decreases to the predetermined voltages.
Judge as NG when the response time is larger than the threshold value.

2. COMPONENT DESCRIPTION



(A)	Electromotive force	(B)	Air fuel ratio	(C)	Lean
(D)	Rich	(E)	Theoretical air fuel ratio	(F)	Comparative voltage
(1)	Atmosphere	(2)	Exhaust gas	(3)	Electromotive force

3. ENABLE CONDITIONS

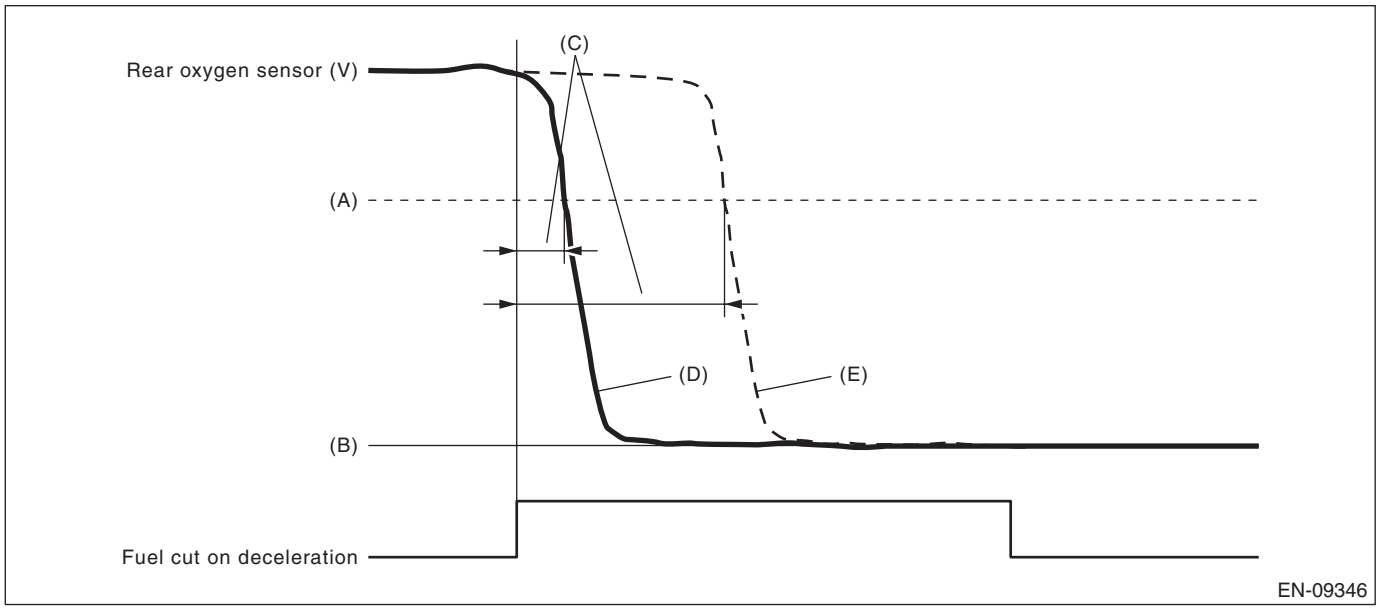
Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Rear oxygen sensor closed loop control	Operation
Engine speed when fuel cut starts	≥ 1000 rpm
Rear oxygen sensor voltage when fuel cut starts	≥ 0.55 V
Fuel cut time	≥ 5000 ms
Engine coolant temperature when fuel cut starts	≥ –40 °C (–40 °F)
Estimated temperature of rear oxygen sensor element when fuel cut starts	≥ 500 °C (932 °F)

4. GENERAL DRIVING CYCLE

Perform diagnosis once during deceleration fuel cut from a constant and high speed driving, when rear oxygen sensor is warmed up sufficiently.

5. DIAGNOSTIC METHOD

Detect the trouble by calculating the time from the beginning of the fuel cut to the beginning of the rear oxygen sensor voltage starting to drop.



(A) 0.5 V
(B) 0 V
(C) Diagnostic parameter
(D) Normal
(E) Malfunction

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Time when rear oxygen sensor voltage changed to 0.5 V after the fuel cut started	> 4000 ms

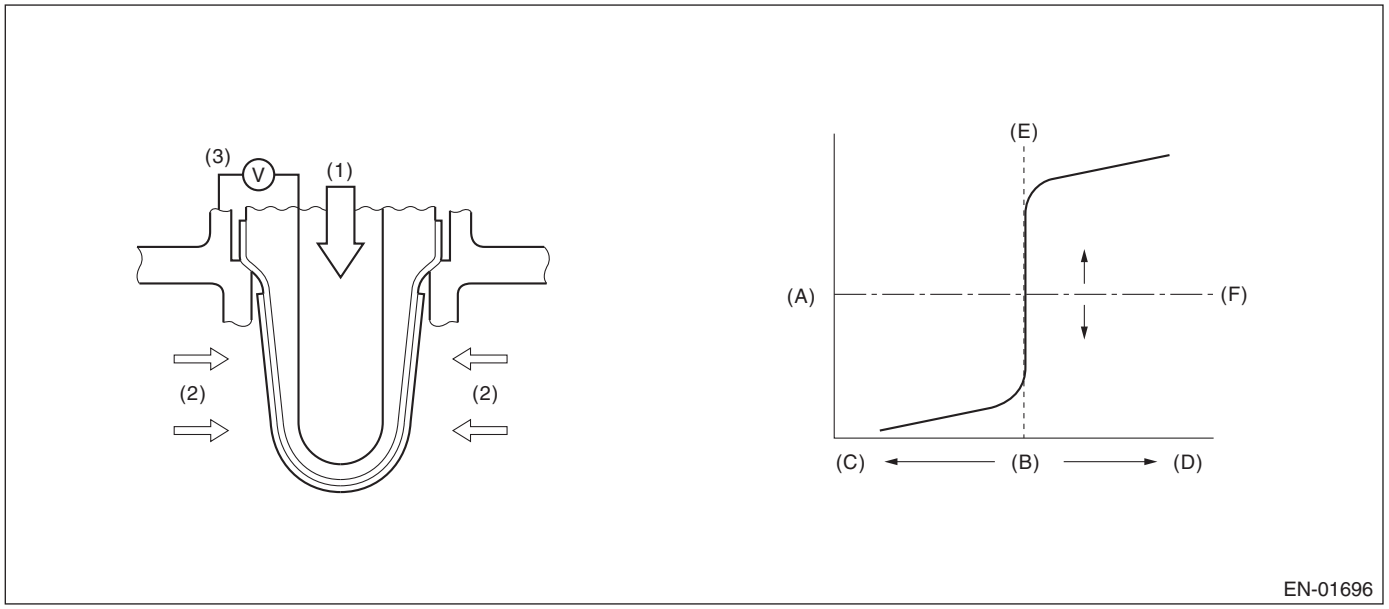
Time Needed for Diagnosis: 10 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

BE:DTC P013F O2 SENSOR DELAYED RESPONSE - LEAN TO RICH (BANK 1 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

Detect the delayed response of rear oxygen sensor output for lean → rich.
After the deceleration fuel cut has completed, detect the trouble by calculating the time when the rear oxygen sensor output increases to the predetermined voltages.
Judge as NG when the response time is larger than the threshold value.

2. COMPONENT DESCRIPTION



(A)	Electromotive force	(B)	Air fuel ratio	(C)	Lean
(D)	Rich	(E)	Theoretical air fuel ratio	(F)	Comparative voltage
(1)	Atmosphere	(2)	Exhaust gas	(3)	Electromotive force

3. ENABLE CONDITIONS

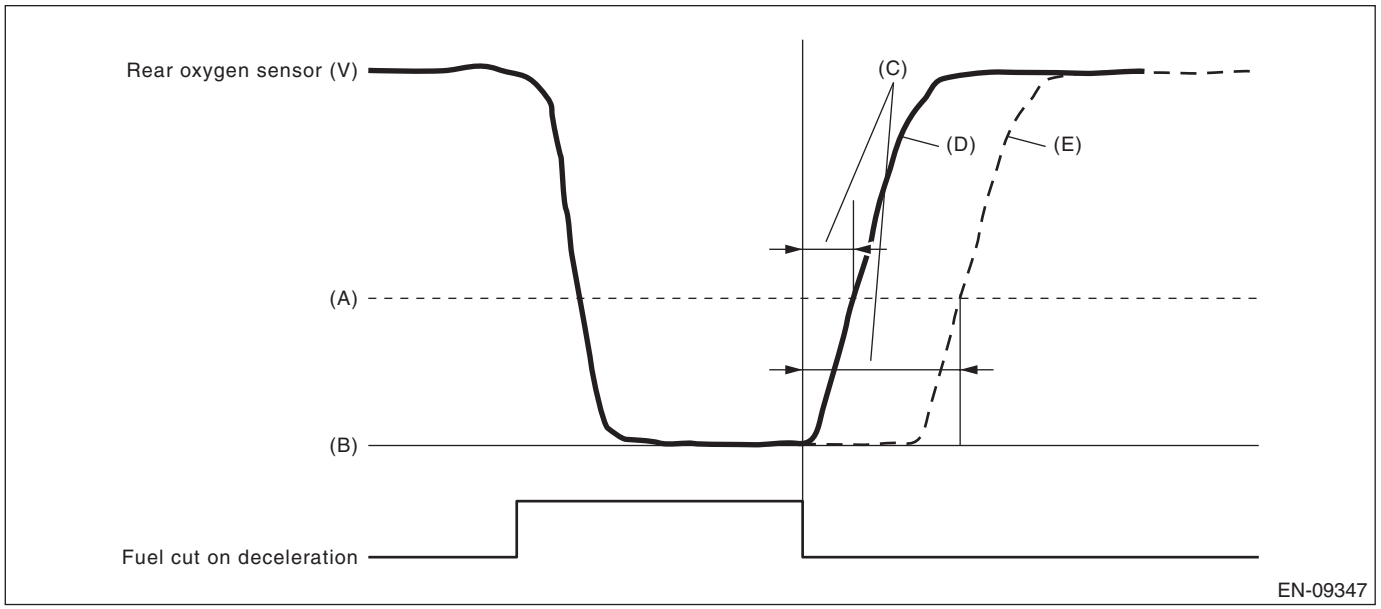
Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Front oxygen (A/F) sensor closed loop control	Operation
Engine speed	≥ 500 rpm
Rear oxygen sensor voltage when fuel cut has completed	< 0.15 V
Fuel cut time	≥ 5000 ms
Engine coolant temperature when fuel cut has completed	≥ –40 °C (–40 °F)
Estimated element temperature of rear oxygen sensor when fuel cut has completed	≥ 500 °C (932 °F)

4. GENERAL DRIVING CYCLE

Perform diagnosis only once when recovering from the deceleration fuel cut continued for more than predetermined time with the rear oxygen sensor warmed up sufficiently.

5. DIAGNOSTIC METHOD

Detect the trouble by calculating the time from the completion of the fuel cut to the beginning of the rear oxygen sensor voltage starting to rise.



(A) 0.3 V
(B) 0 V
(C) Diagnostic parameter
(D) Normal
(E) Malfunction

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
The number of times that the rear oxygen sensor voltage changed to 0.3 V after the fuel cut has completed (time counter)	> 3750 time(s)

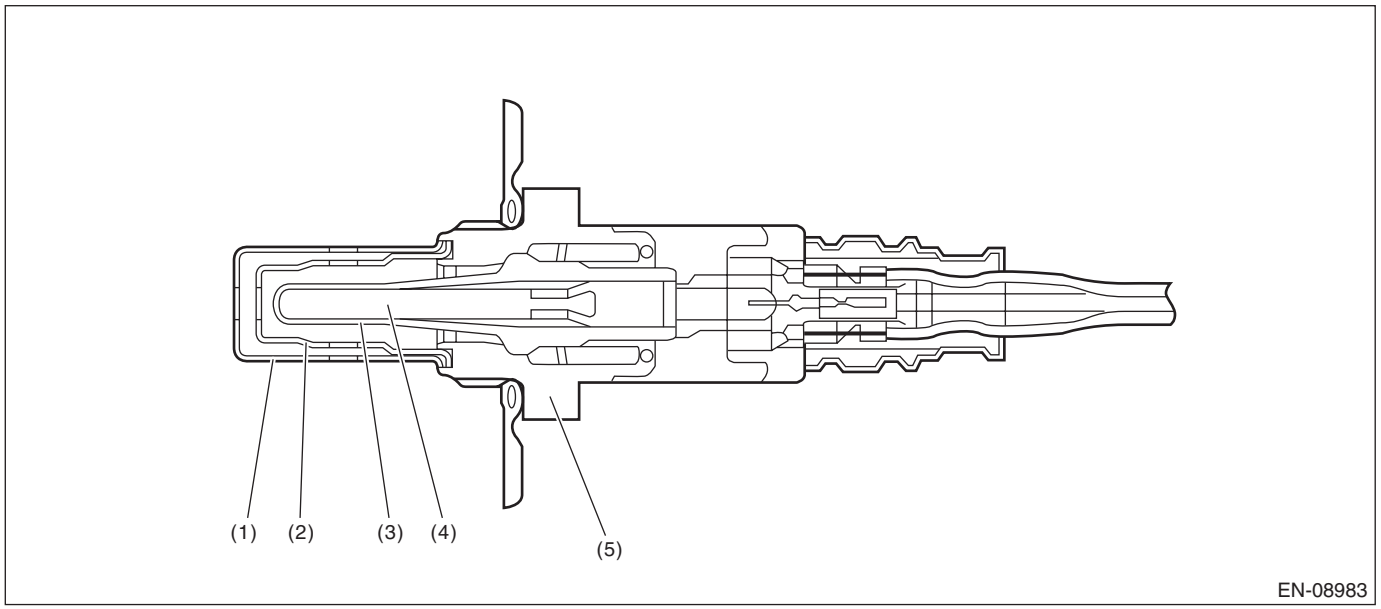
Time Needed for Diagnosis: 10 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

BF:DTC P0141 O2 SENSOR HEATER CIRCUIT (BANK1 SENSOR2)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of rear oxygen sensor heater.
While observing the engine condition, judge as NG if the rear oxygen sensor impedance is great.

2. COMPONENT DESCRIPTION



(1) Element cover (outer)
(2) Element cover (inner)
(3) Sensor element
(4) Ceramic heater
(5) Sensor housing

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1000 ms
A/F sensor element impedance	≤ 82 Ω
A/F sensor heater control duty	≤ 75 %
Rear oxygen sensor heater control duty	< 70 %

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after 1000 ms seconds or more have passed since the engine started.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Measured secondary oxygen sensor heater control voltage	12 V battery system voltage × 0.88 V

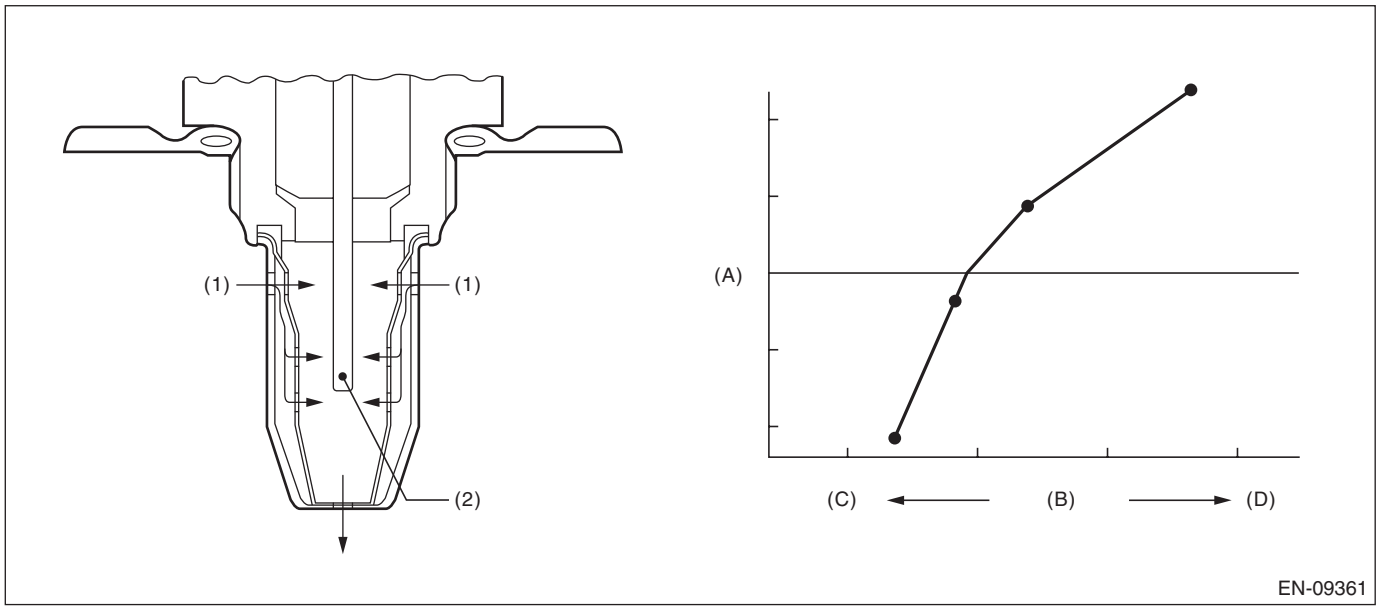
Time Needed for Diagnosis: 4 ms × 2500 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

BG:DTC P014C O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect the slow response of front oxygen (A/F) sensor.
For diagnosis, detect the trouble by processing the λ waveform in normal driving without forcibly changing the target air fuel ratio.

2. COMPONENT DESCRIPTION



(A) Electromotive force (B) Air fuel ratio (C) Rich
(D) Lean

(1) Exhaust gas (2) ZrO_2

3. ENABLE CONDITIONS

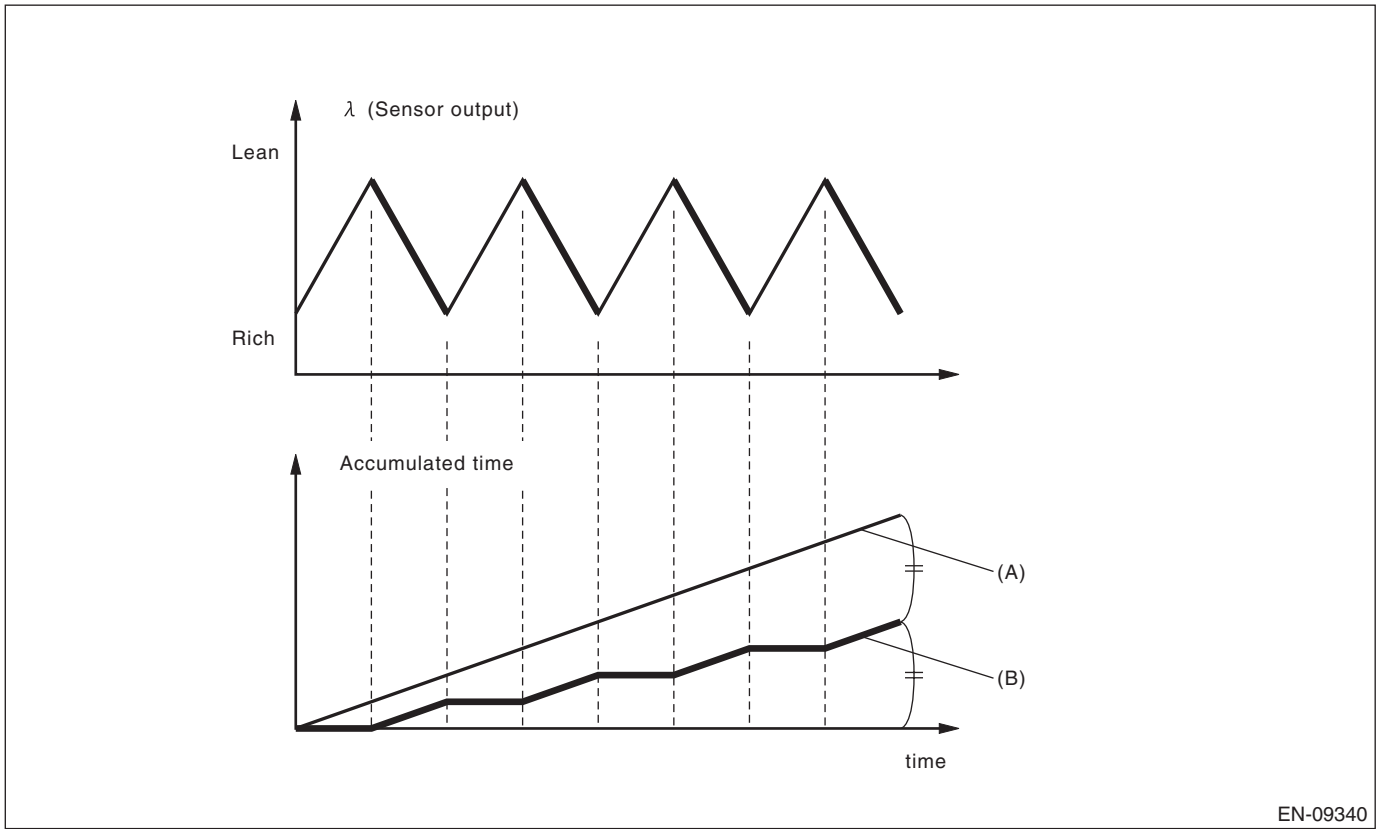
Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Closed loop control with main feedback	Operation
Engine speed	≥ 1000 rpm
Amount of intake air	≥ 10 g/s (0.35 oz/s) (CVT model) ≥ 10 g/s (0.35 oz/s) (MT model)
Elapsed time after returning from the fuel cut	≥ 3000 ms
Accelerator pedal position	≠ 0%

4. GENERAL DRIVING CYCLE

Perform diagnosis only once in a city driving including normal acceleration and deceleration.

5. DIAGNOSTIC METHOD 1

Detect the malfunction by checking “Cumulative value of time when λ changes from lean → rich” in comparison to “Time during which diagnosis is in progress”.



(A) Time during which diagnosis is in progress
(B) Cumulative value of time when λ changes from lean → rich

Judge as NG when the following conditions are established.

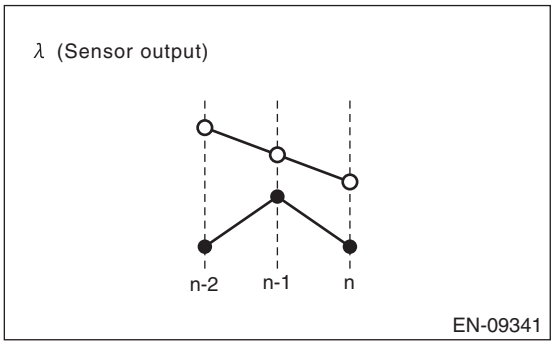
Judgment Value

Malfunction Criteria	Threshold Value	DTC
(Cumulative value of time when λ changes from lean → rich) / (Time during which diagnosis is in progress)	< 0.1 (CVT model) < 0.1 (MT model)	P014C
	> 0.9 (CVT model) > 0.9 (MT model)	P014D

Time Needed for Diagnosis: 90 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DIAGNOSTIC METHOD 2

Detect the malfunction by the cumulative value obtained from the amount of variation in λ change.



Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Cumulative value obtained from the amount of variation in λ change Σ |(lambda(n) – lambda(n-1)) – (lambda(n-1) – lambda(n-2))|	< Value from Map	P014C and P014D

Map (CVT model)

Cumulative value obtained from the amount of variation in λ Σ |lambda(n) – lambda(n-1)|	0.00	1.00
Cumulative value obtained from the amount of variation in λ change	0.01	0.01

Map (MT model)

Cumulative value obtained from the amount of variation in λ Σ |lambda(n) – lambda(n-1)|	0.00	1.00
Cumulative value obtained from the amount of variation in λ change	0.01	0.01

Time Needed for Diagnosis: 90 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

BH:DTC P014D O2 SENSOR SLOW RESPONSE - LEAN TO RICH (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

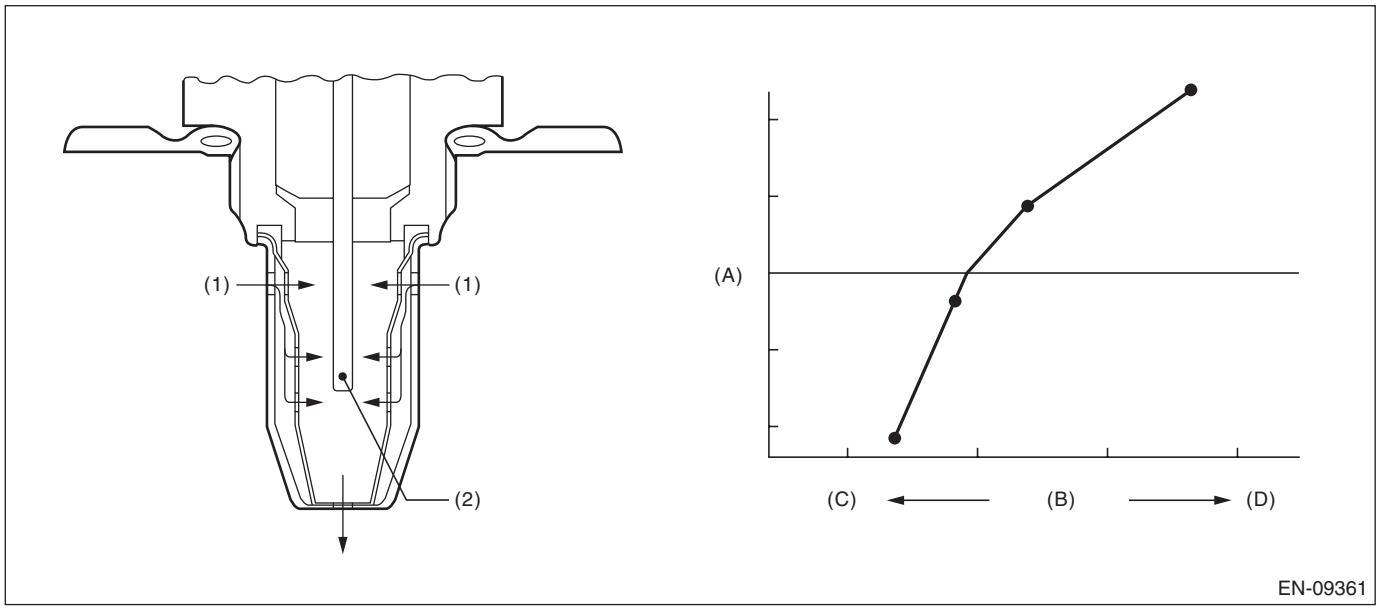
NOTE:
For the detection standard, refer to DTC P014C. <Ref. to GD(H4DO w/o HEV)-68, DTC P014C O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

BI: DTC P015A O2 SENSOR DELAYED RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect the slow response of front oxygen (A/F) sensor.
For diagnosis, detect the trouble by processing the λ waveform in normal driving without forcibly changing the target air fuel ratio.

2. COMPONENT DESCRIPTION



(A) Electromotive force (B) Air fuel ratio (C) Rich
(D) Lean

(1) Exhaust gas (2) ZrO_2

3. ENABLE CONDITIONS

Diagnostic method 1 and 2

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Closed loop control with main feedback	Operation
Engine speed	≥ 1000 rpm
Amount of intake air	≥ 10 g/s (0.35 oz/s) (CVT model) ≥ 10 g/s (0.35 oz/s) (MT model)
Elapsed time after returning from the fuel cut	≥ 3000 ms
Accelerator pedal position	≠ 0%

Diagnosis method 3 (only MT model)

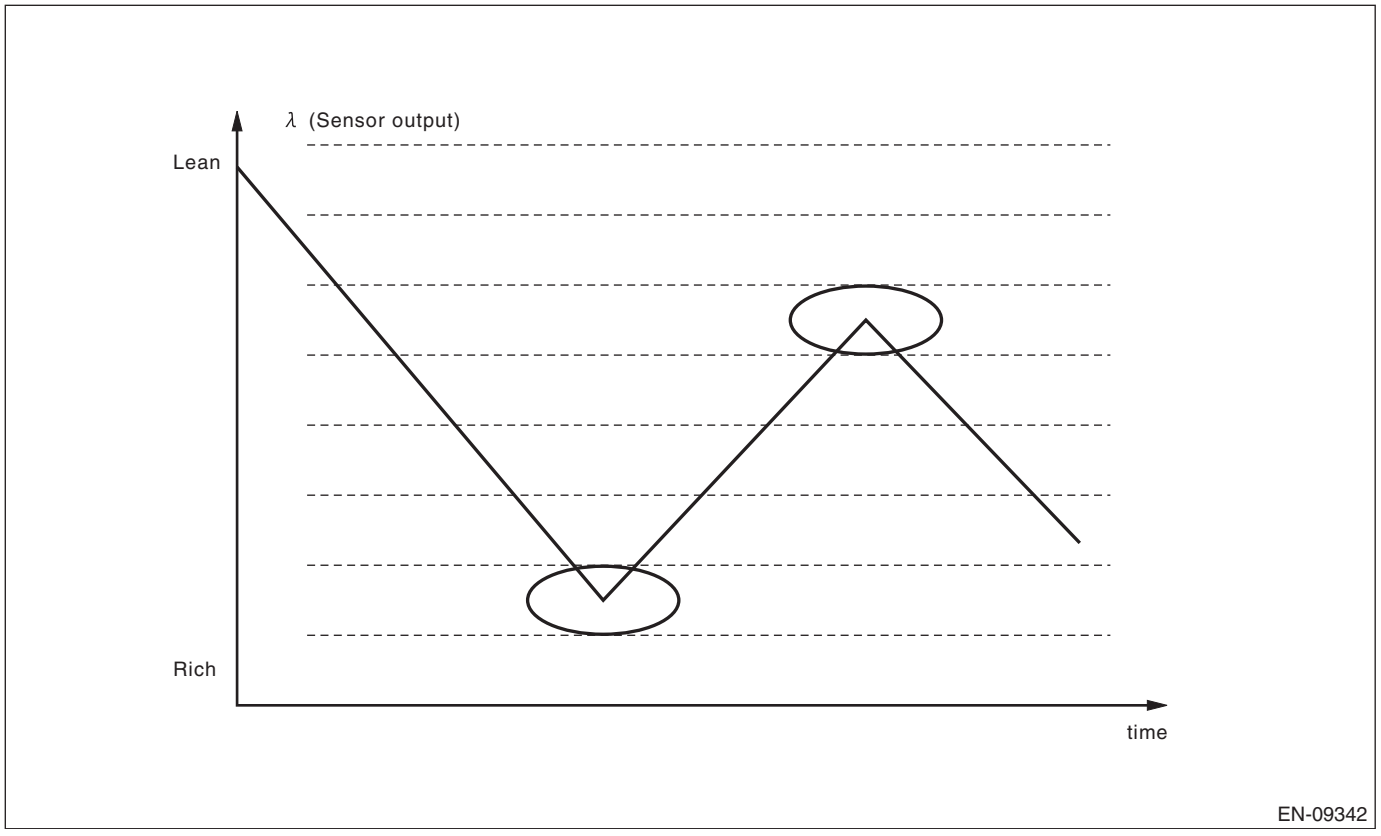
Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Closed loop control with main feedback	Operation
Vehicle speed	≥ 40 km/h (24.9 MPH)
Engine speed	≥ 1000 rpm and < 4000 rpm
Amount of intake air	≥ 7.5 g/s (0.26 oz/s) and < 40 g/s (1.41 oz/s)
Catalyst deterioration diagnosis	Not diagnosed

4. GENERAL DRIVING CYCLE

Perform diagnosis only once in a city driving including normal acceleration and deceleration.

5. DIAGNOSTIC METHOD 1

Detect the malfunction depending on the average value of time necessary for λ to inverse the air fuel ratio from “Lean → Rich → Lean” to “Rich → Lean → Rich”.



Judge as NG when the following conditions are established.

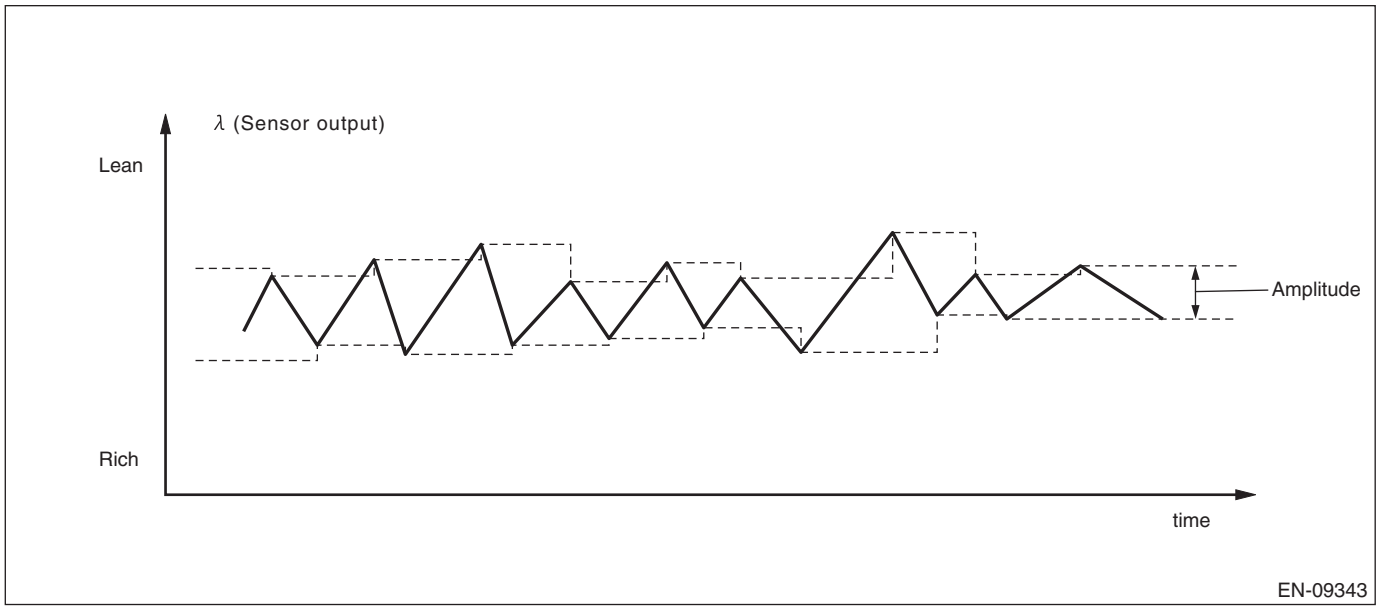
Judgment Value

Malfunction Criteria	Threshold Value	DTC
Average value of time necessary for λ to inverse the air fuel ratio to Lean → Rich → Lean	> 1000 ms (CVT model) > 1000 ms (MT model)	P015A
Average value of time necessary for λ to inverse the air fuel ratio to Rich → Lean → Rich	> 1000 ms (CVT model) > 1000 ms (MT model)	P015B

Time Needed for Diagnosis: 50 times of inversion
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DIAGNOSTIC METHOD 2

Detect the malfunction by calculating the average amplitude of λ.



Judge as NG when the following conditions are established.

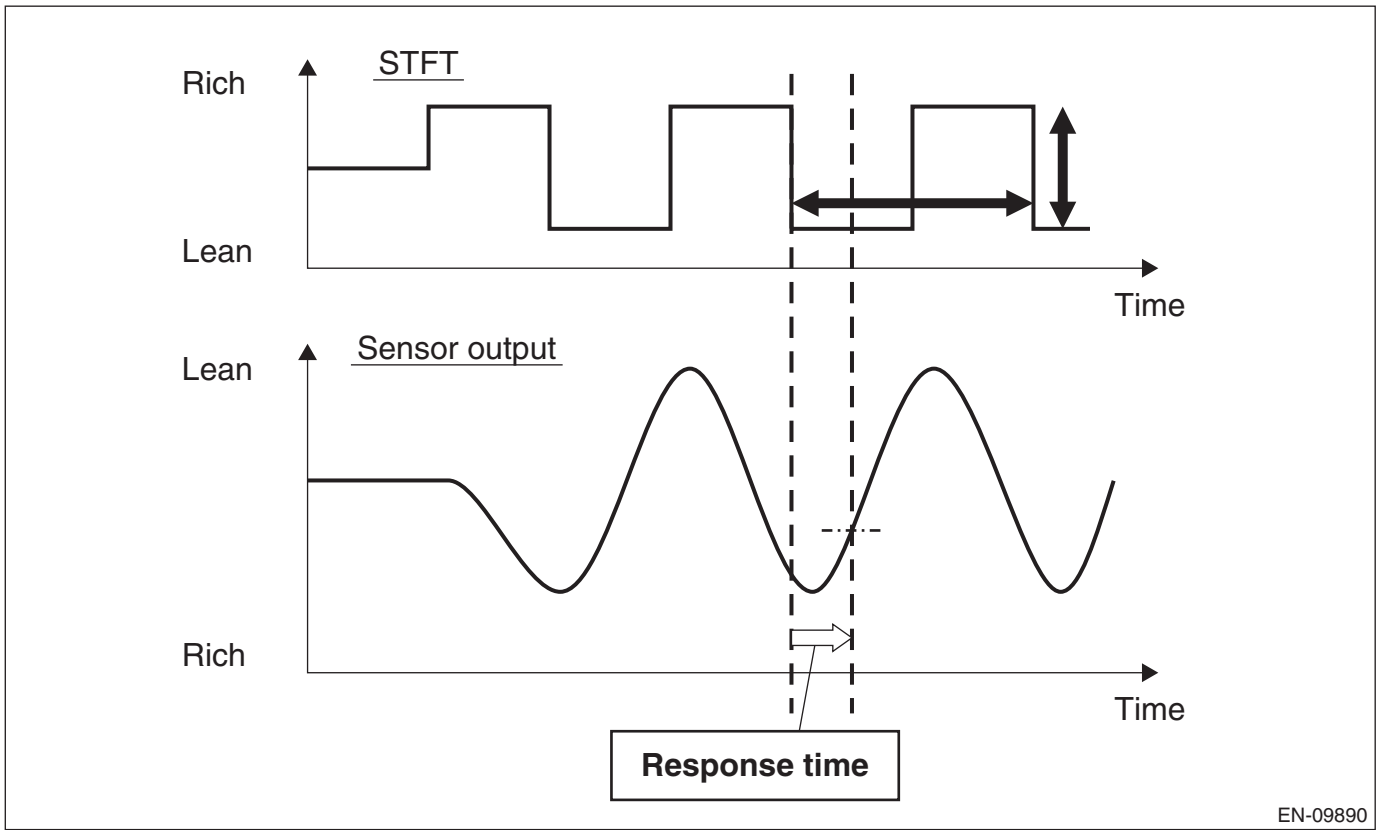
Judgment Value

Malfunction Criteria	Threshold Value	DTC
Average value for λ amplitude	> 0.25 (CVT model) > 0.25 (MT model)	P015A and P015B

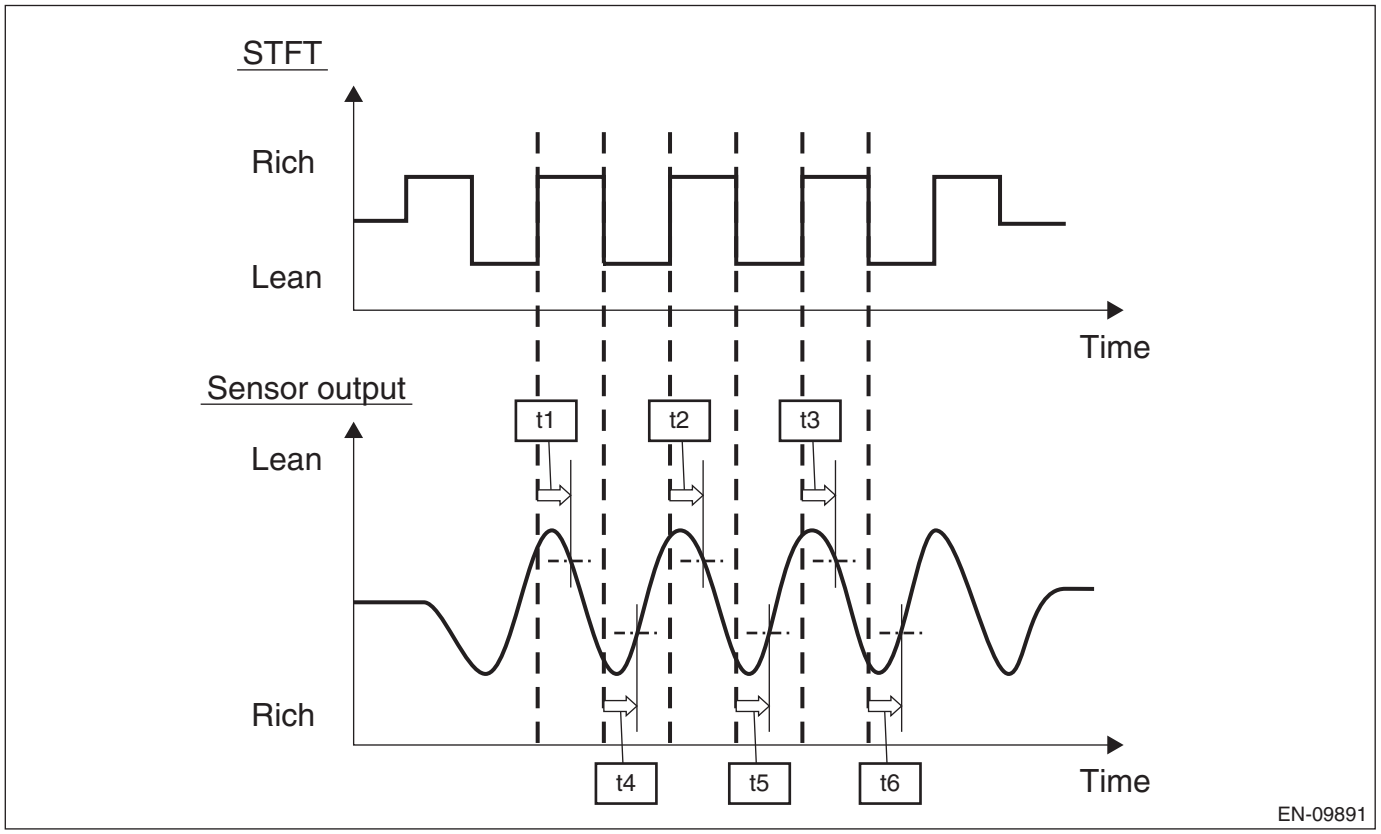
Time Needed for Diagnosis: 11250 time(s) × 8 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

7. DIAGNOSIS METHOD 3 (MT MODEL ONLY)

Change STFT (A/F compensation value) by interruption, and measure the reaction time of λ value. When A/F sensor malfunctions, the reaction time takes longer than at normal condition. In this case, judge as abnormal.



Measure reaction time (t1, t2, t3) and reaction time (t4, t5, t6). Use the average value of the reaction time to obtain the diagnostic value.



Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
(t1 + t2 + t3)/3 and (t4 + t5 + t6)/3	> 10000 ms > 10000 ms	P015A and P015B

Time Needed for Diagnosis: 1000 ms × [1 time(s)/2] + 1000 ms × 3 time(s) + 500 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

BJ:DTC P015B O2 SENSOR DELAYED RESPONSE - LEAN TO RICH (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P015A. <Ref. to GD(H4DO w/o HEV)-71, DTC P015A O2 SENSOR DELAYED RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

BK:DTC P0171 SYSTEM TOO LEAN (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect fuel system malfunction by the amount of main feedback control.

DIAGNOSTIC METHOD

Fuel system is diagnosed by comparing the target air fuel ratio calculated by ECM with the actual air fuel ratio measured by sensor.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
A/F main learning system	In operation
Engine coolant temperature	≥ –40 °C (–40 °F)
Engine load change	< 1 g/rev (0.04 oz/rev)
Engine load	≥ Value of Map 1

Engine speed (rpm)	Idling	670	1000	1500	2000	2500	3000	3500	4000	4500
Measured value (g (oz)/rev)	na	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling or at a constant speed after warming up the engine.

4. DIAGNOSTIC METHOD

Compare the diagnostic value (fsobd) with the threshold value, and if a condition meeting the malfunction criteria below continues for 10 s × 3 time(s) or more, judge that there is a fault in the fuel system.

Judgment Value

Malfunction Criteria	Threshold Value
fsobd = (sglmd – tglmda) + faf + flaf In this case: sglmd = measured lambda tglmda = target lambda faf = main feedback compensation coefficient (every 64 milliseconds) flaf = main feedback learning compensation coefficient	≥ Value from Map 2

Map 2

Amount of air (g (oz)/s)	0 (0)	3.2 (0.11)	6.4 (0.23)	9.6 (0.34)	12.8 (0.45)	16 (0.56)	19.2 (0.68)
fsobdL1 (%)	1.33	1.33	1.33	1.33	1.33	1.33	1.33

Time Needed for Diagnosis: 10 s × 3 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

BL:DTC P0172 SYSTEM TOO RICH (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect fuel system malfunction by the amount of main feedback control.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
A/F main learning system	In operation

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously during the closed loop.

4. DIAGNOSTIC METHOD

Compare the diagnostic value (fsobd) with the threshold value, and if a condition meeting the malfunction criteria below continues for 10 s × 3 time(s) or more, judge that there is a fault in the fuel system.

Judgment Value

Malfunction Criteria	Threshold Value
fsobd = (sglmd – tglmda) + faf + flaf In this case: sglmd = measured lambda tglmda = target lambda faf = main feedback compensation coefficient (every 64 milliseconds) flaf = main feedback learning compensation coefficient	< Value from Map

Map

Compensation coefficient of warm-up increase amount	0	0.1	0.2	0.3
Threshold Value	0.67	0.572	0.494	0.432

Compensation coefficient of warm-up increase amount	0.35	0.6
Threshold Value	0.401	0.401

Time Needed for Diagnosis: 10 s × 3 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

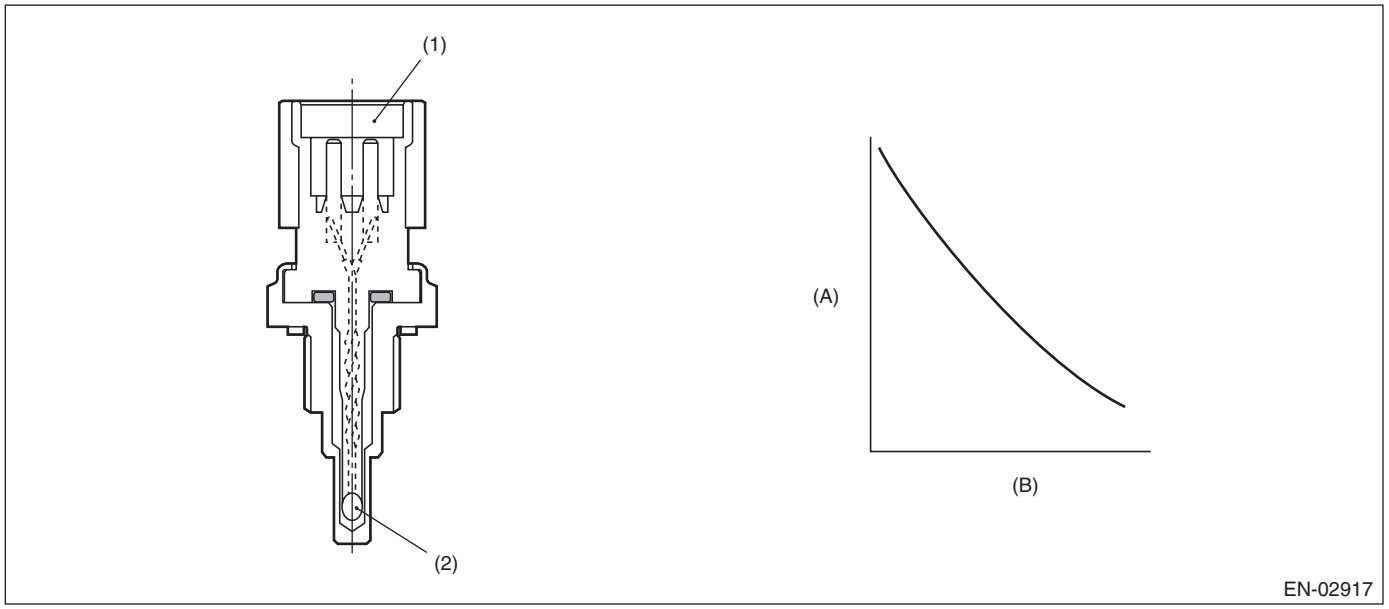
BM:DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the abnormality of the engine oil temperature sensor output characteristics. Perform the following two diagnosis, and judge as NG if either is NG.

- **Diagnosis 1 (relative diagnosis):** Perform diagnosis in reference to the engine oil temperature sensor value, engine coolant temperature sensor value and intake air temperature sensor value after engine start after predetermined time have passed in soak time. Judge as NG when the difference is more than the specific value in comparison respectively between engine oil and engine coolant temperature, engine oil and intake air temperature.
- **Diagnosis 2 (function diagnosis):** Judge as NG when the engine oil temperature does not rise to the specific value even if certain conditions are cleared at driving.

2. COMPONENT DESCRIPTION



(A) Resistance value (kΩ)
(B) Temperature °C (°F)
(1) Connector
(2) Thermistor element

3. ENABLE CONDITIONS

Diagnosis 1

Secondary Parameters	Enable Conditions
Soaking time	≥ 21600 s
Block heater judgment	Completed
Block heater activation	not activate

Diagnosis 2

Secondary Parameters	Enable Conditions
Engine oil temperature at engine starting	≤ 50 °C (122 °F)
Engine speed	> 500 rpm
Percentage of idling	≤ 0.5 × 100

4. GENERAL DRIVING CYCLE

- **Diagnosis 1:** Perform diagnosis only once after engine start after constant soak time.
- **Diagnosis 2:** Perform the diagnosis only once after starting the engine in cold condition.

5. DIAGNOSTIC METHOD

Judge as NG when diagnosis 1 or diagnosis 2 becomes NG.
If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Diagnosis 1

Judgment Value

Malfunction Criteria	Threshold Value
|Engine oil temperature at engine start – Engine coolant temperature at engine start|	> 10 °C (18°F)
|Engine oil temperature at engine start – Intake air temperature 30 s after engine start|	> Value of Map 1

Map 1

Ambient air temperature °C (°F)	-30 (-22)	30 (86)	45 (113)	60 (140)
|Engine oil temperature at engine start – Intake air temperature 30 s after engine start| °C (°F)	10 (18°F)	10 (18°F)	22 (39.6°F)	22 (39.6°F)

Time Needed for Diagnosis: Less than 1 second

Diagnosis 2

Judgment Value

Malfunction Criteria	Threshold Value
Engine oil temperature	< 50 °C (122 °F)
Elapsed time after starting the engine	≥ Value from Map 2

Map 2

		Intake air temperature at engine start °C (°F)							
		–30 (–22)	–20 (–4)	–10 (14)	0 (32)	10 (50)	20 (68)	30 (86)	40 (104)
Ratio of time at engine stop during elapsed time after engine start	0.0	3600000	3600000	3600000	3600000	3600000	3600000	3600000	3600000
	0.3	3600000	3600000	3600000	3600000	3600000	3600000	3600000	3600000
	0.6	3600000	3600000	3600000	3600000	3600000	3600000	3600000	3600000
	1.0	3600000	3600000	3600000	3600000	3600000	3600000	3600000	3600000
ms									

Time Needed for Diagnosis: Value of Map 2

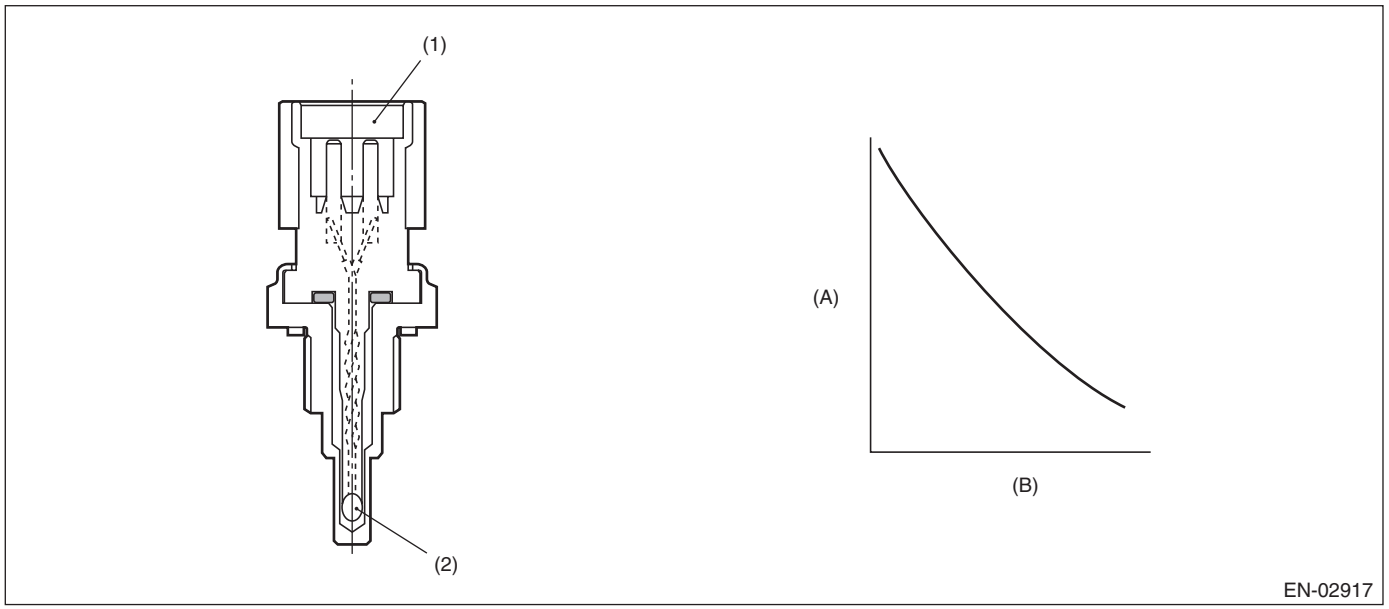
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

BN:DTC P0197 ENGINE OIL TEMPERATURE SENSOR LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the oil temperature sensor.
Judge as NG when outside of the judgment value.

2. COMPONENT DESCRIPTION



(A) Resistance value (kΩ)
(B) Temperature °C (°F)
(1) Connector
(2) Thermistor element

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.203 V

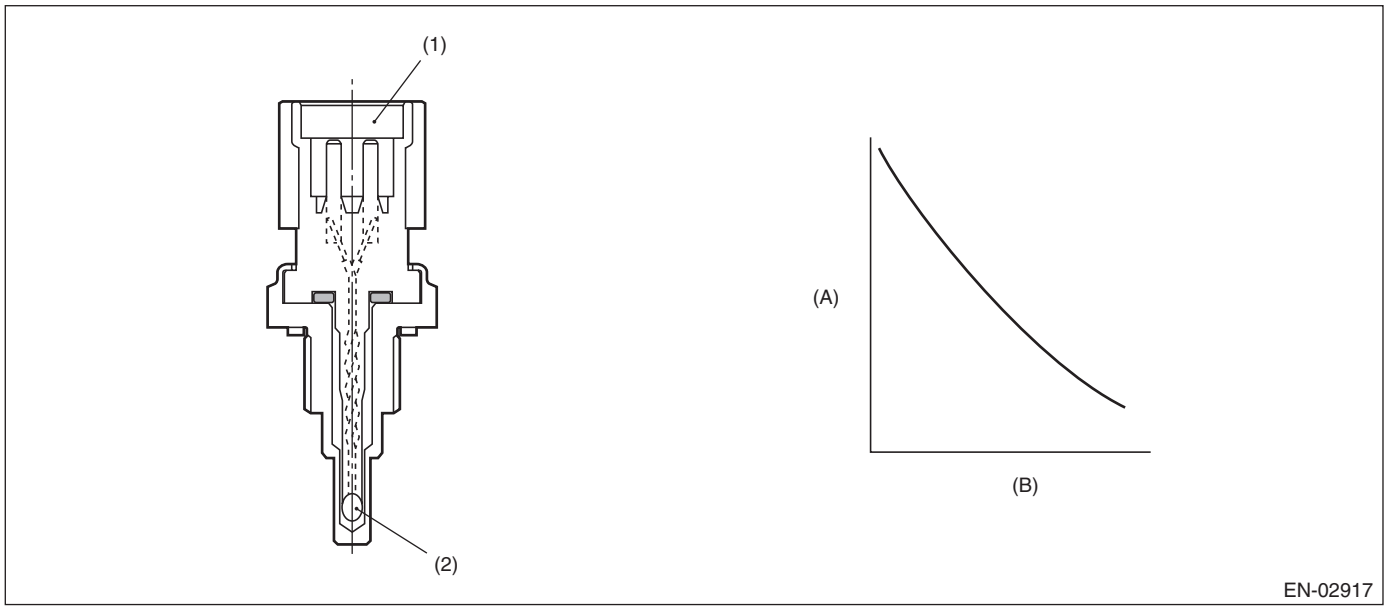
Time Needed for Diagnosis: 500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

BO:DTC P0198 ENGINE OIL TEMPERATURE SENSOR HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the oil temperature sensor.
Judge as NG when outside of the judgment value.

2. COMPONENT DESCRIPTION



(A) Resistance value (kΩ)
(B) Temperature °C (°F)
(1) Connector
(2) Thermistor element

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.698 V

Time Needed for Diagnosis: 500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

BP:DTC P0201 INJECTOR #1

1. OUTLINE OF DIAGNOSIS

Based on the self-diagnostic result of the injector driving IC, judge the injector driving circuit as normal or abnormal.
Injector driving IC detects the status of “fuel remains injected” or “fuel is not injected” as a malfunction.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	> 1 s
Engine speed	> 500 rpm
Injection status	Not during fuel cut

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Injector driving IC information	Malfunction

Time Needed for Diagnosis: 2560 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

BQ:DTC P0202 INJECTOR #2

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0201. <Ref. to GD(H4DO w/o HEV)-82, DTC P0201 INJECTOR #1, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BR:DTC P0203 INJECTOR #3

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0201. <Ref. to GD(H4DO w/o HEV)-82, DTC P0201 INJECTOR #1, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BS:DTC P0204 INJECTOR #4

1. OUTLINE OF DIAGNOSIS

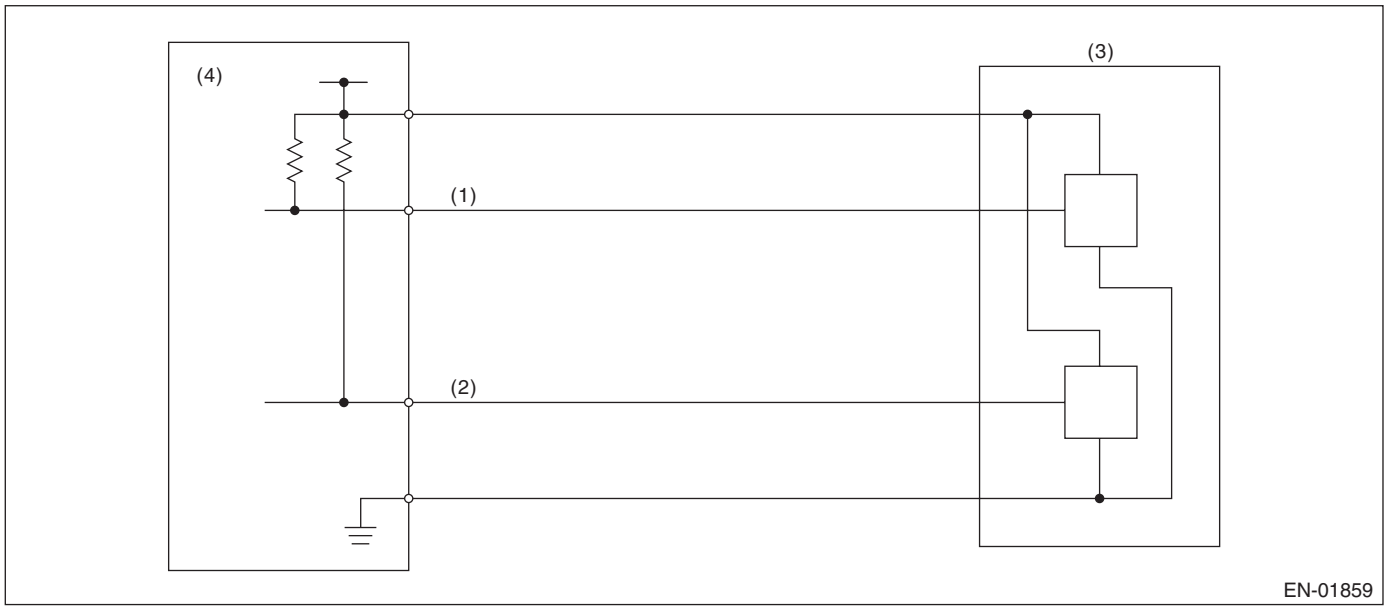
NOTE:
For the detection standard, refer to DTC P0201. <Ref. to GD(H4DO w/o HEV)-82, DTC P0201 INJECTOR #1, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BT:DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 2.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) Throttle position sensor 1 signal
(2) Throttle position sensor 2 signal
(3) Throttle position sensor
(4) Engine control module (ECM)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	≤ 1.133 V

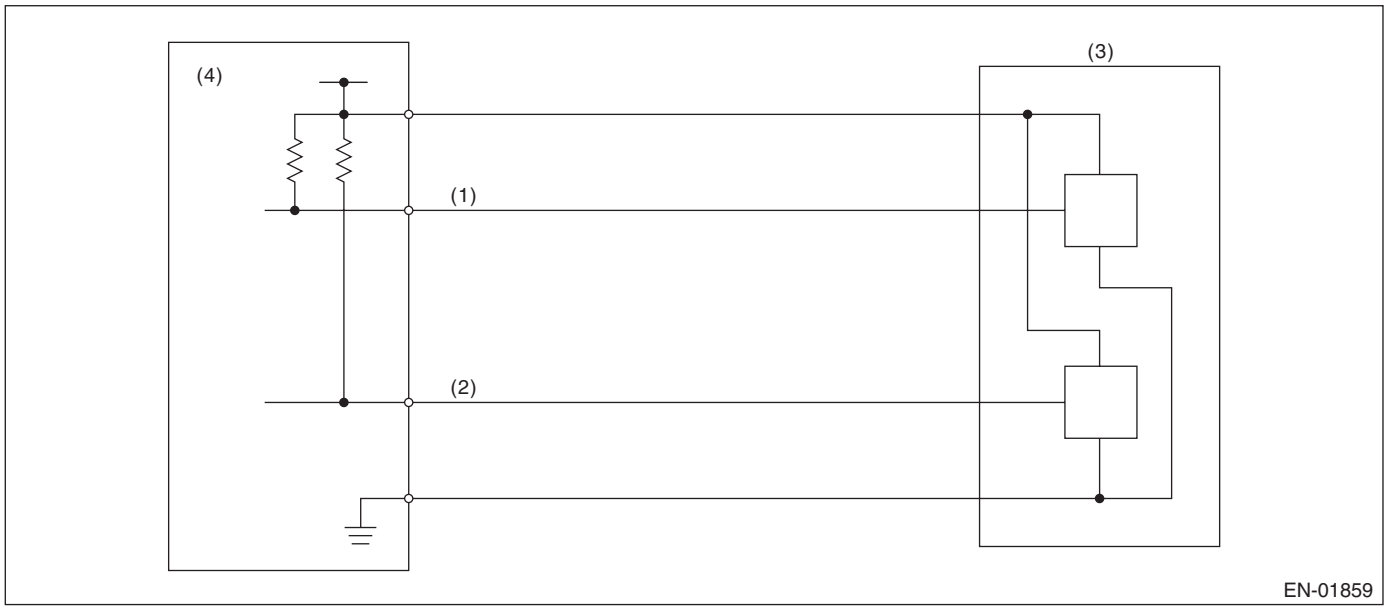
Time Needed for Diagnosis: 24 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

BU:DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 2.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) Throttle position sensor 1 signal
(2) Throttle position sensor 2 signal
(3) Throttle position sensor
(4) Engine control module (ECM)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	≥ 4.772 V

Time Needed for Diagnosis: 24 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

BV:DTC P0300 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0301. <Ref. to GD(H4DO w/o HEV)-85, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BW:DTC P0301 CYLINDER 1 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

Detect the presence of misfire occurrence. (Revolution fluctuation method)
Monitoring Misfire which influences exhaust deterioration (1.5 times of FTP) and catalyst damage is made obligatory by the law. Misfire affecting these two has two patterns below:

- Intermittent misfire (The same cylinder misfires in random, or different cylinders misfire in random.): FTP 1.5 times misfire
- Every time misfire (The same cylinder misfires every time.): FTP 1.5 times misfire, Catalyst damage misfire

The following detecting methods are adopted for these detection.
1) Intermittent misfire: FTP 1.5 times misfire

- 180° Interval Difference Method (MT: 1,800 rpm or less; CVT: None)
- 360° Interval Difference Method (whole range)
- 720° Interval Difference Method (3,000 rpm or more)

2) Misfire every time: FTP 1.5 times misfire, Catalyst damage misfire

- 360° Interval Difference Method

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
All secondary parameters enable conditions	≥ 10000 ms
Intake manifold pressure change at 180°CA	< Value of Map 1
Throttle position change during 16 milliseconds	< 255 °
Fuel shut-off function	Not in operation
Fuel level	≥ 8.25 ℓ (2.18 US gal, 1.82 Imp gal)
Vehicle dynamic control or AT torque control	Not in operation
Evaporative system leak check	Not in operation
Engine speed	450 rpm — 6450 rpm (CVT model) 500 rpm — 6700 rpm (MT model)
Intake manifold pressure	≥ Value from Map 2
Battery voltage	≥ 8 V
Fuel parameter determination	Not extremely low volatility
Engine speed change during 32 milliseconds	< 1000 rpm

Map 1

- CVT model

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6300
kPa (mmHg, inHg)	34 (255, 10)	34 (255, 10)	34 (255, 10)	34 (255, 10)	34 (255, 10)	34 (255, 10)	34 (255, 10)	34 (255, 10)	34 (255, 10)	34 (255, 10)	34 (255, 10)	34 (255, 10)	34 (255, 10)

- MT model

rpm	650	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6300
kPa (mmHg, inHg)	34 (255, 10)	34 (255, 10)	34 (255, 10)	34 (255, 10)	34 (255, 10)	34 (255, 10)	34 (255, 10)	34 (255, 10)	34 (255, 10)	34 (255, 10)	34 (255, 10)	34 (255, 10)	34 (255, 10)

Map 2 (CVT model)

- Normal ignition

		Barometric pressure (kPa (mmHg, inHg))						
		65.3 (490 , 19.3)	73.3 (550 , 21.7)	80 (600 , 23.6)	83.6 (627 , 24.7)	86.7 (650 , 25.6)	93.3 (700 , 27.6)	101.1 (758 , 29.8)
Engine speed (rpm)	650	19.8 (148.3 , 5.8)	23.7 (177.9 , 7)	25.4 (190.9 , 7.5)	26.5 (198.7 , 7.8)	26.6 (199.2 , 7.8)	26.7 (200.5 , 7.9)	26.9 (202.0 , 8)
	1000	19.3 (144.5 , 5.7)	21 (157.3 , 6.2)	22.9 (171.4 , 6.7)	24 (179.9 , 7.1)	24.1 (180.7 , 7.1)	24.4 (182.7 , 7.2)	24.7 (184.9 , 7.3)
	1200	18.8 (140.7 , 5.5)	20.5 (154.0 , 6.1)	22 (165.1 , 6.5)	22.9 (171.8 , 6.8)	23.5 (175.9 , 6.9)	24.8 (186.2 , 7.3)	26.3 (197.6 , 7.8)
	1600	18.6 (139.5 , 5.5)	19.6 (146.8 , 5.8)	21.2 (158.7 , 6.2)	22.1 (165.9 , 6.5)	22.4 (167.8 , 6.6)	23 (172.7 , 6.8)	23.7 (178.1 , 7)
	2000	18.6 (139.6 , 5.5)	20.7 (155.0 , 6.1)	21.7 (162.7 , 6.4)	22.3 (167.2 , 6.6)	22.7 (170.2 , 6.7)	23.7 (177.6 , 7)	24.8 (185.7 , 7.3)
	2400	18.8 (140.8 , 5.5)	20.6 (154.7 , 6.1)	22.1 (165.6 , 6.5)	22.9 (172.1 , 6.8)	23.4 (175.5 , 6.9)	24.5 (184.1 , 7.2)	25.8 (193.5 , 7.6)
	2800	19.8 (148.3 , 5.8)	22 (165.2 , 6.5)	23.1 (173.2 , 6.8)	23.7 (177.9 , 7)	24 (180.3 , 7.1)	24.8 (186.2 , 7.3)	25.7 (192.7 , 7.6)
	3000	20.4 (153.3 , 6)	22.8 (171.2 , 6.7)	24.2 (181.2 , 7.1)	25 (187.2 , 7.4)	25.3 (189.5 , 7.5)	26 (195.1 , 7.7)	26.8 (201.3 , 7.9)
	3200	21.9 (164.6 , 6.5)	24.3 (182.5 , 7.2)	25.7 (193.1 , 7.6)	26.6 (199.4 , 7.9)	26.9 (202.1 , 8)	27.8 (208.8 , 8.2)	28.8 (216.2 , 8.5)
	3600	23.4 (175.3 , 6.9)	26 (194.8 , 7.7)	27.1 (203.0 , 8)	27.7 (207.8 , 8.2)	28.1 (210.6 , 8.3)	29 (217.6 , 8.6)	30 (225.4 , 8.9)
	4000	25.3 (189.5 , 7.5)	27.3 (204.9 , 8.1)	28.3 (212.4 , 8.4)	28.9 (217.0 , 8.5)	29.2 (219.2 , 8.6)	30 (224.7 , 8.8)	30.8 (230.7 , 9.1)
	4400	26.8 (201.1 , 7.9)	28.9 (216.5 , 8.5)	29.9 (224.0 , 8.8)	30.5 (228.6 , 9)	30.8 (230.8 , 9.1)	31.5 (236.3 , 9.3)	32.3 (242.3 , 9.5)
	4800	28.4 (212.7 , 8.4)	30.4 (228.1 , 9)	31.4 (235.6 , 9.3)	32 (240.2 , 9.5)	32.3 (242.4 , 9.5)	33 (247.8 , 9.8)	33.8 (253.9 , 10)
	5200	29.9 (224.3 , 8.8)	32 (239.7 , 9.4)	33 (247.2 , 9.7)	33.6 (251.8 , 9.9)	33.9 (253.9 , 10)	34.6 (259.4 , 10.2)	35.4 (265.5 , 10.5)
	5600	31.4 (235.9 , 9.3)	33.5 (251.3 , 9.9)	34.5 (258.8 , 10.2)	35.1 (263.3 , 10.4)	35.4 (265.5 , 10.5)	36.1 (271.0 , 10.7)	36.9 (277.1 , 10.9)
	6000	33 (247.5 , 9.7)	35 (262.9 , 10.3)	36.1 (270.4 , 10.6)	36.7 (274.9 , 10.8)	36.9 (277.1 , 10.9)	37.7 (282.6 , 11.1)	38.5 (288.7 , 11.4)
kPa (mmHg, inHg)								

- Idling ignition

		Barometric pressure (kPa (mmHg, inHg))						
		65.3 (490 , 19.3)	73.3 (550 , 21.7)	80 (600 , 23.6)	83.6 (627 , 24.7)	86.7 (650 , 25.6)	93.3 (700 , 27.6)	101.1 (758 , 29.8)
Engine speed (rpm)	650	19.8 (148.3 , 5.8)	23.7 (177.9 , 7)	25.4 (190.9 , 7.5)	26.5 (198.7 , 7.8)	26.6 (199.2 , 7.8)	26.7 (200.5 , 7.9)	26.9 (202.0 , 8)
	1000	19.3 (144.5 , 5.7)	21 (157.3 , 6.2)	22.9 (171.4 , 6.7)	24 (179.9 , 7.1)	24.2 (181.6 , 7.1)	24.8 (185.8 , 7.3)	25.4 (190.4 , 7.5)
	1200	18.8 (141.0 , 5.6)	20.6 (154.9 , 6.1)	23 (172.7 , 6.8)	24.5 (183.4 , 7.2)	25 (187.4 , 7.4)	26.3 (197.3 , 7.8)	27.8 (208.3 , 8.2)
	1600	18.6 (139.5 , 5.5)	20.1 (150.8 , 5.9)	21.4 (160.2 , 6.3)	22.1 (165.9 , 6.5)	22.5 (168.6 , 6.6)	23.4 (175.6 , 6.9)	24.4 (183.3 , 7.2)
	2000	18.8 (140.7 , 5.5)	20.7 (155.2 , 6.1)	21.7 (162.7 , 6.4)	22.3 (167.2 , 6.6)	22.8 (170.7 , 6.7)	23.9 (179.4 , 7.1)	25.2 (188.9 , 7.4)
	2400	18.8 (140.8 , 5.5)	20.6 (154.7 , 6.1)	22.1 (165.6 , 6.5)	22.9 (172.1 , 6.8)	23.4 (175.7 , 6.9)	24.6 (184.8 , 7.3)	26 (194.7 , 7.7)
	2800	20 (150.1 , 5.9)	22 (165.2 , 6.5)	23.1 (173.2 , 6.8)	23.7 (177.9 , 7)	24 (180.3 , 7.1)	24.8 (186.2 , 7.3)	25.7 (192.7 , 7.6)
	3000	22.6 (169.5 , 6.7)	24 (180.0 , 7.1)	24.8 (186.1 , 7.3)	25.3 (189.7 , 7.5)	25.7 (192.8 , 7.6)	26.7 (200.6 , 7.9)	27.9 (209.2 , 8.2)
	3200	23.7 (178.1 , 7)	25.3 (189.7 , 7.5)	26.2 (196.1 , 7.7)	26.7 (200.0 , 7.9)	27.1 (203.5 , 8)	28.3 (212.3 , 8.4)	29.6 (221.9 , 8.7)
	3600	24.7 (185.5 , 7.3)	26.3 (197.3 , 7.8)	27.6 (207.3 , 8.2)	28.4 (213.3 , 8.4)	28.7 (215.6 , 8.5)	29.5 (221.4 , 8.7)	30.4 (227.8 , 9)
	4000	25.6 (192.1 , 7.6)	27.3 (205.1 , 8.1)	28.8 (215.8 , 8.5)	29.6 (222.3 , 8.8)	29.9 (224.2 , 8.8)	30.5 (228.8 , 9)	31.2 (233.9 , 9.2)
	4400	27.2 (203.7 , 8)	28.9 (216.7 , 8.5)	30.3 (227.4 , 9)	31.2 (233.9 , 9.2)	31.4 (235.8 , 9.3)	32.1 (240.4 , 9.5)	32.7 (245.5 , 9.7)
	4800	28.7 (215.3 , 8.5)	30.4 (228.3 , 9)	31.9 (239.0 , 9.4)	32.7 (245.5 , 9.7)	33 (247.4 , 9.7)	33.6 (252.0 , 9.9)	34.3 (257.1 , 10.1)
	5200	30.2 (226.9 , 8.9)	32 (239.8 , 9.4)	33.4 (250.6 , 9.9)	34.3 (257.1 , 10.1)	34.5 (258.9 , 10.2)	35.1 (263.6 , 10.4)	35.8 (268.7 , 10.6)
	5600	31.8 (238.5 , 9.4)	33.5 (251.4 , 9.9)	35 (262.2 , 10.3)	35.8 (268.7 , 10.6)	36.1 (270.5 , 10.7)	36.7 (275.2 , 10.8)	37.4 (280.3 , 11)
	6000	33.3 (250.1 , 9.8)	35.1 (263.0 , 10.4)	36.5 (273.8 , 10.8)	37.4 (280.3 , 11)	37.6 (282.1 , 11.1)	38.2 (286.8 , 11.3)	38.9 (291.9 , 11.5)
kPa (mmHg, inHg)								

Map 2 (MT model)

- Normal ignition

		Barometric pressure (kPa (mmHg, inHg))						
		65.3 (490 , 19.3)	73.3 (550 , 21.7)	80 (600 , 23.6)	84 (630 , 24.8)	86.7 (650 , 25.6)	93.3 (700 , 27.6)	100.5 (754, 29.7)
Engine speed (rpm)	650	19.4 (145.7 , 5.7)	20.3 (152.6 , 6)	21.5 (161.1 , 6.3)	22.2 (166.2 , 6.5)	22.5 (168.9 , 6.7)	23.5 (175.9 , 6.9)	24.3 (182.25 , 7.2)
	1000	17.2 (128.9 , 5.1)	17.8 (133.4 , 5.3)	18.5 (138.4 , 5.4)	18.9 (141.4 , 5.6)	19.2 (144.2 , 5.7)	20.1 (150.9 , 5.9)	21.1 (158.38 , 6.2)
	1200	16.1 (120.8 , 4.8)	17 (127.4 , 5)	18.2 (136.6 , 5.4)	18.9 (142.1 , 5.6)	19.2 (144.2 , 5.7)	19.9 (149.4 , 5.9)	20.7 (155.18 , 6.1)
	1600	15.9 (119.6 , 4.7)	17.3 (129.7 , 5.1)	18.5 (138.7 , 5.5)	19.2 (144.0 , 5.7)	19.5 (146.2 , 5.8)	20.2 (151.5 , 6)	21 (157.31 , 6.2)
	2000	16.4 (123.0 , 4.8)	17.8 (133.7 , 5.3)	18.7 (140.3 , 5.5)	19.2 (144.3 , 5.7)	19.6 (147.1 , 5.8)	20.5 (153.9 , 6.1)	21.5 (161.43 , 6.4)
	2400	16.5 (123.7 , 4.9)	17.9 (134.0 , 5.3)	18.7 (140.5 , 5.5)	19.3 (144.5 , 5.7)	19.7 (147.8 , 5.8)	20.8 (156.0 , 6.1)	22 (165.09 , 6.5)
	2800	16.3 (122.5 , 4.8)	18 (134.9 , 5.3)	18.9 (141.9 , 5.6)	19.5 (146.2 , 5.8)	20 (149.9 , 5.9)	21.2 (159.3 , 6.3)	22.6 (169.67 , 6.7)
	3000	17.6 (131.8 , 5.2)	19.5 (146.5 , 5.8)	20.7 (155.4 , 6.1)	21.4 (160.8 , 6.3)	21.8 (163.3 , 6.4)	22.6 (169.5 , 6.7)	23.5 (176.39 , 6.9)
	3200	18.5 (138.6 , 5.5)	20.6 (154.2 , 6.1)	21.8 (163.2 , 6.4)	22.5 (168.7 , 6.6)	22.8 (171.0 , 6.7)	23.6 (176.9 , 7)	24.4 (183.32 , 7.2)
	3600	19.8 (148.7 , 5.9)	21.6 (162.1 , 6.4)	22.3 (167.6 , 6.6)	22.8 (170.9 , 6.7)	23.2 (174.0 , 6.8)	24.2 (181.5 , 7.1)	25.3 (189.86 , 7.5)
	4000	20 (149.9 , 5.9)	21.6 (161.9 , 6.4)	22.5 (169.0 , 6.7)	23.1 (173.2 , 6.8)	23.6 (177.1 , 7)	24.9 (186.8 , 7.4)	26.3 (197.46 , 7.8)
	4400	21.1 (158.5 , 6.2)	21.9 (164.5 , 6.5)	23.6 (176.7 , 7)	24.5 (184.1 , 7.2)	24.9 (186.9 , 7.4)	25.8 (193.8 , 7.6)	26.9 (201.41 , 7.9)
	4800	23 (172.8 , 6.8)	24.3 (182.2 , 7.2)	25.4 (190.2 , 7.5)	26 (195.0 , 7.7)	26.5 (198.7 , 7.8)	27.7 (207.9 , 8.2)	29.1 (218.02 , 8.6)
	5200	26.1 (195.7 , 7.7)	27.5 (206.2 , 8.1)	28.2 (211.6 , 8.3)	28.6 (214.8 , 8.5)	29.1 (218.4 , 8.6)	30.3 (227.5 , 9)	31.7 (237.52 , 9.4)
	5600	27.7 (207.4 , 8.2)	29.2 (219.3 , 8.6)	30.5 (228.9 , 9)	31.3 (234.6 , 9.2)	31.6 (237.2 , 9.3)	32.5 (243.8 , 9.6)	33.5 (251.08 , 9.9)
	6000	31.9 (239.3 , 9.4)	33.7 (252.4 , 9.9)	34.3 (257.2 , 10.1)	34.7 (260.1 , 10.2)	35.3 (264.4 , 10.4)	36.7 (275.3 , 10.8)	38.3 (287.22 , 11.3)
kPa (mmHg, inHg)								

• Idling ignition

		Barometric pressure (kPa (mmHg, inHg))						
		65.3 (490 , 19.3)	73.3 (550 , 21.7)	80 (600 , 23.6)	84 (630 , 24.8)	86.7 (650 , 25.6)	93.3 (700 , 27.6)	100.5 (754, 29.7)
Engine speed (rpm)	650	19.4 (145.7 , 5.7)	20.3 (152.6 , 6)	21.6 (162.2 , 6.4)	22.4 (168.0 , 6.6)	22.7 (170.3 , 6.7)	23.5 (176.0 , 6.9)	24.3 (182.25 , 7.2)
	1000	17.7 (133.1 , 5.2)	19.2 (144.2 , 5.7)	20.6 (154.7 , 6.1)	21.5 (161.0 , 6.3)	21.9 (163.9 , 6.5)	22.8 (171.2 , 6.7)	23.9 (179.20 , 7.1)
	1200	17.5 (131.2 , 5.2)	19 (142.8 , 5.6)	20.8 (156.4 , 6.2)	21.9 (164.5 , 6.5)	22.2 (166.3 , 6.5)	22.2 (166.3 , 6.5)	27.8 (208.80 , 8.2)
	1600	18.2 (136.7 , 5.4)	18.8 (141.1 , 5.6)	20.5 (153.6 , 6)	21.5 (161.1 , 6.3)	22.3 (167.3 , 6.6)	24.4 (182.7 , 7.2)	26.6 (199.65 , 7.9)
	2000	17.6 (132.1 , 5.2)	19 (142.2 , 5.6)	20 (150.2 , 5.9)	20.7 (155.0 , 6.1)	21.4 (160.7 , 6.3)	23.3 (175.1 , 6.9)	25.4 (190.80 , 7.5)
	2400	17.1 (128.5 , 5.1)	19 (142.8 , 5.6)	20 (150.2 , 5.9)	20.6 (154.6 , 6.1)	21.5 (161.3 , 6.3)	23.7 (178.0 , 7)	26.2 (196.37 , 7.7)
	2800	18.6 (139.6 , 5.5)	18.6 (139.6 , 5.5)	20.4 (153.2 , 6)	21.5 (161.4 , 6.4)	22.2 (166.9 , 6.6)	24.1 (180.5 , 7.1)	26.1 (195.46 , 7.7)
	3000	24.8 (185.8 , 7.3)	26.2 (196.8 , 7.7)	27.2 (204.3 , 8)	27.8 (208.7 , 8.2)	28.7 (215.5 , 8.5)	31 (232.4 , 9.1)	33.5 (251.00 , 9.9)
	3200	27 (202.2 , 8)	28.4 (212.8 , 8.4)	29.6 (221.8 , 8.7)	30.3 (227.3 , 8.9)	31.2 (234.2 , 9.2)	33.6 (251.7 , 9.9)	36.1 (270.90 , 10.7)
	3600	28.4 (212.7 , 8.4)	29.9 (224.2 , 8.8)	30.7 (230.3 , 9.1)	31.2 (234.0 , 9.2)	32.1 (240.4 , 9.5)	34.2 (256.6 , 10.1)	36.6 (274.39 , 10.8)
	4000	27.3 (205.1 , 8.1)	29.7 (222.5 , 8.8)	31.2 (233.8 , 9.2)	32.1 (240.6 , 9.5)	32.8 (245.7 , 9.7)	34.4 (258.2 , 10.2)	36.3 (272.08 , 10.7)
	4400	25.7 (192.4 , 7.6)	26.5 (199.0 , 7.8)	29 (217.6 , 8.6)	30.5 (228.8 , 9)	30.8 (230.9 , 9.1)	31.5 (236.1 , 9.3)	32.2 (241.84 , 9.5)
	4800	26.1 (195.9 , 7.7)	27.1 (203.1 , 8)	28.2 (211.7 , 8.3)	28.9 (216.9 , 8.5)	29.5 (221.0 , 8.7)	30.8 (231.3 , 9.1)	32.3 (242.58 , 9.6)
	5200	27.2 (203.6 , 8)	28.6 (214.6 , 8.5)	29.8 (223.6 , 8.8)	30.5 (229.0 , 9)	30.9 (232.0 , 9.1)	31.9 (239.5 , 9.4)	33 (247.75 , 9.8)
	5600	28.4 (213.1 , 8.4)	30.1 (225.6 , 8.9)	31.4 (235.2 , 9.3)	32.1 (241.0 , 9.5)	32.5 (244.1 , 9.6)	33.6 (251.8 , 9.9)	34.7 (260.24 , 10.2)
	6000	32.6 (244.2 , 9.6)	34 (255.3 , 10.1)	34.7 (260.1 , 10.2)	35.1 (263.0 , 10.4)	35.7 (267.7 , 10.5)	37.3 (279.5 , 11)	39 (292.41 , 11.5)
kPa (mmHg, inHg)								

3. GENERAL DRIVING CYCLE

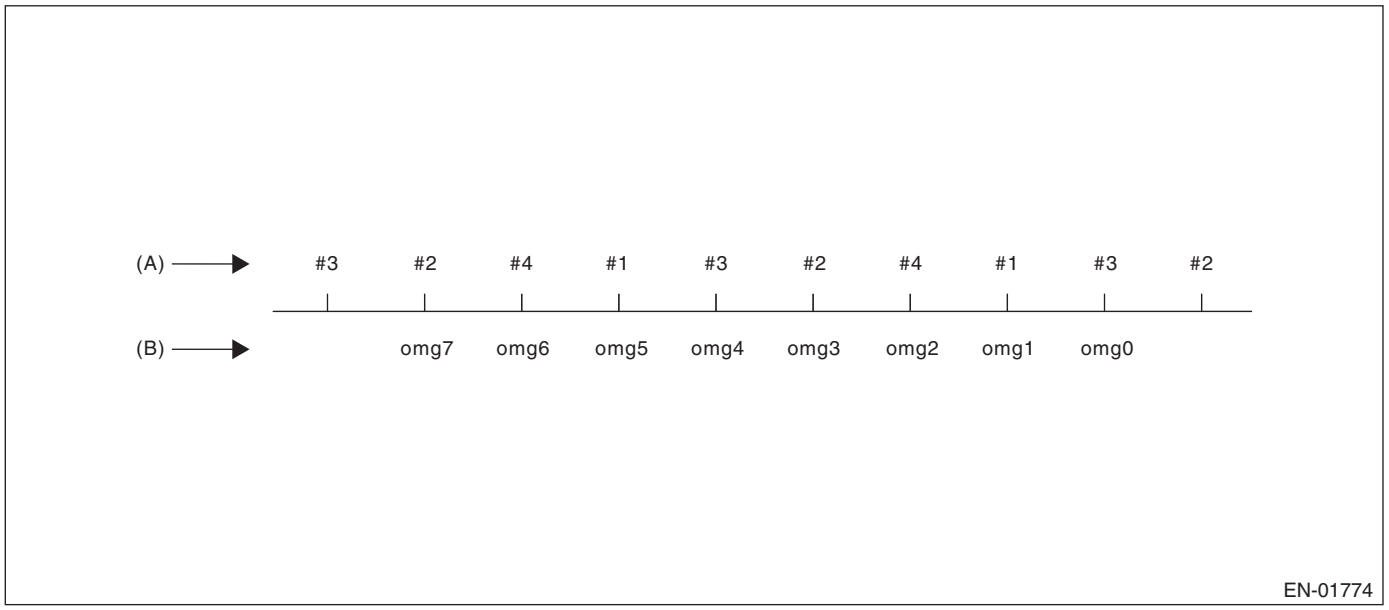
• If conditions are met, it is possible to detect the misfires from idling to high engine speed. However, to avoid excessive load or harm to the engine, perform diagnosis at idle.
• Perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

When a misfire occurs, the engine speed will decrease and the crankshaft position speed will change. Calculate the interval difference value (diagnostic value) from crankshaft position speed by the following formula, and judge whether a misfire is occurring or not comparing the calculated result with judgment value. Count the number of misfires, if the misfire ratio is higher during 1000 revs. or 200 revs., judge corresponding cylinders as NG.

Diagnostic value calculation (Calculate from angle speed) →	Misfire detection every single ignition (Compare diagnostic value with judgment value) →	NG judgment (Misfire occurrence judgment required by the law) (Compare number of misfire with judgment value)
	• 180° Interval Difference Method • 360° Interval Difference Method • 720° Interval Difference Method	• FTP 1.5 times misfire NG judgment • Catalyst damage misfire NG judgment

As shown in the following figure, pick a cylinder as the standard and name it omg 0. And the former crankshaft position speed is named omg 1, the second former crankshaft position speed is named omg 2, the third is named omg 3, etc.

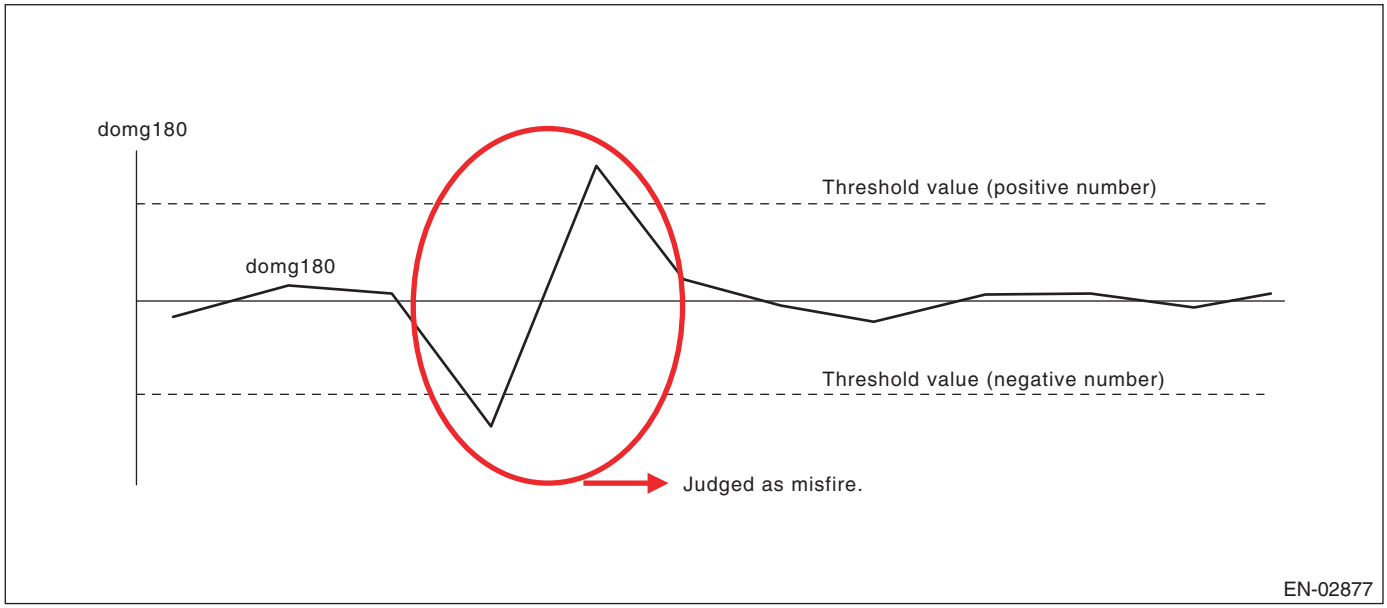


(A) Ignition order

(B) Crankshaft position speed

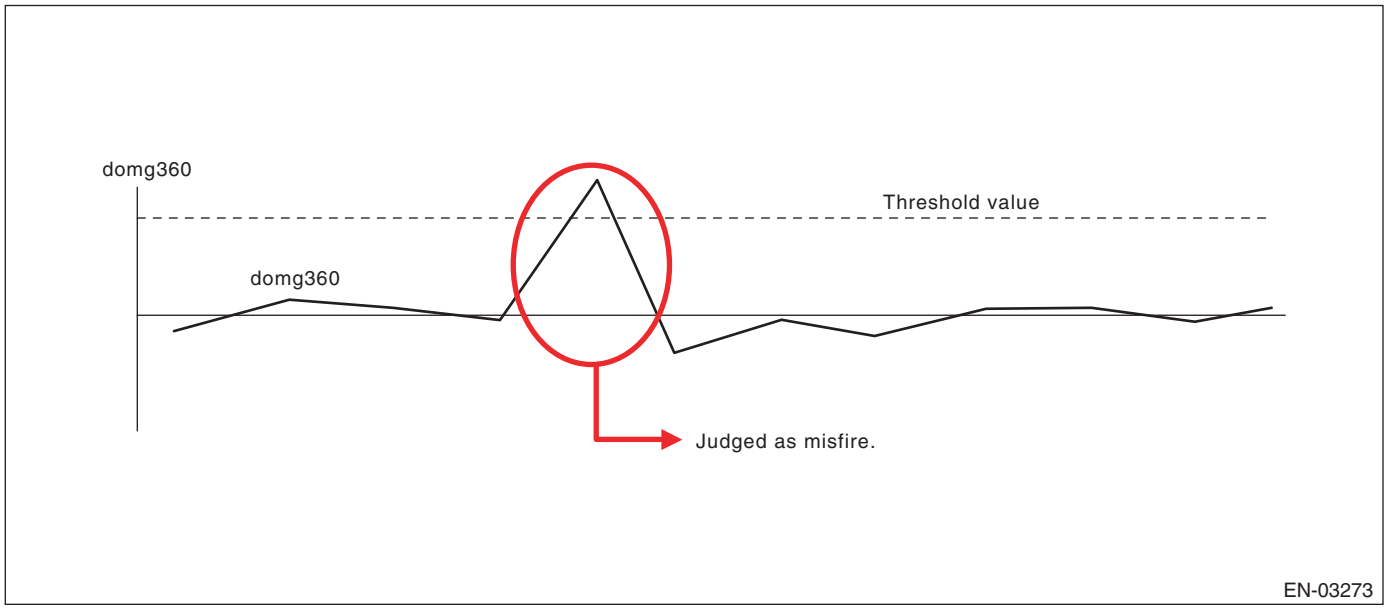
180° Interval Difference Method

Diagnostic value	domg 180 = (omg 1 – omg 0) – (omg 5 – omg 1)/4
Judge as a misfire in the following cases. • domg 180 > judgment value of positive side • domg 180 ≤ judgment value of negative side (Diagnostic value before 180° CA)	



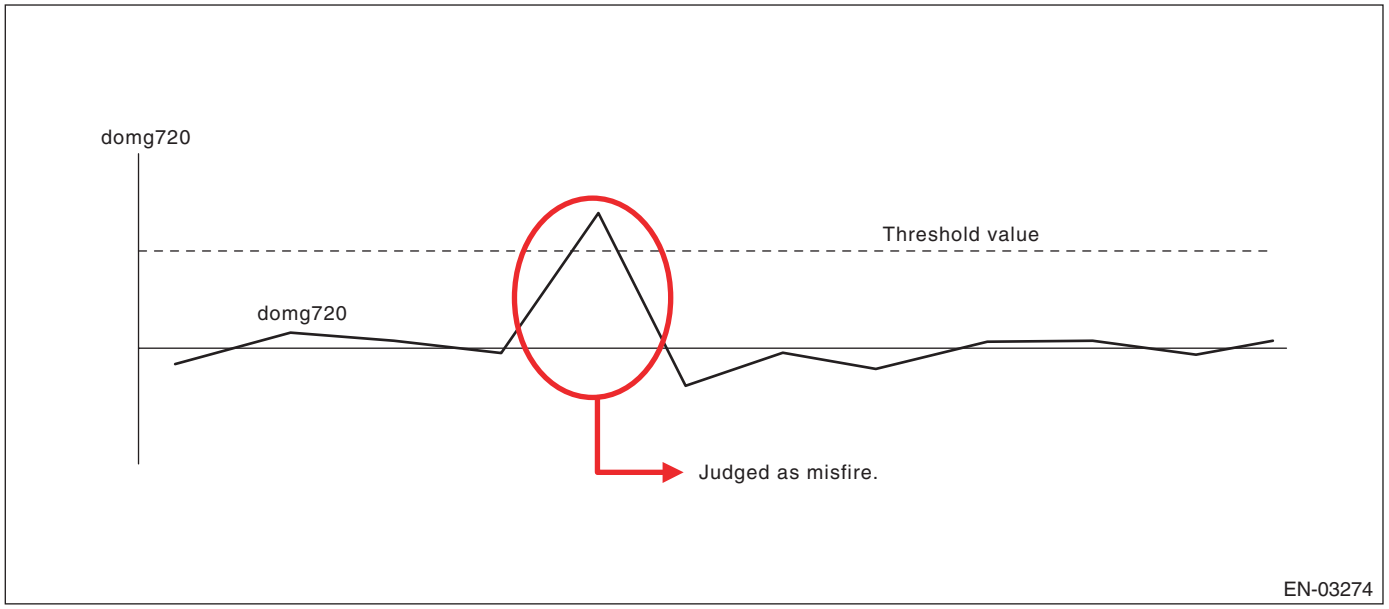
360° Interval Difference Method

Diagnostic value	domg 360 = (omg 1 – omg 0) – (omg 3 – omg 2)
Misfire judgment	domg 360 > Judgment value → Judge as misfire



720° Interval Difference Method

Diagnostic value	domg 720 = (omg 1 – omg 0) – (omg 5 – omg 4)
Misfire judgment	domg 720 > Judgment value → Judge as misfire



- **FTP 1.5 times misfire (Misfire occurrence level which influences exhaust gas)**

Judgment Value (Judge that malfunction occurs when the misfire ratio is high in 1000 engine revs.)

Malfunction Criteria	Threshold Value
FTP emission diagnostic value	≥ 255 × 100/2000% in 1000 revs. (except for XV model) ≥ 255 × 100/2000% in 1000 revs. (XV model)

Time Needed for Diagnosis: 1000 engine revs.
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Catalyst damage misfire (Misfire occurrence level damaging catalyst)**

Judgment Value

Malfunction Criteria	Threshold Value
Catalyst damage misfire diagnostic value	≥ Value from Map 3

Map 3

		Intake air (g(oz)/rev)									
		0.2 (0.01)	0.3 (0.01)	0.4 (0.01)	0.5 (0.02)	0.6 (0.02)	0.7 (0.02)	0.8 (0.03)	0.9 (0.03)	1 (0.04)	1.1 (0.04)
Engine speed (rpm)	700	100	100	100	100	80	80	80	80	80	80
	1000	100	100	100	100	80	80	57	44	80	80
	1200	100	100	100	100	100	80	67	57	57	57
	1600	100	100	80	80	80	57	44	36	44	44
	2000	100	80	80	80	80	57	44	27	44	44
	2400	100	80	80	80	80	57	31	36	36	36
	2800	80	80	80	80	57	44	44	36	36	36
	3200	80	80	57	57	44	36	36	36	36	36
	3600	57	57	57	44	44	44	44	44	44	44
	4000	57	57	57	36	36	36	44	44	44	44
	4400	44	44	44	44	44	44	44	44	44	44
	4800	44	44	44	36	36	36	36	36	36	36
	5200	36	36	36	36	36	36	36	44	44	44
	5600	27	27	27	31	36	36	36	44	44	44
	6000	44	44	44	44	44	44	44	44	36	36
	6400	24	24	24	21	21	21	25	31	31	31

Time Needed for Diagnosis: 200 engine revs.
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

BX:DTC P0302 CYLINDER 2 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0301. <Ref. to GD(H4DO w/o HEV)-85, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BY:DTC P0303 CYLINDER 3 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0301. <Ref. to GD(H4DO w/o HEV)-85, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BZ:DTC P0304 CYLINDER 4 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

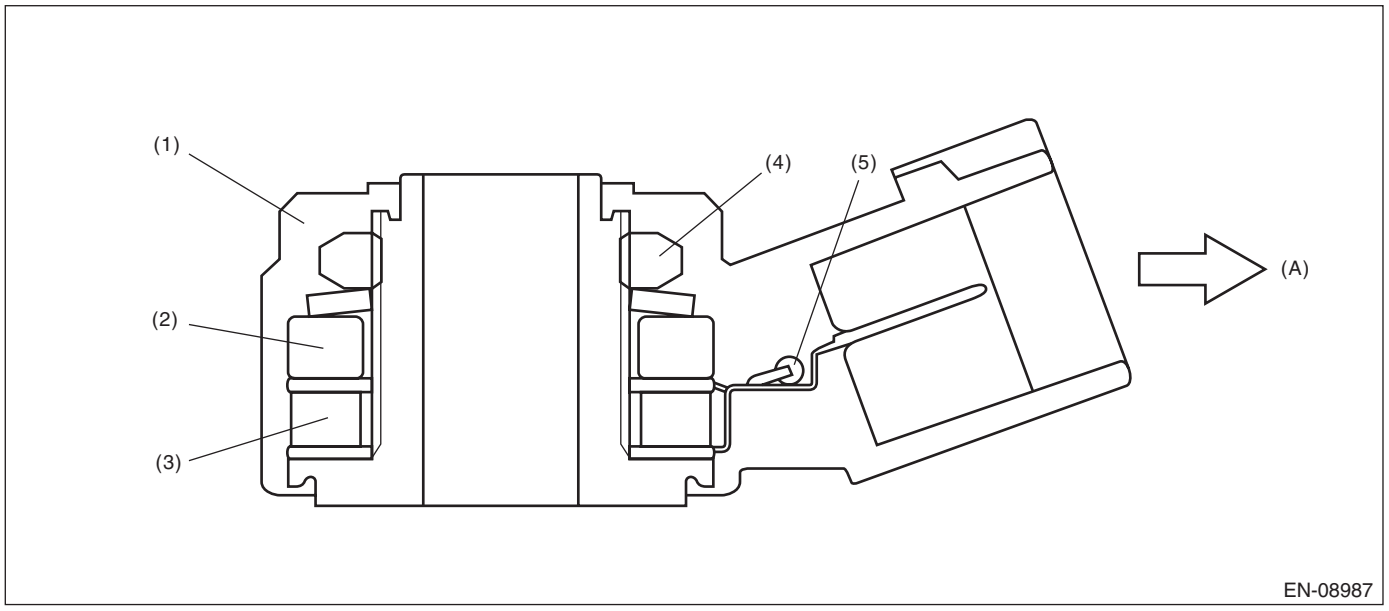
NOTE:
For the detection standard, refer to DTC P0301. <Ref. to GD(H4DO w/o HEV)-85, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CA:DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of knock sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) To knock sensor harness

(1) Case
(2) Weight
(3) Piezoelectric element
(4) Nut
(5) Resistance

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.154 V

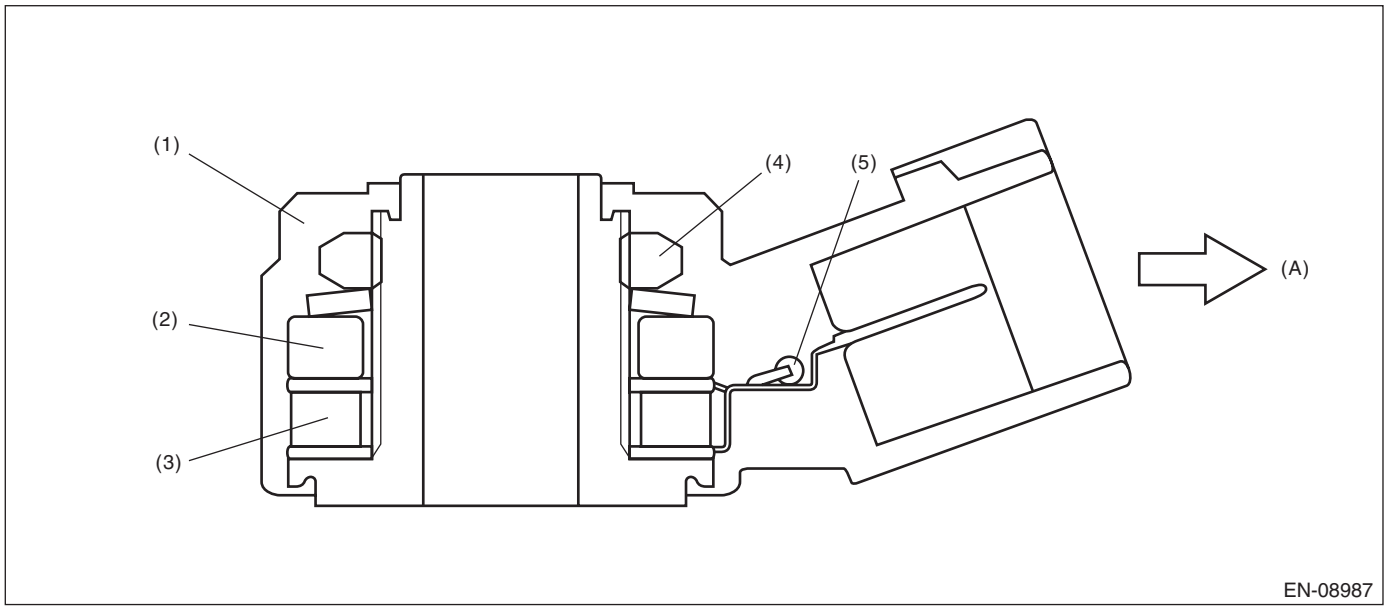
Time Needed for Diagnosis: 1000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

CB:DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of knock sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) To knock sensor harness

(1) Case
(2) Weight
(3) Piezoelectric element
(4) Nut
(5) Resistance

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.838 V

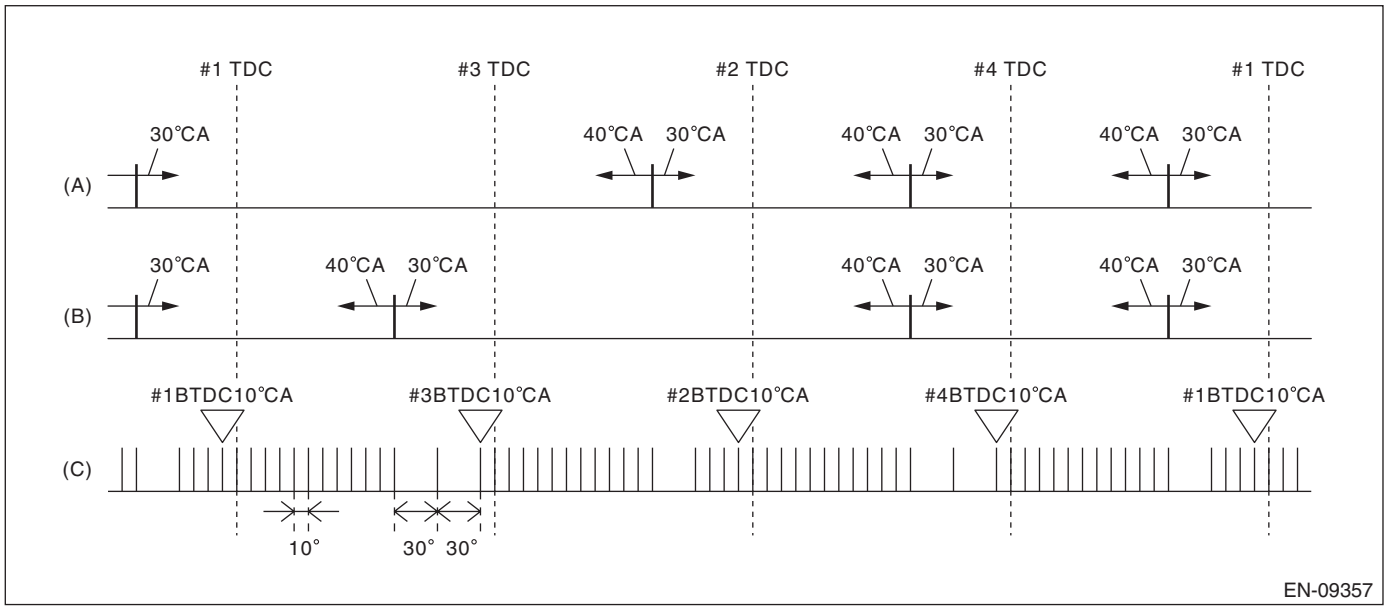
Time Needed for Diagnosis: 1000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

CC:DTC P0335 CRANKSHAFT POSITION SENSOR “A” CIRCUIT

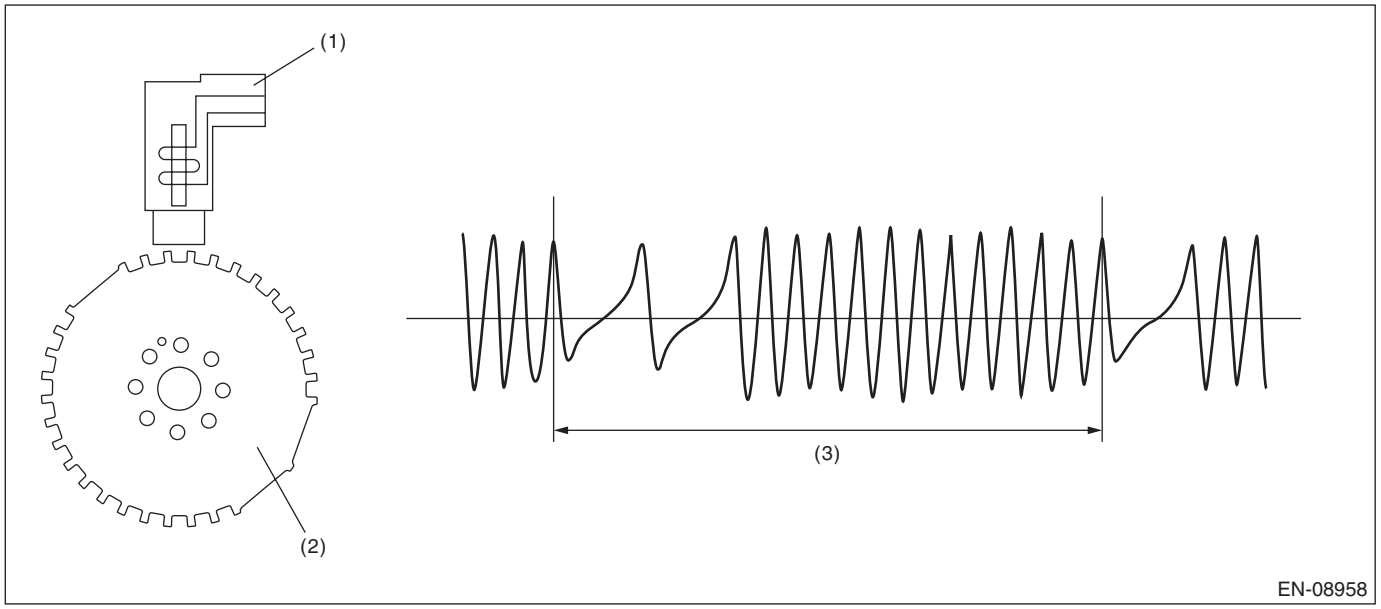
1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the crankshaft position sensor.
Judge as NG when the crank signal is not input even though the starter was rotated.

2. COMPONENT DESCRIPTION



(A) Camshaft signal (RH) (B) Camshaft signal (LH) (C) Crankshaft signal



(1) Crankshaft position sensor (2) Crankshaft position sensor plate (3) Crankshaft half-turn

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Crankshaft position sensor signal	Not detected

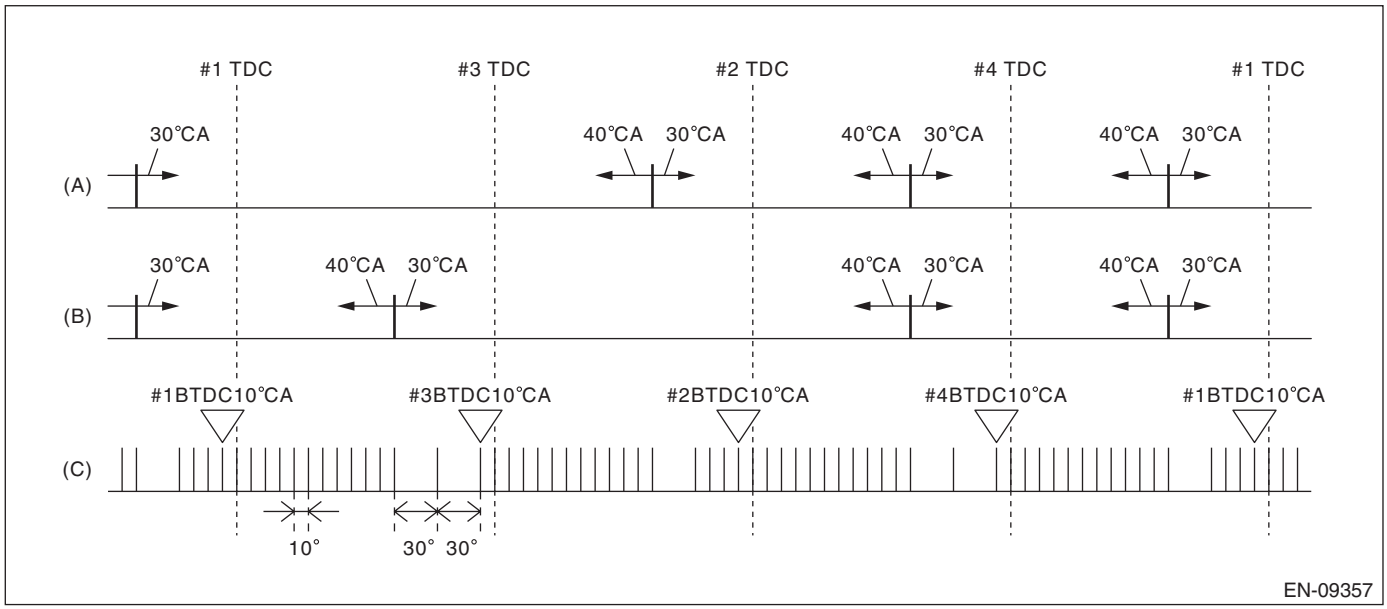
Time Needed for Diagnosis: 3000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

CD:DTC P0336 CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE

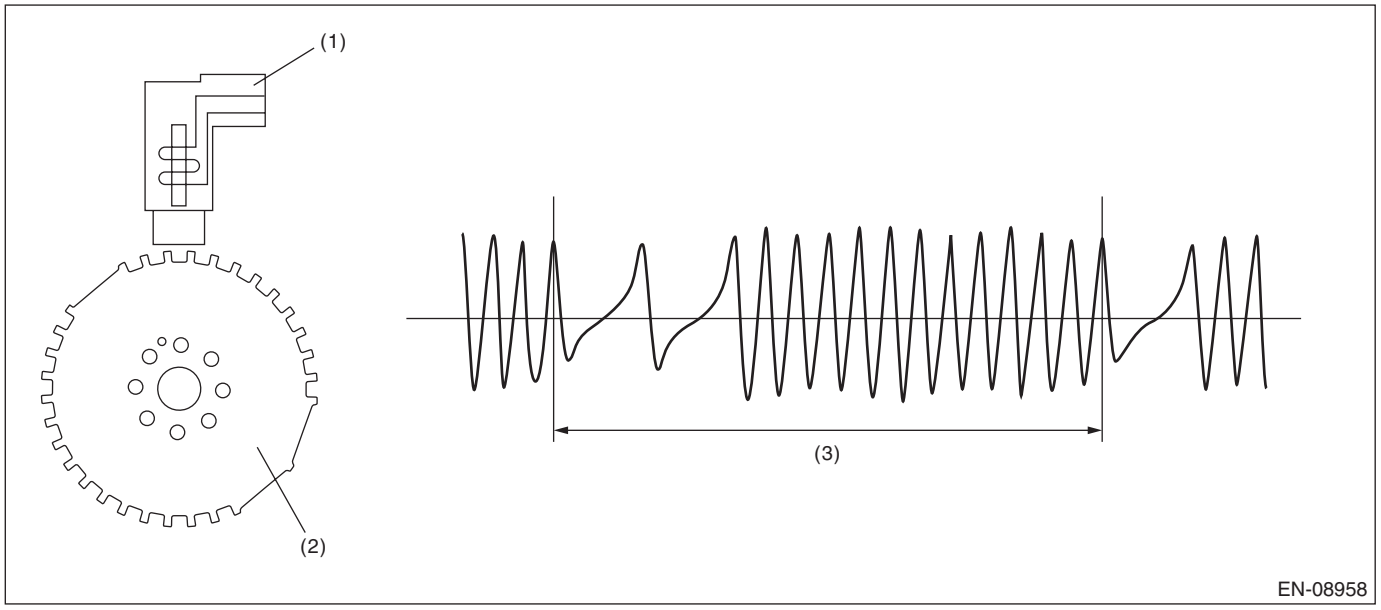
1. OUTLINE OF DIAGNOSIS

Detect for faults in crankshaft position sensor output properties.
Judge as NG when there is a problem in the number of crankshaft signals for every revolution of crankshaft.

2. COMPONENT DESCRIPTION



(A) Camshaft signal (RH) (B) Camshaft signal (LH) (C) Crankshaft signal



(1) Crankshaft position sensor (2) Crankshaft position sensor plate (3) Crankshaft half-turn

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Amount of crank sensor signal during 1 rev of crankshaft	Not = 30

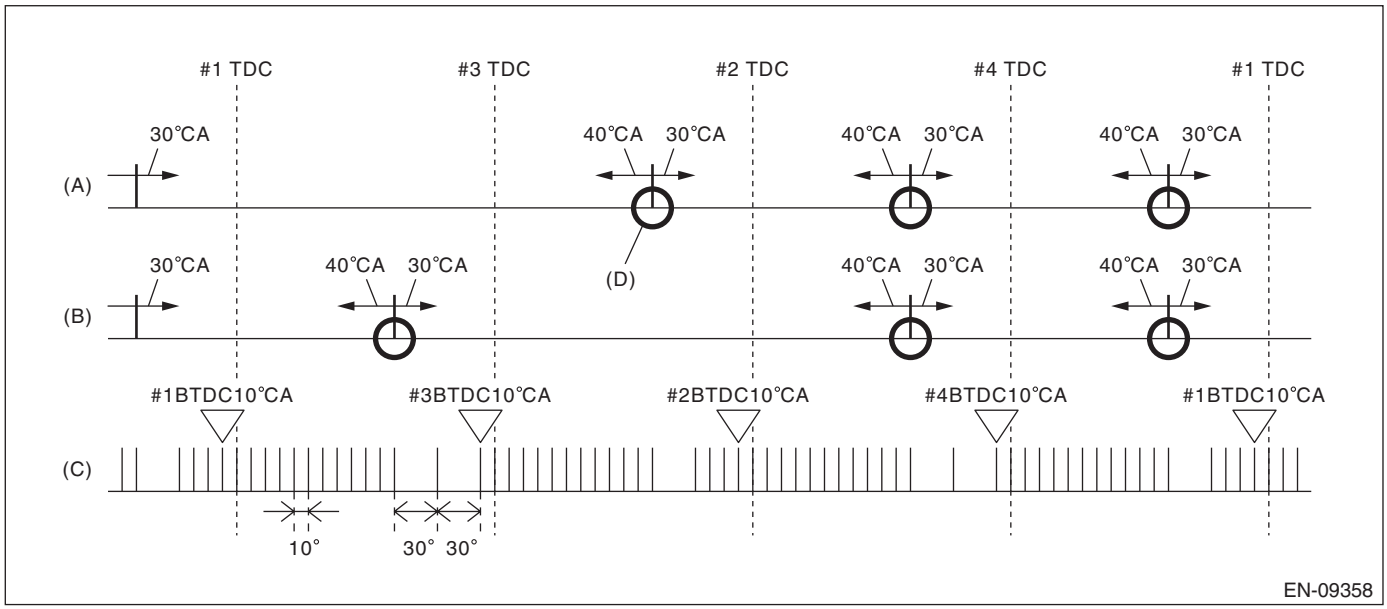
Time Needed for Diagnosis: Engine speed 10 engine revs.
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

CE:DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the camshaft position sensor.
When there is no camshaft position signal input continuously, judge as NG.

2. COMPONENT DESCRIPTION



(A) Camshaft signal (RH)
(B) Camshaft signal (LH)
(C) Crankshaft signal
(D) Camshaft position signal: When normal, there will be 3 camshaft position signals for every 2 crankshaft revolutions.

3. ENABLE CONDITION

Diagnosis 1

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V

Diagnosis 2

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V
Elapsed time after starting the engine	≥ 200 ms

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Diagnosis 1

Judge as NG when no input of camshaft position sensor signal in TDC remains for 10 time(s).

Judgment Value

Malfunction Criteria	Threshold Value
Number of intake camshaft position sensor pulses during cranking	= 0

Time Needed for Diagnosis: TDC × 10 time(s)

Diagnosis 2

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Number of intake camshaft position sensor pulses during 0.5 crankshaft rev.	= 0

Time Needed for Diagnosis: 3000 ms

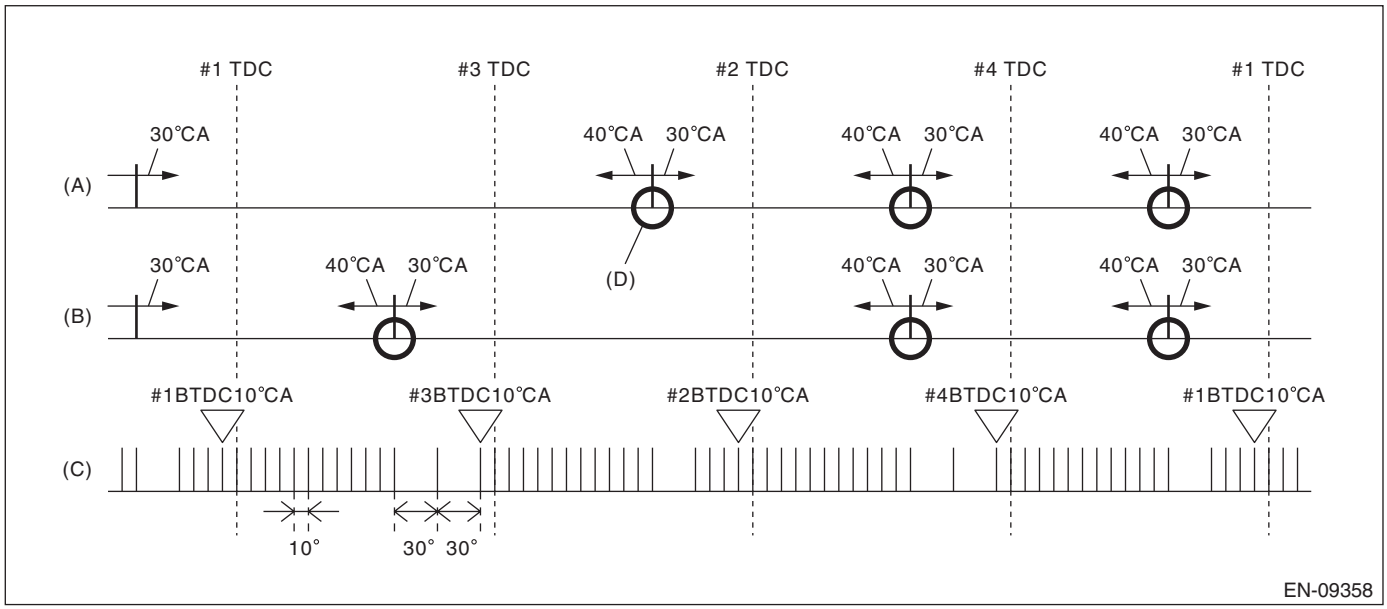
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

CF:DTC P0341 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of camshaft position sensor property.
Judge as NG when the number of camshaft signals remains abnormal.

2. COMPONENT DESCRIPTION



(A) Camshaft signal (RH)
(B) Camshaft signal (LH)
(C) Crankshaft signal
(D) Camshaft position signal: When normal, there will be 3 camshaft position signals for every 2 crankshaft revolutions.

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V
Elapsed time after starting the engine	≥ 200 ms

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as NG when the status where the number of camshaft position sensor signals in two crankshaft revolutions is other than 3 time(s).

Judgment Value

Malfunction Criteria	Threshold Value
Amount of camshaft sensor signal during 2 revs of crankshaft	≠ 3 time(s)

Time Needed for Diagnosis: Two engine revs. × 4 time(s)
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

CG:DTC P0345 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0340. <Ref. to GD(H4DO w/o HEV)-100, DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CH:DTC P0346 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0341. <Ref. to GD(H4DO w/o HEV)-102, DTC P0341 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CI: DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT

1. OUTLINE OF DIAGNOSIS

Based on the self-diagnostic result of the ignition coil driving IC, judge the ignition coil driving circuit as normal or abnormal.
The ignition coil driving IC detects “no ignition” status as a malfunction.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	> 1 s
Engine speed	> 500 rpm

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Ignition driving IC information	Malfunction

Time Needed for Diagnosis: 2560 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

CJ:DTC P0352 IGNITION COIL B PRIMARY/SECONDARY CIRCUIT

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0351. <Ref. to GD(H4DO w/o HEV)-104, DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CK:DTC P0353 IGNITION COIL C PRIMARY/SECONDARY CIRCUIT

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0351. <Ref. to GD(H4DO w/o HEV)-104, DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CL:DTC P0354 IGNITION COIL D PRIMARY/SECONDARY CIRCUIT

1. OUTLINE OF DIAGNOSIS

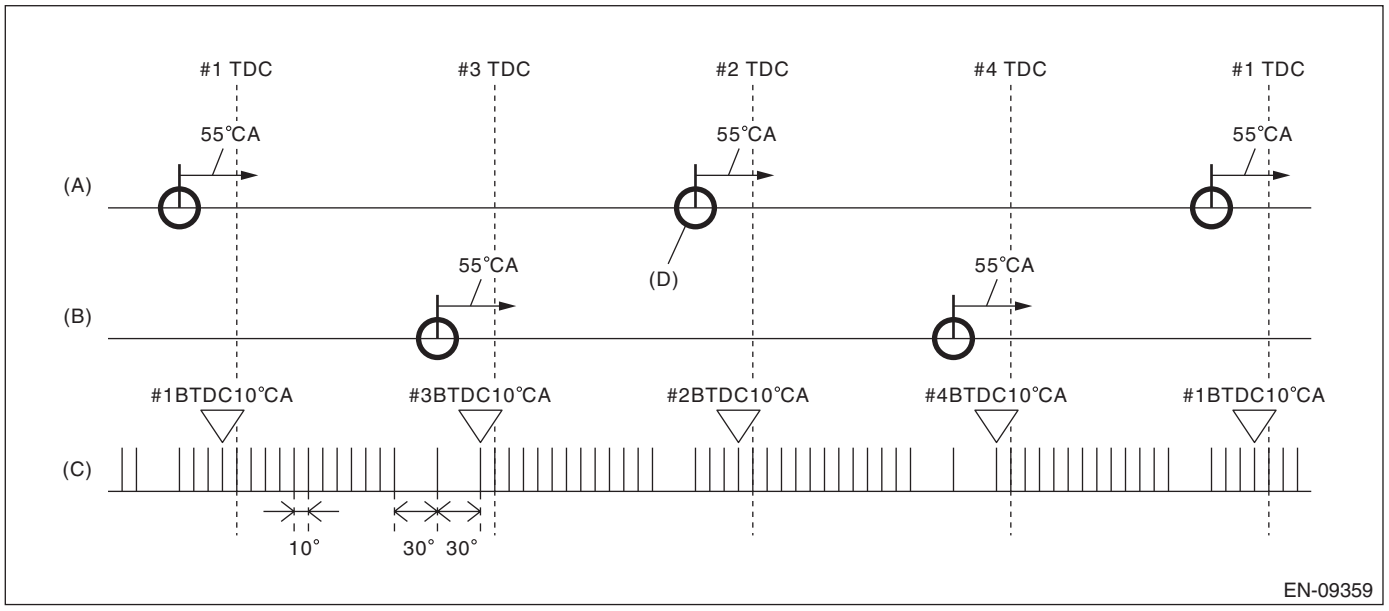
NOTE:
For the detection standard, refer to DTC P0351. <Ref. to GD(H4DO w/o HEV)-104, DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CM:DTC P0365 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the camshaft position sensor.
When there is no camshaft position signal input continuously, judge as NG.

2. COMPONENT DESCRIPTION



(A) Camshaft signal (RH)
(B) Camshaft signal (LH)
(C) Crankshaft signal
(D) Camshaft position signal: When normal, there will be 2 camshaft position signals for every 2 crankshaft revolutions.

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 200 ms

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as NG when no input of camshaft position sensor signal in TDC remains for 10 time(s).

Judgment Value

Malfunction Criteria	Threshold Value
Number of exhaust camshaft position sensor pulse during 0.5 crankshaft rev.	= 0

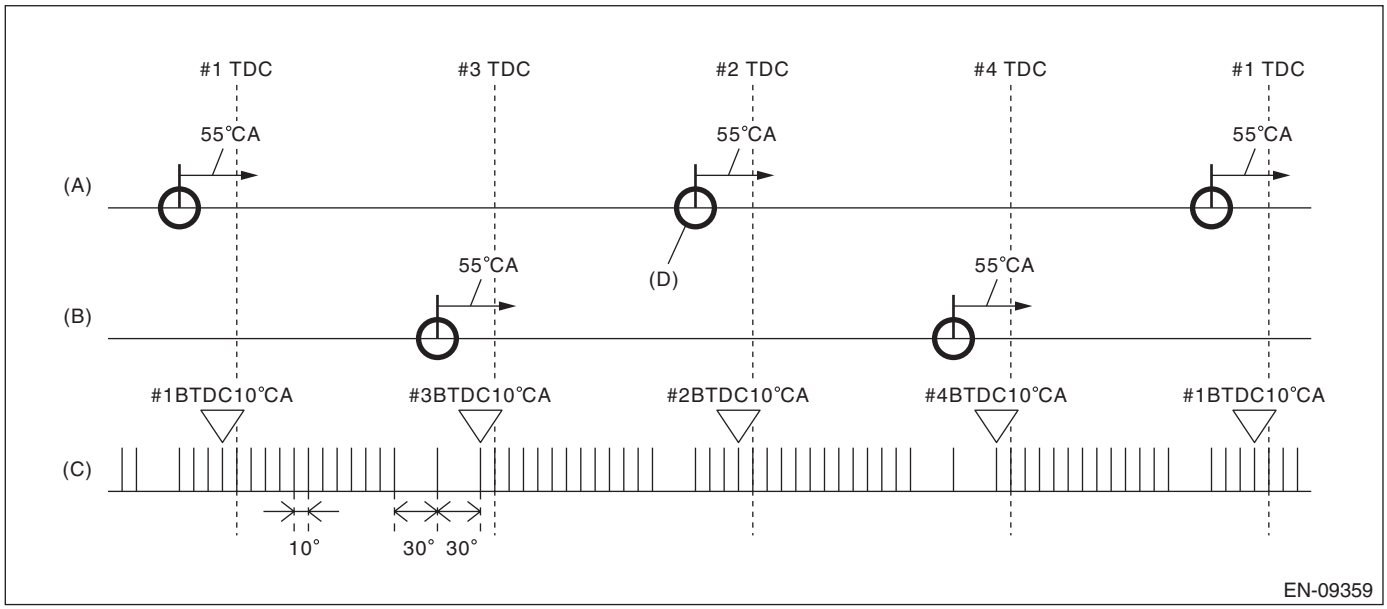
Time Needed for Diagnosis: TDC × 10 time(s)
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

CN:DTC P0366 CAMSHAFT POSITION SENSOR B CIRCUIT RANGE/PERFORMANCE (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of camshaft position sensor property.
Judge as NG when the number of camshaft signals remains abnormal.

2. COMPONENT DESCRIPTION



(A) Camshaft signal (RH)
(B) Camshaft signal (LH)
(C) Crankshaft signal
(D) Camshaft position signal: When normal, there will be 2 camshaft position signals for every 2 crankshaft revolutions.

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 200 ms

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as NG when the status where the number of camshaft position sensor signals in two crankshaft revolutions is other than 2 time(s).

Judgment Value

Malfunction Criteria	Threshold Value
Amount of camshaft sensor signal during 2 revs of crankshaft	≠ 2 time(s)

Time Needed for Diagnosis: Two engine revs. × 4 time(s)
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

CO:DTC P0390 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0365. <Ref. to GD(H4DO w/o HEV)-105, DTC P0365 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CP:DTC P0391 CAMSHAFT POSITION SENSOR B CIRCUIT RANGE/PERFORMANCE (BANK 2)

1. OUTLINE OF DIAGNOSIS

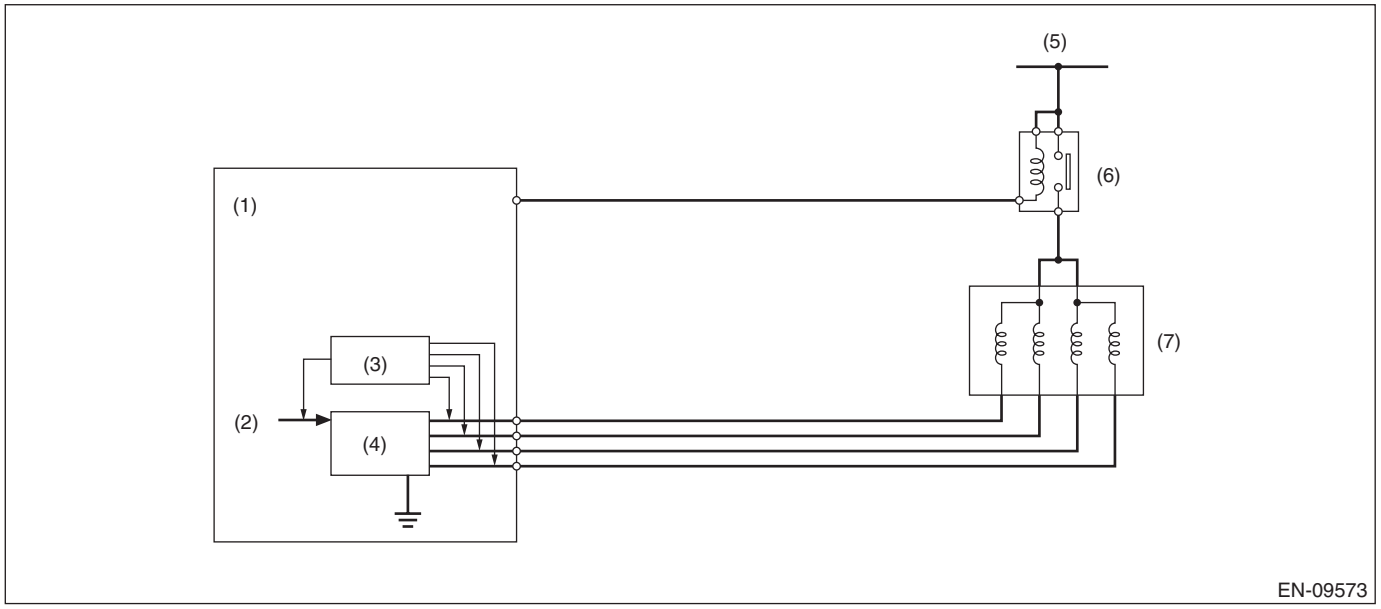
NOTE:
For the detection standard, refer to DTC P0366. <Ref. to GD(H4DO w/o HEV)-106, DTC P0366 CAMSHAFT POSITION SENSOR B CIRCUIT RANGE/PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CQ:DTC P0400 EXHAUST GAS RECIRCULATION FLOW

1. OUTLINE OF DIAGNOSIS

Detect EGR system malfunction.
Intake manifold pressure (negative pressure) is constant because the throttle valve is fully closed during deceleration fuel cut. At this time, when the EGR control valve is opened/closed, the intake manifold pressure will change. EGR System OK/NG is judged by the range of this change.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Computer unit (CPU)
(3) Detecting circuit
(4) Switching circuit
(5) Battery voltage
(6) Main relay
(7) EGR control valve

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Engine speed	1300 rpm — 5000 rpm
Intake manifold pressure (absolute pressure)	< 133.3 kPa (1000 mmHg, 39.4 inHg)
Intake air temperature	≥ 0 °C(32 °F)
Throttle position	< 0.25 °
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75.1 kPa (563 mmHg, 22.2 inHg)
Vehicle speed	≥ 40 km/h (24.9 MPH)
Fuel shut-off function	In operation
Neutral switch	OFF

4. GENERAL DRIVING CYCLE

During deceleration fuel cut from 53 km/h (approx. 33 MPH) or more, perform diagnosis once.
Be careful of vehicle speed and engine speed. (Diagnosis will not be completed if the vehicle speed and engine speed conditions become out of specification due to deceleration.)

5. DIAGNOSTIC METHOD

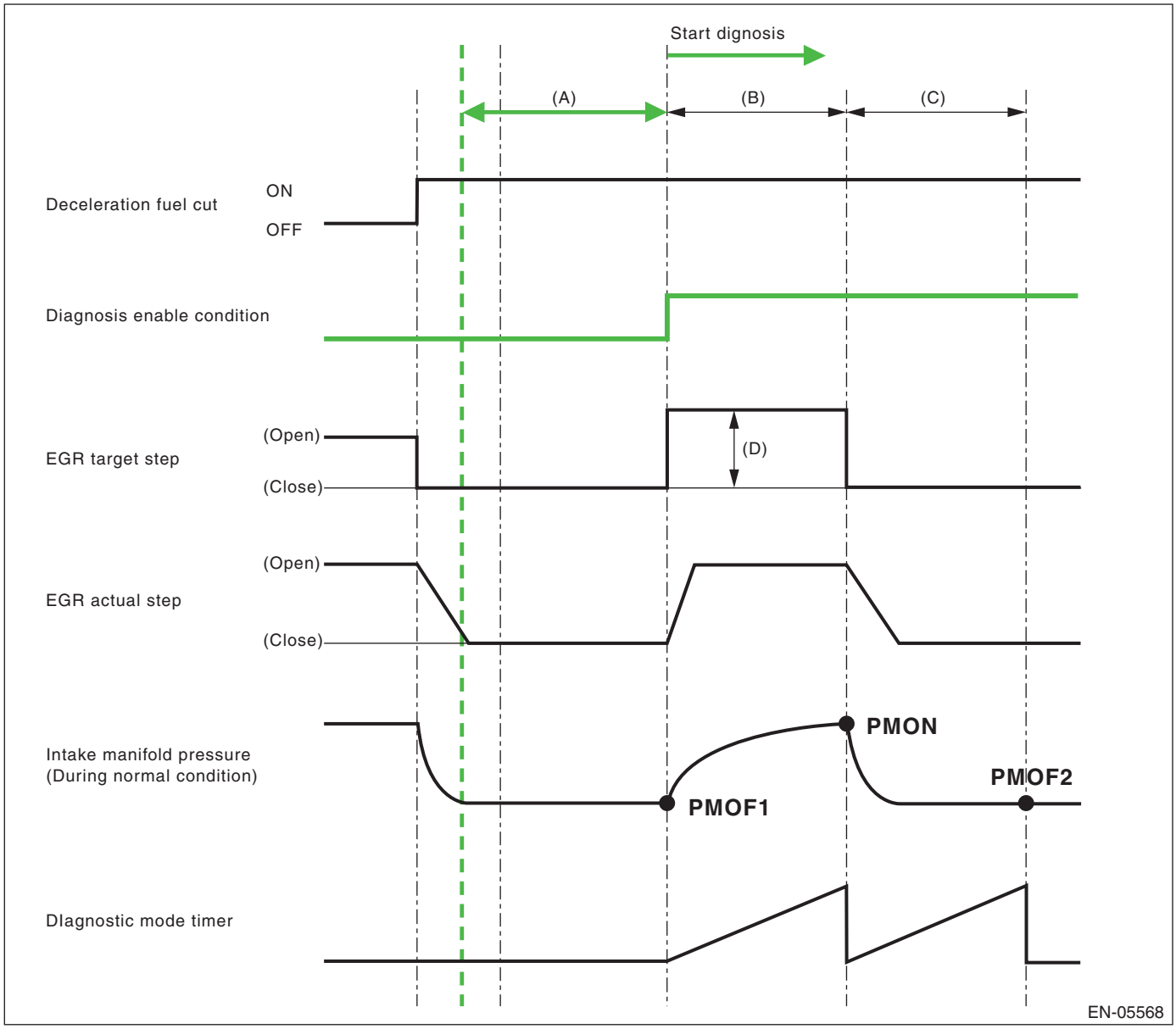
Measure the pressure values when the enable conditions are established, and perform diagnosis by calculating those results.
1. Label the intake manifold pressure value as PMOF1, which is observed when enable conditions are established, and set the EGR target step to 45 step(s) (nearly full open).

2. Label the intake manifold pressure value as PMON, which is observed after 1000 ms has passed since EGR target step was set to 45 step(s) (when the enable conditions were established), and set the EGR target step to 0.
3. Label the intake manifold pressure as PMOF2, which is observed after 1000 ms has passed since EGR target step was set to 0 (after (1000 ms + 1000 ms) have passed since the enable conditions were established).
Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
PMON – (PMOF1 + PMOF2)/2	< 2.5 kPa (18.63 mmHg, 0.7 inHg)

Time Needed for Diagnosis: 1 time
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.



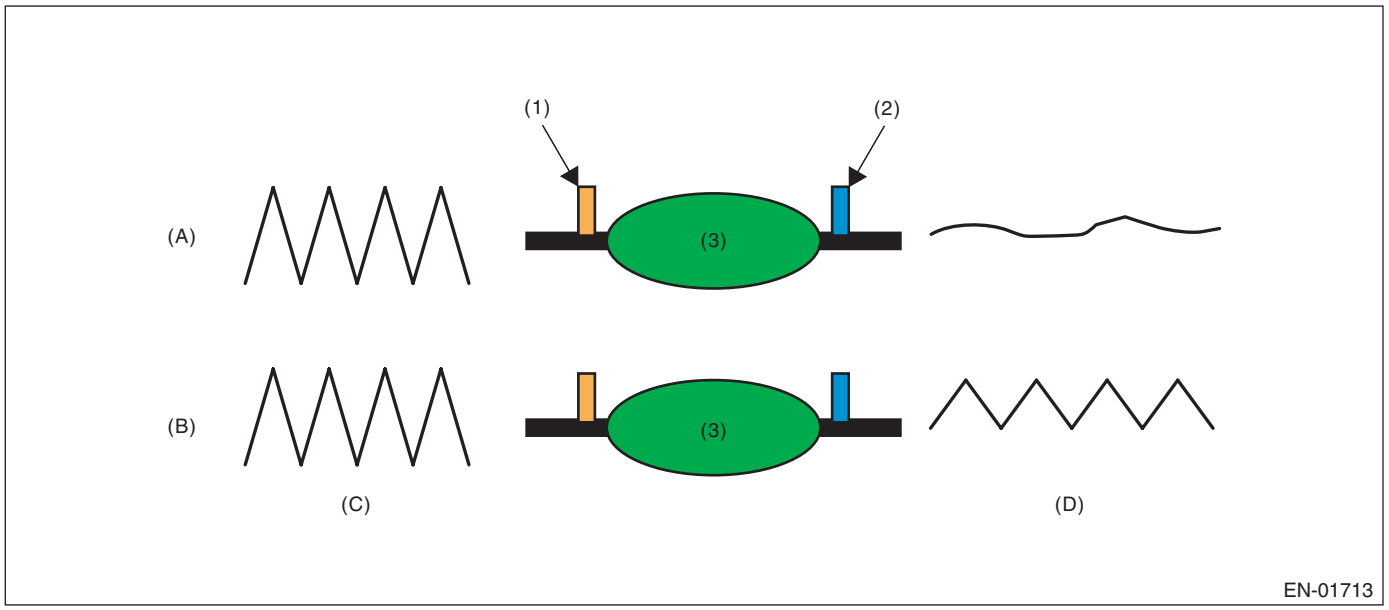
(A) 3000 ms (B) 1000 ms (C) 1000 ms
(D) 45 step(s)

CR:DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the deterioration of the catalyst function.
Though the front oxygen sensor output would change slowly with a new catalyst, the sensor output with a deteriorated catalyst becomes high and the inversion time is shortened.
For this reason, the catalyst diagnosis is carried out by monitoring the front oxygen sensor output and comparing it with the front oxygen (A/F) sensor output.

2. COMPONENT DESCRIPTION



(A) Normal
(B) Deterioration
(C) Output waveform from the front oxygen (A/F) sensor
(D) Output waveform from the front oxygen sensor

(1) Front oxygen (A/F) sensor
(2) Front oxygen sensor
(3) Catalytic converter

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75.1 kPa (563 mmHg, 22.2 inHg)
Estimated catalyst temperature	≥ 490 °C (914 °F) (CVT model) ≥ 490 °C (914 °F) (MT model)
Misfire detection every 200 rotations	< 65535 time(s)
Sub feedback	In operation
Evaporative system diagnosis	Not in operation
Time of difference (< 0.10) between actual lambda and target lambda	≥ 0 ms
Vehicle speed	> 40 km/h (24.9 MPH)
Amount of intake air	≥ 5 g/s (0.18 oz/s) and < 40 g/s (1.41 oz/s)
Engine load change every 0.5 engine revs.	< 255 g/rev (8.99 oz/rev)
Rear oxygen output change from 660 mV or less to 660 mV or more	Experienced after fuel cut
Purge execution calculated time	≥ 0 s

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once at a constant speed of 40 km/h (24.9 MPH) or higher.

5. DIAGNOSTIC METHOD

After the enable conditions have been established, calculate the front oxygen (A/F) sensor lambda value deviation sum value (Σ |(sglmd$_n$ – sglmd$_{n-1}$)|), and rear oxygen sensor output voltage deviation sum value (Σ |(ro2sad$_n$ – ro2sad$_{n-1}$)|) in every 32 ms × 4 times. If the front oxygen (A/F) sensor lambda value deviation sum value (Σ |(sglmd$_n$ – sglmd$_{n-1}$)|) is the predetermined value or more, calculate the diagnostic value.

- **Abnormality Judgment**

If the duration of time while the following conditions are met is within the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Σ |(ro2sad$_n$ – ro2sad$_{n-1}$)| / Σ |(sglmd$_n$ – sglmd$_{n-1}$)|	> 100

Time Needed for Diagnosis: 30 — 55 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

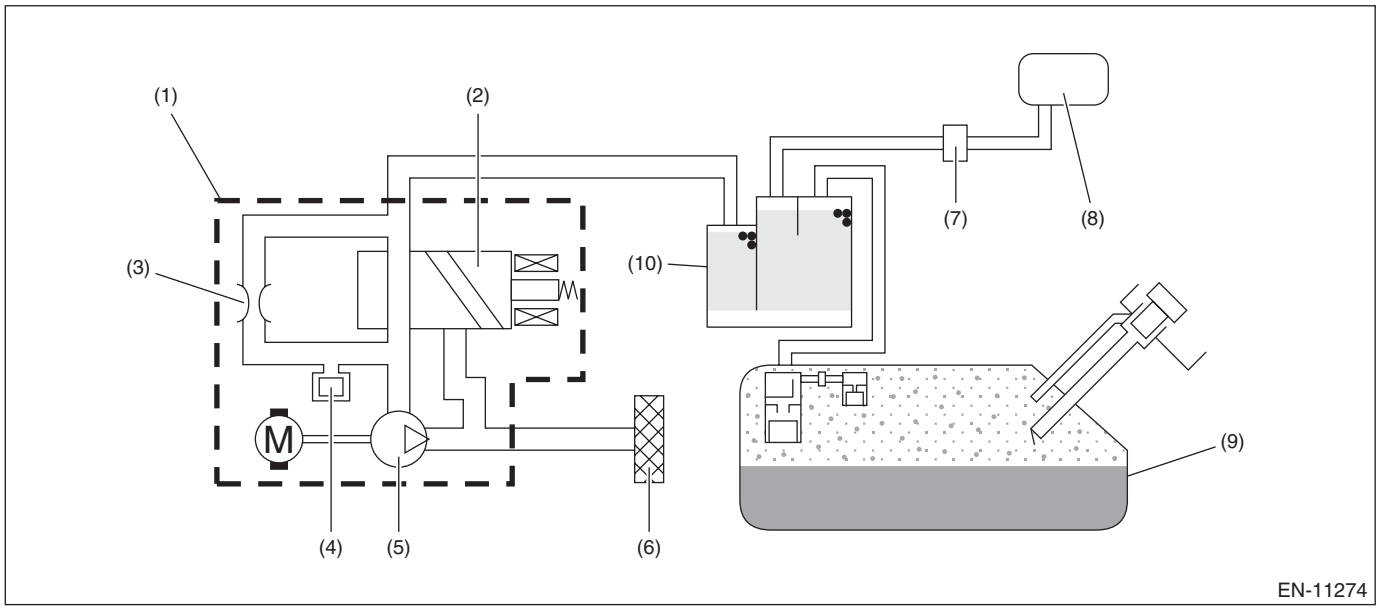
CS:DTC P0441 EVAPORATIVE EMISSION CONT. SYS. INCORRECT PURGE FLOW

1. OUTLINE OF DIAGNOSIS

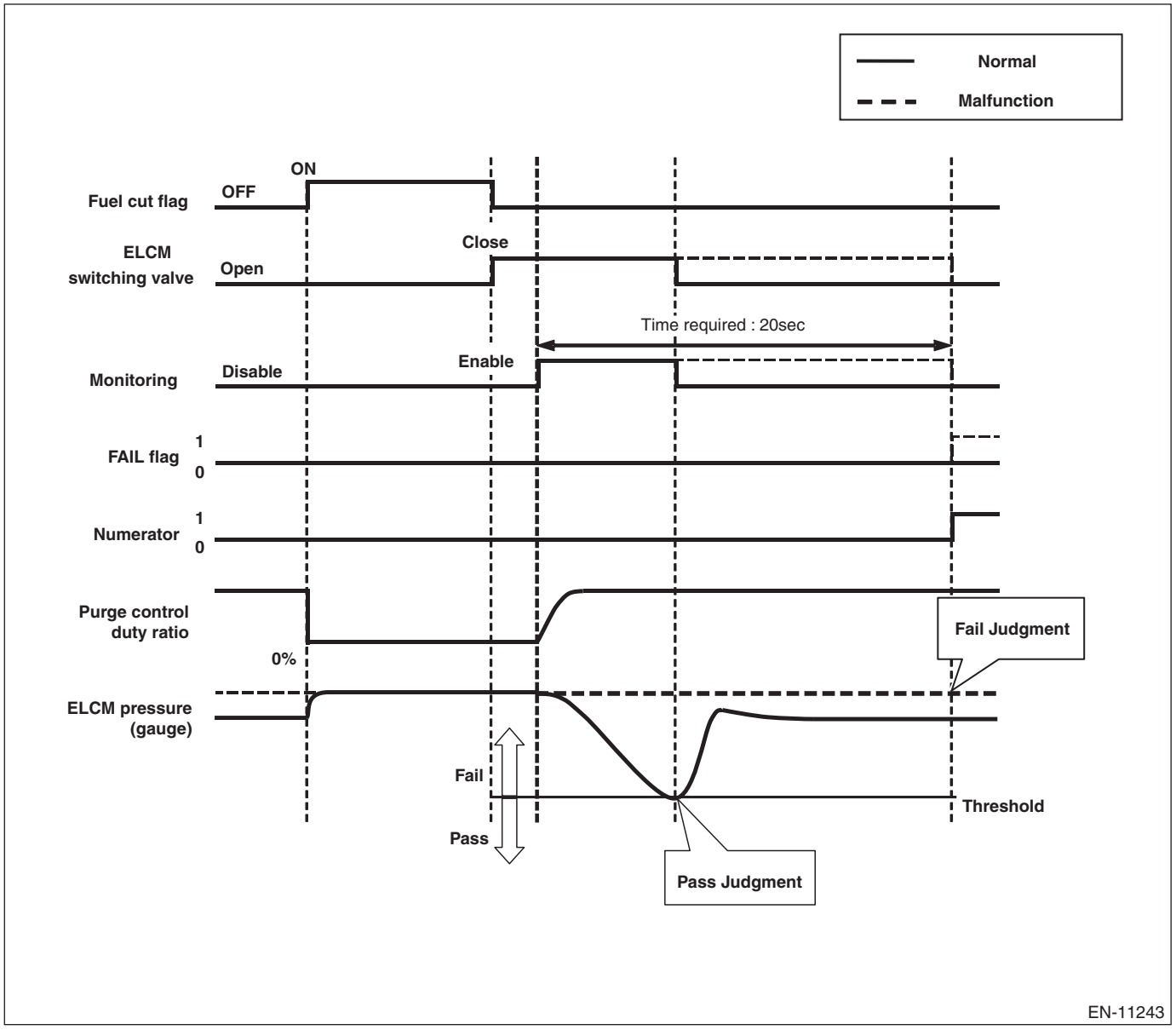
This monitor intrusively performs a functional check to detect incorrect purge flow. The monitor seals the EVAP system (i.e. isolate from atmosphere) by closing the ELCM switching valve intrusively after recovering from a fuel cut event. In the case of normal condition, and the commanded purge control duty ratio is more than 0%, ELCM pressure (gauge) will decrease due to engine vacuum and reach to the threshold value. However, in the case of malfunction condition (e.g. fuel cap open, purge valve stuck closed, purge line disconnected or blocked), if the ELCM pressure (gauge) does not reach the threshold within a predetermined time, the monitor determines a malfunction and stores a fault code.

Malfunction Criteria

ELCM pressure (gauge) > Threshold



(1) ELCM
(2) Switching valve (closed)
(3) Reference orifice (0.02 inch orifice)
(4) Pressure sensor
(5) Vacuum pump
(6) Drain filter
(7) Purge control solenoid valve
(8) Intake manifold
(9) Fuel tank
(10) Canister


Normal
Malfunction
Fuel cut flag
ON
OFF
ELCM switching valve
Close
Open
Time required : 20sec
Monitoring
Disable
Enable
FAIL flag
1
0
Numerator
1
0
Purge control duty ratio
0%
Fail Judgment
ELCM pressure (gauge)
Fail
Pass
Threshold
Pass Judgment
EN-11243

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Time when ELCM switching valve is closed	< 120000 ms
Purge control solenoid valve control duty	> 0%
Precondition Conditions to close the switching valve of ELCM intrusively.	
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75.1 kPa (563 mmHg, 22.2 inHg)
Integrated value of calculated purge airflow since engine start	≥ Value from Map
Atmospheric pressure – Intake manifold absolute pressure	≥ 11.3 kPa (85 mmHg, 3.3 inHg)
Fuel cut time	≥ 1000 ms
Ambient air temperature	≥ –25 °C (–13 °F)

Map

Ambient air temperature °C (°F)	0 (32)	10 (50)	20 (68)	30 (86)	40 (104)	50 (122)
Integrated value of calculated purge airflow since engine start g (oz)	2250 (79.36)	2250 (79.36)	2250 (79.36)	2250 (79.36)	2250 (79.36)	2250 (79.36)

3. GENERAL DRIVING CYCLE

Perform the diagnosis only once during ordinary driving.

4. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
ELCM pressure	> 666.6 Pa × –1 (5 mmHg × –1, 0.2 inHg × –1)

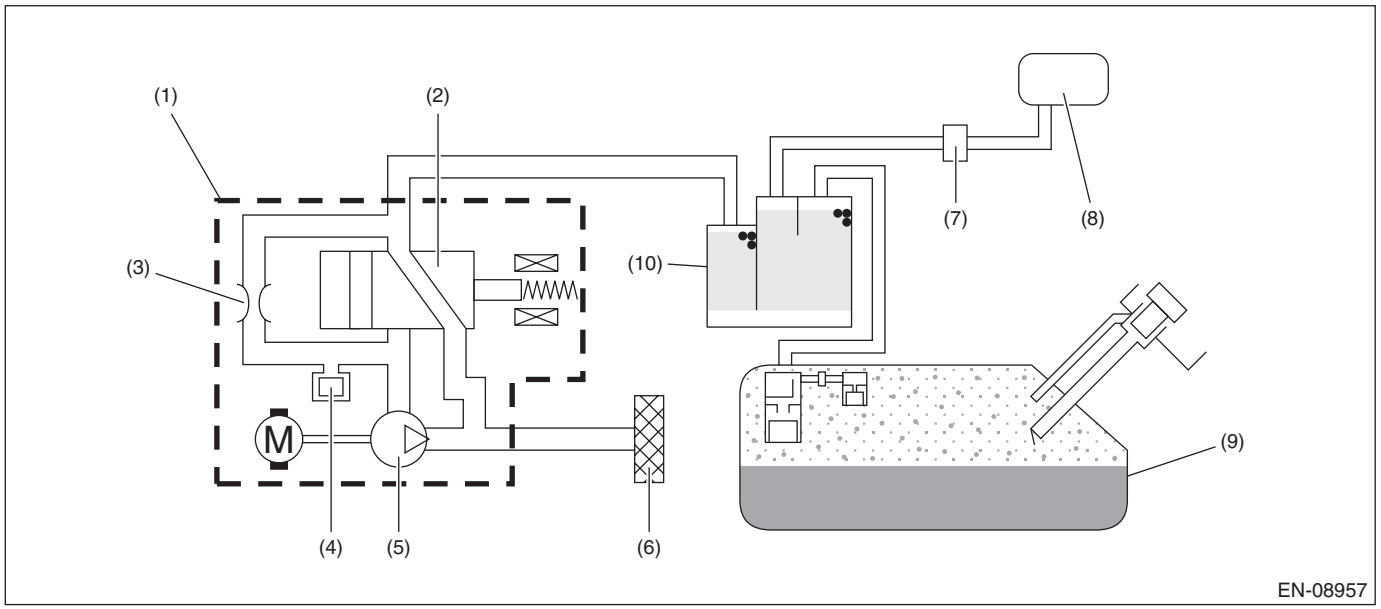
Time Needed for Diagnosis: 30000 ms – 10000 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

CT:DTC P0451 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/ SWITCH RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of ELCM pressure sensor output properties.
Judge as NG when the ELCM pressure sensor output value is largely different from the intake manifold pressure when the ignition switch is ON.

2. COMPONENT DESCRIPTION



(1) ELCM
(2) Switching valve
(3) Reference orifice (0.02 inch orifice)
(4) Pressure sensor
(5) Vacuum pump
(6) Drain filter
(7) Purge control solenoid valve
(8) Intake manifold
(9) Fuel tank
(10) Canister

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Ignition switch	ON
Engine speed	< 300 rpm
Vehicle speed	< 1 km/h (0.621 MPH)
Soaking time	≥ 60 s
Variation value of intake manifold pressure (absolute pressure) since ignition switch is turned to ON	< 1.332 kPa (9.99 mmHg, 0.39 inHg)
ELCM vacuum pump	Not in operation
ELCM switching valve	Open
Purge control	Not in operation

4. GENERAL DRIVING CYCLE

Perform the diagnosis once at ignition ON.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
|ELCM pressure sensor output value – intake manifold pressure (absolute pressure) when ignition switch is ON|	> 4.7 kPa (35.5 mmHg, 1.4 inHg)

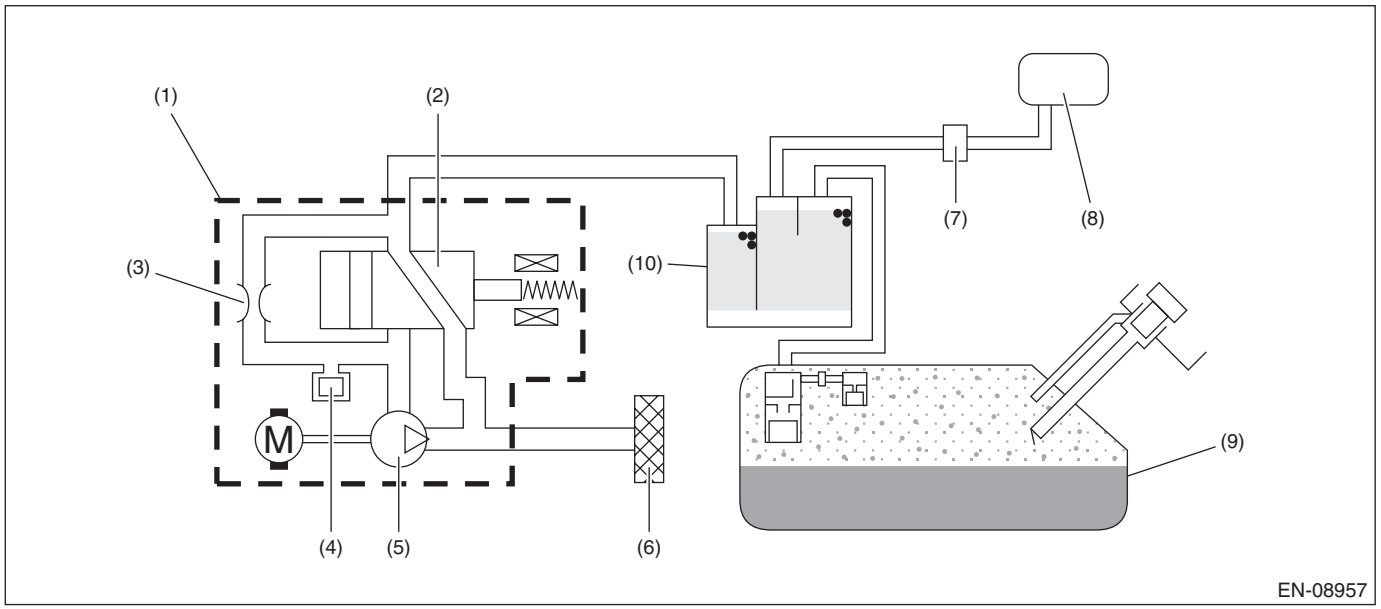
Time Needed for Diagnosis: 328 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

CU:DTC P0452 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/ SWITCH LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the ELCM pressure sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) ELCM
(2) Switching valve
(3) Reference orifice (0.02 inch orifice)
(4) Pressure sensor
(5) Vacuum pump
(6) Drain filter
(7) Purge control solenoid valve
(8) Intake manifold
(9) Fuel tank
(10) Canister

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
12V battery system voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.973 V

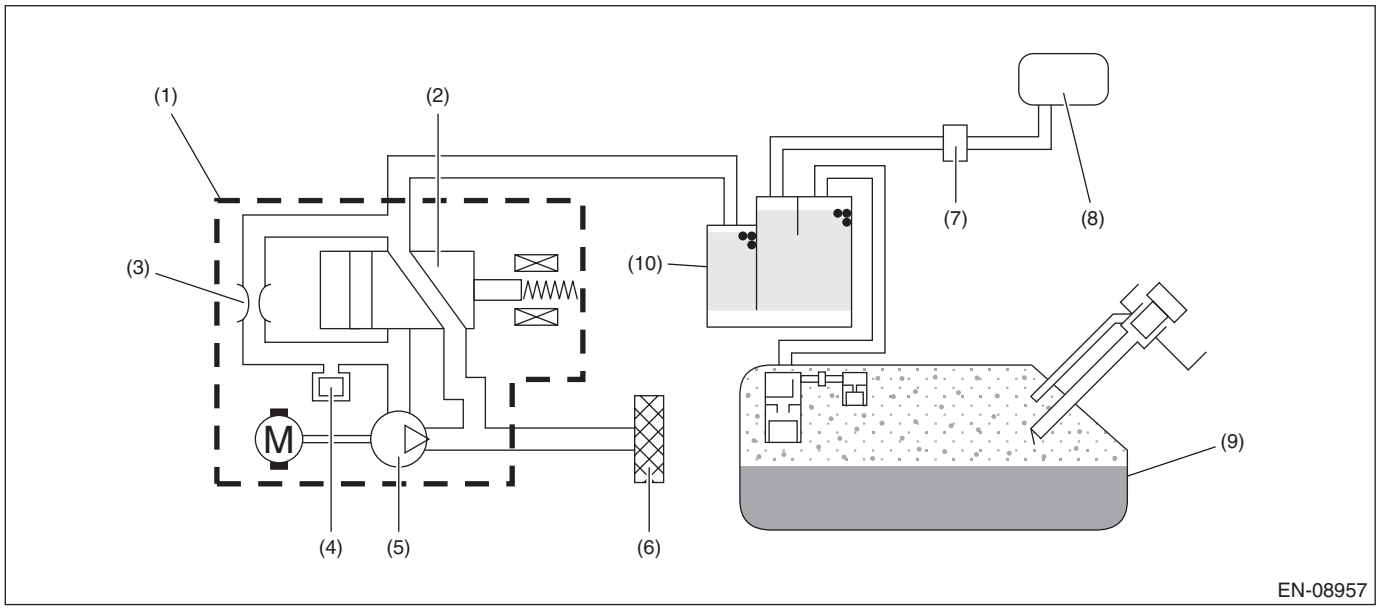
Time Needed for Diagnosis: 1000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

CV:DTC P0453 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/ SWITCH HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the ELCM pressure sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) ELCM
(2) Switching valve
(3) Reference orifice (0.02 inch orifice)
(4) Pressure sensor
(5) Vacuum pump
(6) Drain filter
(7) Purge control solenoid valve
(8) Intake manifold
(9) Fuel tank
(10) Canister

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
12V battery system voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.095 V

Time Needed for Diagnosis: 1000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

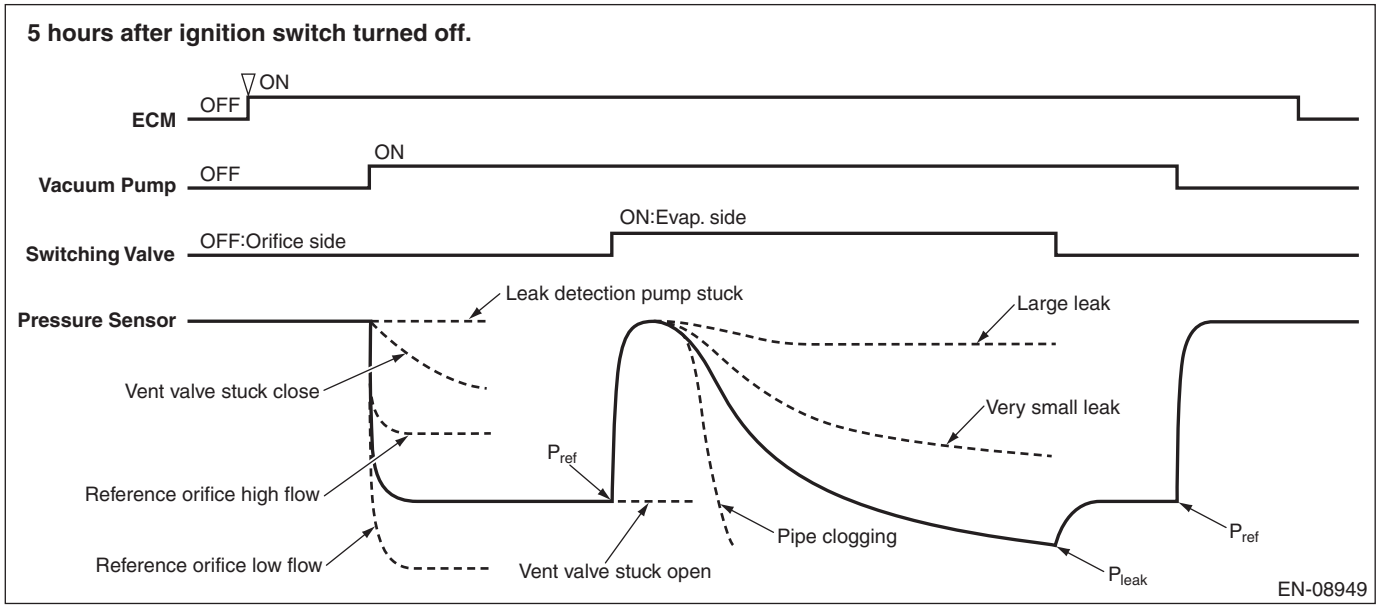
CW:DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK)

1. OUTLINE OF DIAGNOSIS

This diagnosis judges whether the ELCM operation is normal or not, and whether the evaporative emission system has leak and clogging or not.
To purge the canister, after driving, perform the five hours soaking after ignition switch OFF in order to stabilize the evaporative gas status. * After 5, 7 or 9.5 hours passed, ECM is activated by soaking timer, and the leak check is started.
Judges whether the ELCM operation is normal or not, by measuring the reference pressure status via reference orifice (0.02 inch orifice). Judge as malfunction if the reference pressure is out of specified range. Then, judge whether there is a leak or not, by comparing the pressure (leak pressure) when the reference pressure and the evaporative emission system are in negative pressure condition. Judge as system leak in the evaporative emission system if the leak pressure is higher than reference pressure. Judge as clogging of pipe if the leak pressure becomes lower than the reference pressure within the specified amount of time.
0.02 inch leak and 0.04 inch leak can be distinguished by measuring the leak pressure.
The diagnosis results are stored inside ECM until the engine is started again.
*: When the test conditions are not met in 5 hours, perform diagnosis at elapsed time of 7 hours. When the test conditions are not met in 7 hours, perform diagnosis at elapsed time of 9.5 hours.

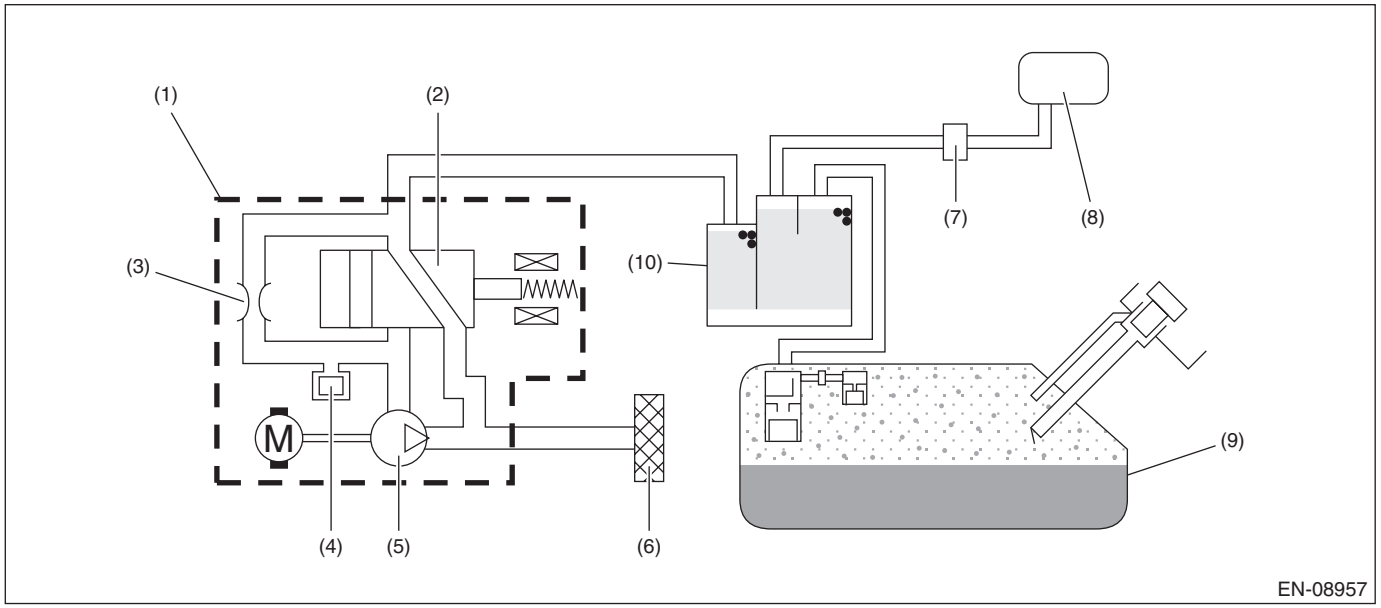
Diagnostic item	
ELCM system (ELCM body)	Vacuum pump stuck Switching valve stuck to open Switching valve stuck to close Reference orifice flow large Reference orifice flow small
Leak check	Large leak • 0.04 inch leak • Fuel cap loose • Fuel cap off • System malfunction
	Very small leak • 0.02 inch leak
Clogging of pipe	—

OUTLINE OF DIAGNOSIS



2. COMPONENT DESCRIPTION

ELCM consists of the pressure sensor, the reference orifice (diameter of 0.02 inch), the vacuum pump which introduces the negative pressure into evaporative emission system, and the switching valve which switches the passage to introduce the negative pressure.



(1) ELCM
(2) Switching valve
(3) Reference orifice (0.02 inch orifice)
(4) Pressure sensor
(5) Vacuum pump
(6) Drain filter
(7) Purge control solenoid valve
(8) Intake manifold
(9) Fuel tank
(10) Canister

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Activation of soaking timer	Completed
Battery voltage	≥ 10.9 V
Ignition switch	OFF
Engine coolant temperature	≥ 4.4 °C (39.9 °F) and < 45 °C (113 °F)
Atmospheric pressure	≥ 75.1 kPa (563 mmHg, 22.2 inHg) and < 110 kPa (825 mmHg, 32.5 inHg)
Accumulated purge amount during previous driving cycle	≥ Value of Map 1

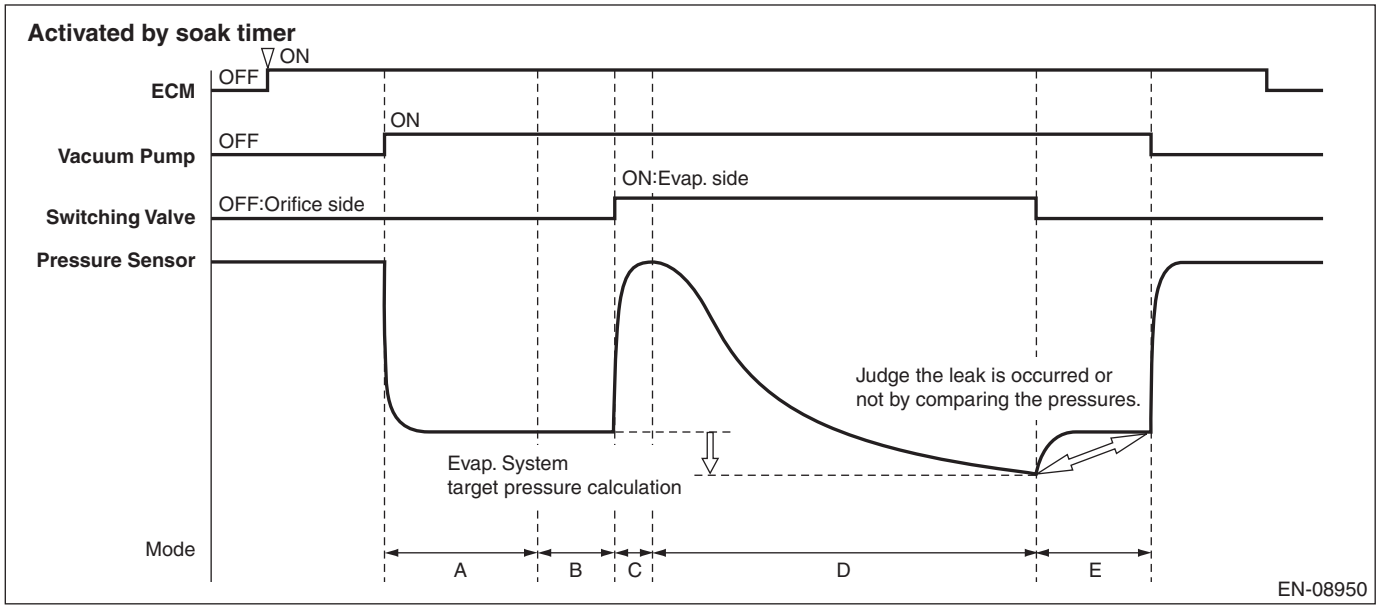
Map 1

Engine coolant temperature °C (°F)	0 (32)	30 (86)	35 (95)	40 (104)	45 (113)
Accumulated purge amount during previous driving cycle g (oz)	4000 (141.08)	4000 (141.08)	15000 (529.05)	25000 (881.75)	35000 (1234.45)

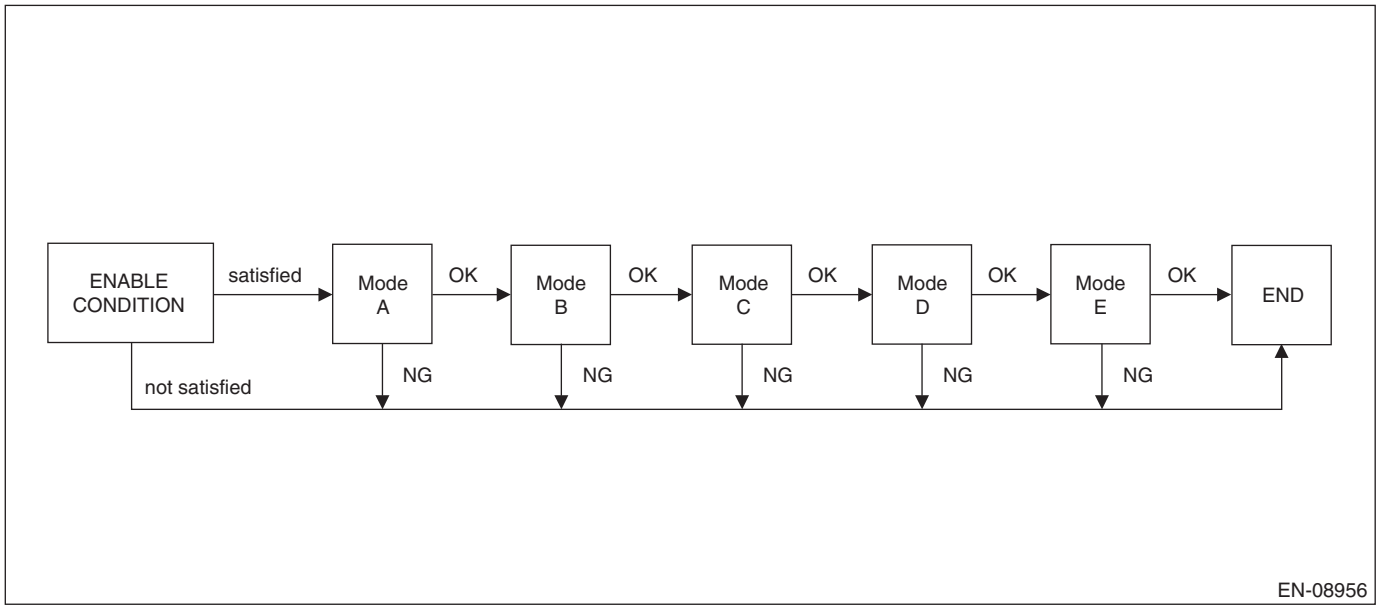
4. GENERAL DRIVING CYCLE

Perform the diagnosis only once when 5, 7 or 9.5 hours has passed after ignition switch is OFF. For more detail, refer to “OUTLINE OF DIAGNOSIS”. <Ref. to GD(H4DO w/o HEV)-119, OUTLINE OF DIAGNOSIS, DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

5. DIAGNOSTIC METHOD



Mode	Explanation of Mode	Diagnosis Period
A	Vacuum pump operation confirmation and characteristics stability	7 s or less & 300 s
B	Measurement of reference pressure for setting the target negative pressure	40 s or less
C	Switching valve operation confirmation	12 s or less
D	Clogging of pipe diagnosis and leak pressure measurement	900 s or less
E	Reference pressure measurement for judgment	40 s or less



Mode A (Vacuum pump operation confirmation and characteristics stability)

Purpose: Detect the vacuum pump operation trouble.
Judge as NG when the following conditions are established.
Judge as OK if the following conditions are not established, and warm up for five minutes to stabilize the vacuum pump characteristics.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Pressure sensor output value	> –0.2 kPa (–1.68 mmHg, –0.1 inHg)	P2404

Mode B (Measurement of reference pressure for setting the target negative pressure)

1. Purpose: Judge the reference pressure stability.
Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
|Pressure sensor maximum output value – Pressure sensor minimum output value|	> 0.3 kPa (2.355 mmHg, 0.1 inHg)	P2404

2. Purpose: Judge whether the reference pressure is within the normal range, and detect the vacuum pump and orifice malfunctions.
Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Reference pressure for setting the target negative pressure	< Value of Map 2 or > Value of Map 3	P2404

Map 2

Atmospheric pressure kPa (mmHg, inHg)	70 (525, 20.7)	80 (600, 23.6)	90 (675, 26.6)	100 (750, 29.5)
Reference pressure for setting the target negative pressure kPa (mmHg, inHg)	-4 (-29.790, -1.2)	-4.1 (-30.593, -1.2)	-4.2 (-31.395, -1.2)	-4.3 (-32.190, -1.3)

Map 3

Atmospheric pressure kPa (mmHg, inHg)	70 (525, 20.7)	80 (600, 23.6)	90 (675, 26.6)	100 (750, 29.5)
Reference pressure for setting the target negative pressure kPa (mmHg, inHg)	-0.9 (-7.065, -0.3)	-1 (-7.860, -0.3)	-1.2 (-8.663, -0.3)	-1.3 (-9.465, -0.4)

Mode C (Switching valve operation confirmation)

Purpose: Measure the pressure increase when switching valve is changed from open to close, and detect the stuck to open/close malfunctions of the switching valve.
Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Pressure sensor output value – Reference pressure for setting the target negative pressure	< 0.2 kPa (1.68 mmHg, 0.1 inHg)	P2404

Mode D (Clogging of pipe diagnosis and leak pressure measurement)

1. **Clogging of pipe**
   Purpose: Measure the time required for the evaporative emission system to reach the target negative pressure by the vacuum pump, and detect the clogging of pipe trouble.
   Judge as clogging of pipe malfunction if the evaporative emission system reaches to the target negative pressure within the specified time.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Time required to reach to the target negative pressure For target vacuum, use one of the followings. •Reference pressure for target vacuum setting – value of Map 4 •–5 kPa (–37.298 mmHg, –1.5 inHg)	≤ 34000 ms	P1451

Map 4

Time of negative pressure introduction ms	0	100000	200000	300000	400000	500000	600000	700000	800000	900000	1000000	1100000	1200000
Reference pressure for setting the target negative pressure – Pressure sensor output value kPa (mmHg, inHg)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)

2. **Leak pressure measurement**
   Purpose: Measure the pressure (leak pressure) when the evaporative emission system becomes the negative pressure by the vacuum pump.
   Store the pressure as a leak pressure while the following conditions are met.

Judgment Value

Conditions for storing the leak pressure	Threshold Value
When any one of the followings is established:	
• Reference pressure for setting the target negative pressure – Pressure sensor output value	≥ Value of Map 4
• Pressure sensor output value	< –5 kPa (–37.298 mmHg, –1.5 inHg)
• Time of negative pressure introduction	≥ 900000 ms

Mode E (Measurement of reference pressure for judgment)

1. Purpose: Judge the reference pressure stability.
Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
|Pressure sensor maximum output value – Pressure sensor minimum output value|	> 0.3 kPa (2.355 mmHg, 0.1 inHg)	P2404

2. Purpose: Judge whether the reference pressure is within the normal range, and detect the vacuum pump and orifice malfunctions. Judge the vacuum pump performance stability.
Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Reference pressure for judgment	< Value of Map 5 or > Value of Map 6	P2404

Map 5

Atmospheric pressure kPa (mmHg, inHg)	70 (525, 20.7)	80 (600, 23.6)	90 (675, 26.6)	100 (750, 29.5)
Reference pressure for judgment kPa (mmHg, inHg)	-4.5 (-34.020, -1.3)	-4.6 (-34.815, -1.4)	-4.7 (-35.618, -1.4)	-4.9 (-36.420, -1.4)

Map 6

Atmospheric pressure kPa (mmHg, inHg)	70 (525, 20.7)	80 (600, 23.6)	90 (675, 26.6)	100 (750, 29.5)
Reference pressure for judgment kPa (mmHg, inHg)	-0.8 (-6.180, -0.2)	-0.9 (-6.983, -0.3)	-1 (-7.785, -0.3)	-1.1 (-8.580, -0.3)

3. Purpose: Judge the presence of evaporative emission system leak.
Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
<Large leak (0.04 inch)> Leak pressure lleakjdg = (Reference pressure for judgment) × 0.377 – (–45.5 Pa)	≥ lleakjdg (Pa)	P0455
<Very small leak (0.02 inch)> Leak pressure	< lleakjdg (Pa)	P0456

Time Needed for Diagnosis: Approx. 23 min
At next engine start, confirm whether the enable conditions are satisfied even though refueling has been done during soaking, and determine the malfunction.
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

CX:DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK)

1. OUTLINE OF DIAGNOSIS

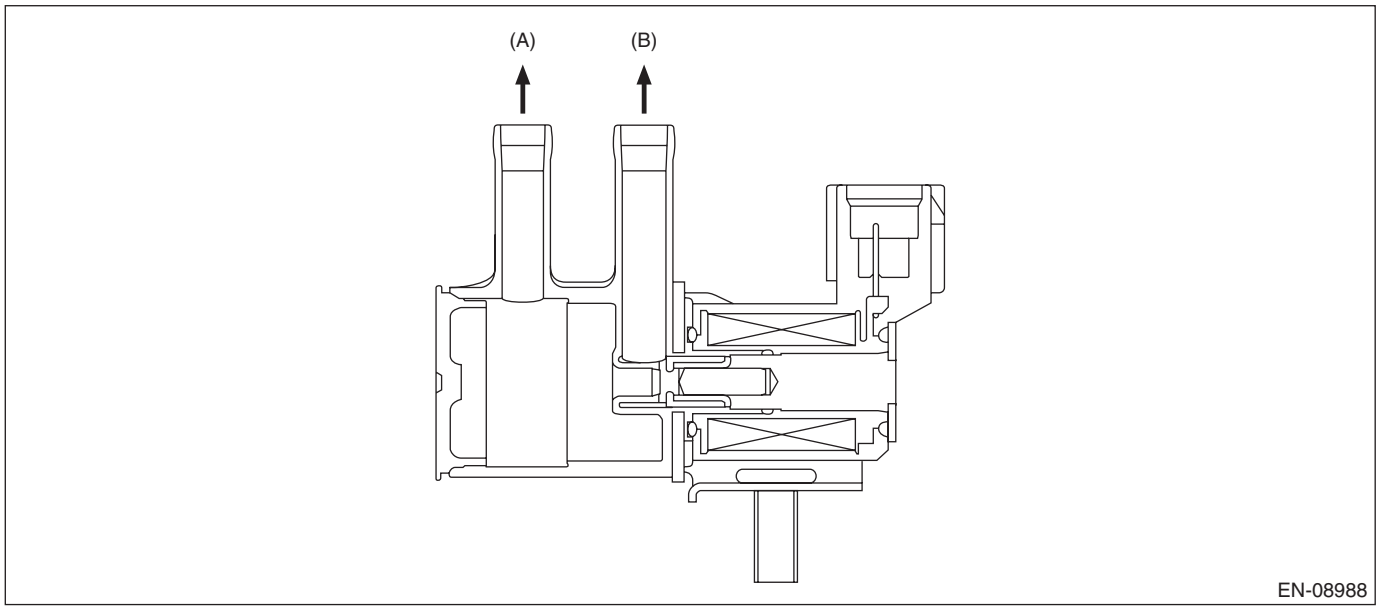
NOTE:
For the detection standard, refer to DTC P0455. <Ref. to GD(H4DO w/o HEV)-119, DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CY:DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the purge control solenoid valve.
Judge as NG when the ECM output level differs from the actual terminal level.

2. COMPONENT DESCRIPTION



(A) To canister (B) To intake manifold

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
12 V battery system voltage	≥ 10.9 V
Purge control duty ratio	< 75%

4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Measured solenoid valve for purge control voltage	≤ 12 V battery system voltage × 0.34 V

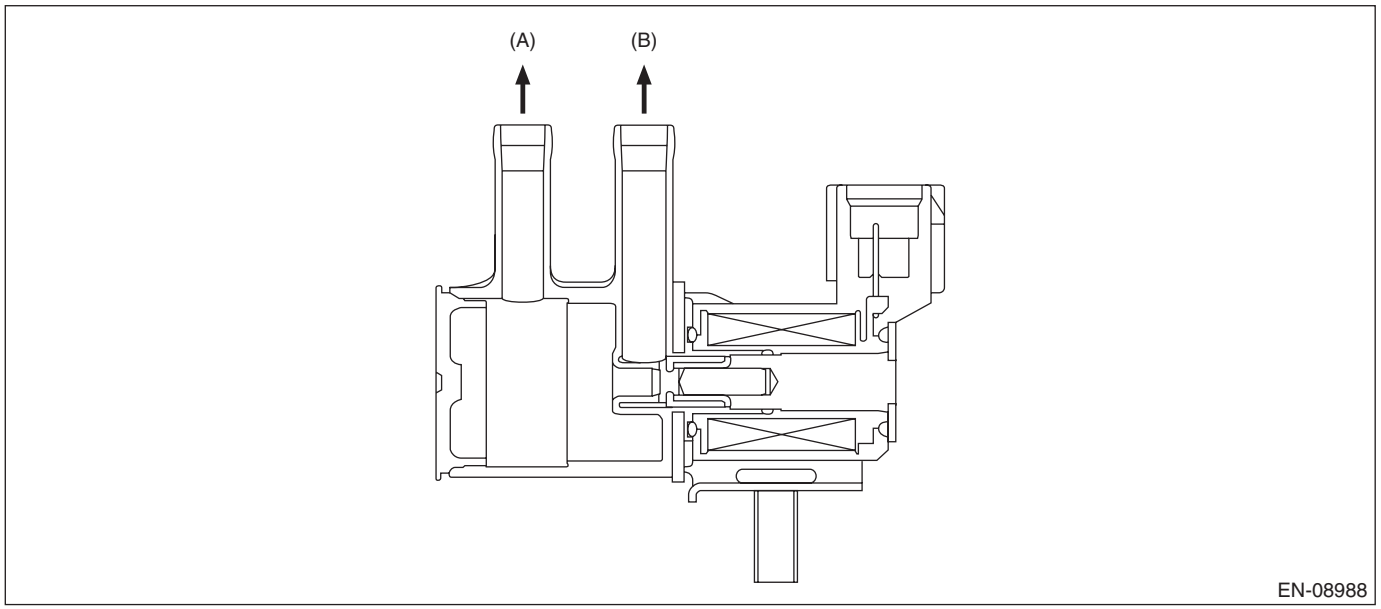
Time Needed for Diagnosis: 2500 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

CZ:DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the purge control solenoid valve.
Judge as NG when the ECM output level differs from the actual terminal level.

2. COMPONENT DESCRIPTION



(A) To canister (B) To intake manifold

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
12 V battery system voltage	≥ 10.9 V
Purge control duty ratio	≥ 25%

4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Measured solenoid valve for purge control current	≥ 12 A

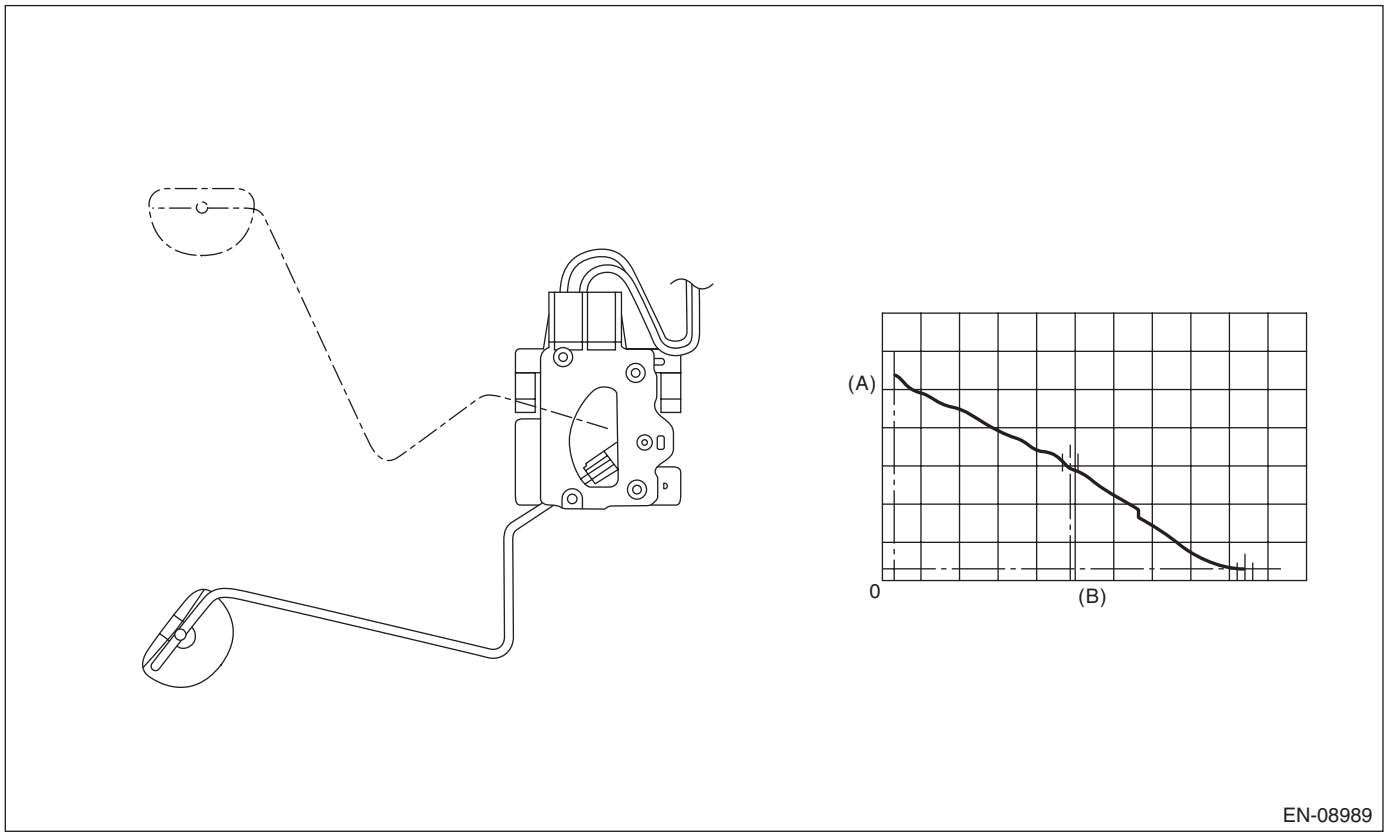
Time Needed for Diagnosis: 2500 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

DA:DTC P0461 FUEL LEVEL SENSOR "A" CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect malfunctions of the fuel level sensor output property.
If the fuel level does not vary in a particular driving condition / engine condition where it should, judge as NG.

2. COMPONENT DESCRIPTION



(A) Fuel level (B) Resistance

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Accumulated amount of intake air	≥ 165375 g (5832.78 oz)
Max. – min. values of fuel level output	< 2.6 ℓ (0.69 US gal, 0.57 Imp gal)
Battery voltage	≥ 10.9 V
Engine speed	< 10000 rpm
Elapsed time after starting the engine	≥ 5000 ms

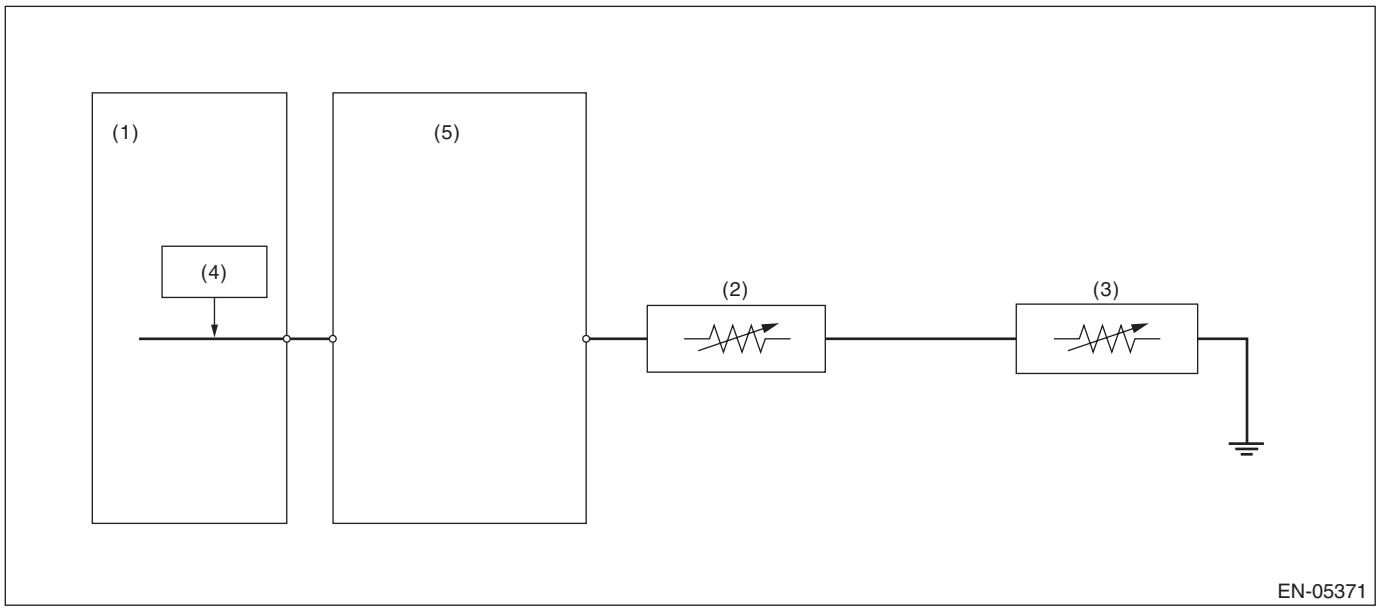
Time Needed for Diagnosis: Less than 1 second
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

DB:DTC P0462 FUEL LEVEL SENSOR “A” CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel level sensor. Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Fuel level sensor
(3) Fuel sub level sensor
(4) Detecting circuit
(5) Body integrated unit

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 3000 ms

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously after the enable conditions have been established.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.383 V

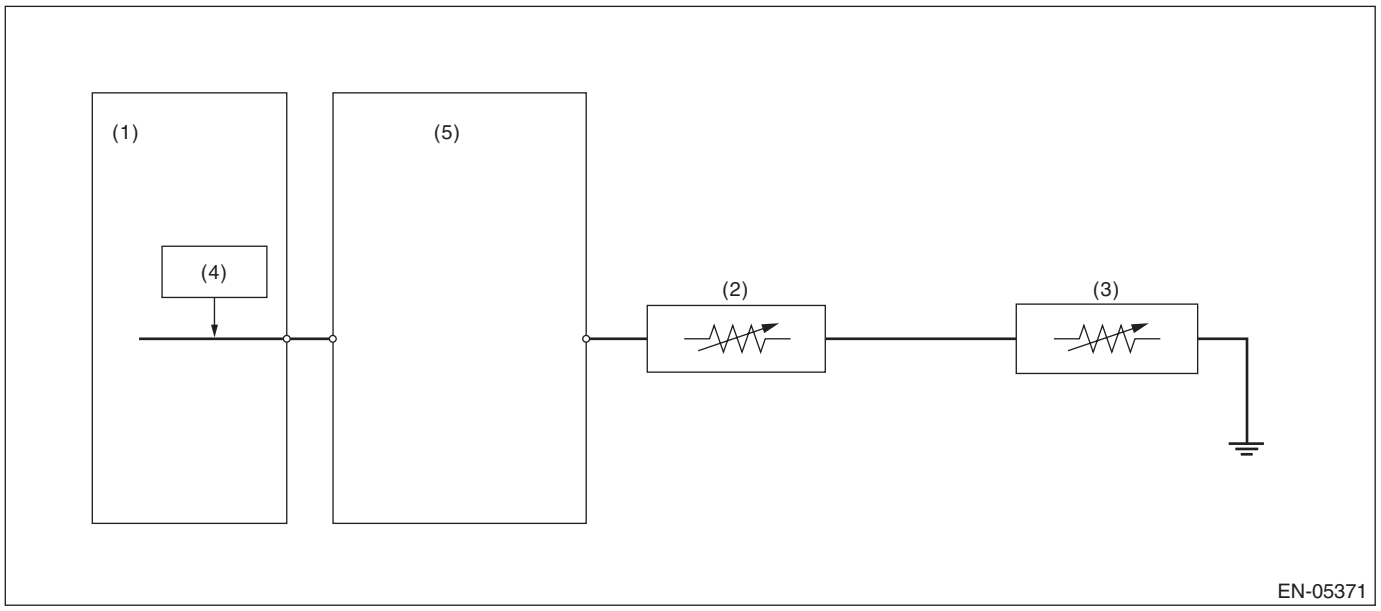
Time Needed for Diagnosis: 2500 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

DC:DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel level sensor. Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Fuel level sensor
(3) Fuel sub level sensor
(4) Detecting circuit
(5) Body integrated unit

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 6.632 V

Time Needed for Diagnosis: 1000 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

DD:DTC P0500 VEHICLE SPEED SENSOR “A”

1. OUTLINE OF DIAGNOSIS

Judge as NG when outside of the judgment value.
Judge NG when the received data from VDCCM&H/U is abnormal vehicle speed, and the vehicle speed data is impossible.

2. COMPONENT DESCRIPTION

Vehicle speed signals are taken in to the VDC control module and hydraulic control unit, and normal/erroneous data of the ABS wheel speed sensor is received by CAN communication from the VDC control module and hydraulic control unit.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Speed of RH wheel received from VDC control module & hydraulic control unit	≥ 300 km/h (186.4 MPH)

Time Needed for Diagnosis: 2500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DE:DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED

1. OUTLINE OF DIAGNOSIS

Detect the malfunction that actual engine speed is not close to target engine speed during idling. Judge as NG when actual engine speed is not close to target engine speed during idling.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	≥ 60 °C (140 °F)
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75.1 kPa (563 mmHg, 22.2 inHg)
Fuel level	≥ 9 ℓ (2.38 US gal, 1.98 Imp gal)
Elapsed time after starting the engine	≥ 10 s
Accelerator pedal position	= 0%
Lambda value (left and right)	≥ 0.85 and < 1.151
After intake manifold pressure changes by 133.3 kPa (1000 mmHg, 39.4 inHg) or more.	> 0 s
Elapsed time after switching neutral position switch to ON/OFF	> 5 s
Vehicle speed	0 km/h (0 MPH)

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling after warming up engine.

4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Actual engine speed – Targeted engine speed	< –100 rpm
Feedback compensation for ISC	Max.

Time Needed for Diagnosis: 15 s × 1 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

DF:DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED

1. OUTLINE OF DIAGNOSIS

Detect the malfunction that actual engine speed is not close to target engine speed during idling. Judge as NG when actual engine speed is not close to target engine speed during idling.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	≥ 60 °C (140 °F)
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75.1 kPa (563 mmHg, 22.2 inHg)
Fuel level	≥ 9 ℓ (2.38 US gal, 1.98 Imp gal)
Elapsed time after starting the engine	≥ 10 s
Accelerator pedal position	= 0%
Lambda value (left and right)	≥ 0.85 and < 1.151
After intake manifold pressure changes by 133.3 kPa (1000 mmHg, 39.4 inHg) or more.	> 0 s
Elapsed time after switching neutral position switch to ON/OFF	> 5 s
Vehicle speed	0 km/h (0 MPH)

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling after warming up engine.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Actual – Target engine speed	≥ 200 rpm
Feedback compensation for ISC	Min.

Time Needed for Diagnosis: 15 s × 1 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

DG:DTC P050A COLD START IDLE AIR CONTROL SYSTEM PERFORMANCE

1. OUTLINE OF DIAGNOSIS

• When cold, the abnormality in the control of target engine speed increase is detected. (P050A)

Judge as NG if the exhaust gas temperature diagnosis or idle speed diagnosis is NG.
• Exhaust gas temperature diagnosis
Judge as NG when the estimated exhausted gas temperature in 14 seconds after the cold start is below the specified value.
• Idle speed diagnosis
Judge as NG when actual engine speed is not close to target engine speed at cold start.

• Detect malfunctions of the catalyst advanced idling retard angle control. (P050B)

Judge as NG when ECM is not controlling the angle properly during catalyst advanced idling retard angle control.
• Final ignition timing diagnosis
Judge as NG when actual retard amount is under the specified value at cold start.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
<Exhaust gas temperature diagnosis>	
Atmospheric pressure	≥ 75.1 kPa (563 mmHg, 22.2 inHg)
Battery voltage	> 10.9 V
Engine condition	In operation
Vehicle speed	≤ 2 km/h (1.2 MPH)
Elapsed time after gear position change (P ←→ D or N ←→ D)	≥ 3000 ms
ISC feedback	In operation
Throttle opening angle	< 0.37 °
Fuel property	Not extremely low volatility
Target retard amount	≥ 0 °CA (CVT model) ≥ 0 °CA (MT model)
<Idle speed diagnosis>	
Atmospheric pressure	≥ 75.1 kPa (563 mmHg, 22.2 inHg)
Battery voltage	> 10.9 V
Engine condition	In operation
Vehicle speed	≤ 2 km/h (1.2 MPH)
Engine coolant temperature	≤ 70 °C (158 °F)
Intake air amount sum value	≤ Value of Map 1
Elapsed time after gear position change (P ←→ D or N ←→ D)	≥ 3000 ms
Throttle opening angle	< 0.37 °
Fuel property	Not extremely low volatility
Elapsed time after starting the engine	≥ 2000 ms
<Final ignition timing diagnosis>	
Atmospheric pressure	≥ 75.1 kPa (563 mmHg, 22.2 inHg)
Battery voltage	> 10.9 V
Engine condition	In operation
Vehicle speed	≤ 2 km/h (1.2 MPH)
Engine coolant temperature	≤ 70 °C (158 °F)
Intake air amount sum value	≤ Value of Map 2
Elapsed time after gear position change (P ←→ D or N ←→ D)	≥ 3000 ms
Throttle opening angle	< 0.37 °
Fuel property	Not extremely low volatility
Target retard amount	≥ Value from Map 3

Map 1

Engine coolant temperature at engine starting °C (°F)	–40 (–40)	–30 (–22)	–20 (–4)	–10 (14)	0 (32)	10 (50)	20 (68)	30 (86)
Intake air amount sum value g (oz)	770 (27.16)	690 (24.34)	620 (21.87)	560 (19.75)	510 (17.99)	450 (15.87)	390 (13.76)	390 (13.76)

Engine coolant temperature at engine starting °C (°F)	40 (104)	50 (122)	60 (140)	70 (158)	80 (176)	90 (194)	100 (212)	110 (230)
Intake air amount sum value g (oz)	390 (13.76)	390 (13.76)	390 (13.76)	390 (13.76)	390 (13.76)	390 (13.76)	390 (13.76)	390 (13.76)

Map 2

Engine coolant temperature at engine starting °C (°F)	–40 (–40)	–30 (–22)	–20 (–4)	–10 (14)	0 (32)	10 (50)	20 (68)	30 (86)
Intake air amount sum value g (oz)	770 (27.16)	690 (24.34)	620 (21.87)	560 (19.75)	510 (17.99)	450 (15.87)	390 (13.76)	390 (13.76)

Engine coolant temperature at engine starting °C (°F)	40 (104)	50 (122)	60 (140)	70 (158)	80 (176)	90 (194)	100 (212)	110 (230)
Intake air amount sum value g (oz)	390 (13.76)	390 (13.76)	390 (13.76)	390 (13.76)	390 (13.76)	390 (13.76)	390 (13.76)	390 (13.76)

Map 3

Engine coolant temperature	-40 °C (-40 °F)	-30 °C (-22 °F)	-20 °C (-4 °F)	-10 °C (14 °F)	0 °C (32 °F)	10 °C (50 °F)	20 °C (68 °F)	30 °C (86 °F)	40 °C (104 °F)	50 °C (122 °F)	60 °C (140 °F)
Target retard amount (CVT model)	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA
Target retard amount (MT model)	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA	5 °CA

3. GENERAL DRIVING CYCLE

Perform the diagnosis at cold start.

4. DIAGNOSTIC METHOD

• Exhaust gas temperature diagnosis

Calculate the estimated exhaust gas temperature when the diagnostic enable condition is established. Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Estimated exhaust gas temperature	< Value of Map 4

Map 4

Engine coolant temperature at engine starting	-40 °C (-40 °F)	-30 °C (-22 °F)	-20 °C (-4 °F)	-10 °C (14 °F)	0 °C (32 °F)	10 °C (50 °F)	20 °C (68 °F)	30 °C (86 °F)	40 °C (104 °F)	50 °C (122 °F)	60 °C (140 °F)
Threshold value (CVT model)	0 °C (32 °F)	0 °C (32 °F)	0 °C (32 °F)	0 °C (32 °F)	0 °C (32 °F)	0 °C (32 °F)	0 °C (32 °F)	0 °C (32 °F)	0 °C (32 °F)	0 °C (32 °F)	0 °C (32 °F)
Threshold value (MT model)	0 °C (32 °F)	0 °C (32 °F)	0 °C (32 °F)	0 °C (32 °F)	0 °C (32 °F)	0 °C (32 °F)	0 °C (32 °F)	0 °C (32 °F)	0 °C (32 °F)	0 °C (32 °F)	0 °C (32 °F)

Time Needed for Diagnosis: 14 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Idle speed diagnosis

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Actual engine speed – Target engine speed	< – 125 rpm

Time Needed for Diagnosis: 6000 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Final ignition timing diagnosis

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Final ignition timing – ignition timing during CSERS* *: Ignition timing during CSERS (Cold Start Emission Reduction Strategy) = Base ignition timing – retard amount	> Value of Map 5

Map 5

Engine coolant temperature	-40 °C (-40 °F)	-30 °C (-22 °F)	-20 °C (-4 °F)	-10 °C (14 °F)	0 °C (32 °F)	10 °C (50 °F)	20 °C (68 °F)	30 °C (86 °F)	40 °C (104 °F)	50 °C (122 °F)	60 °C (140 °F)
Threshold value (CVT model)	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA
Threshold value (MT model)	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA

Time Needed for Diagnosis: 7000 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

DH:DTC P050B COLD START IGNITION TIMING PERFORMANCE

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P050A. <Ref. to GD(H4DO w/o HEV)-133, DTC P050A COLD START IDLE AIR CONTROL SYSTEM PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DI: DTC P0512 STARTER REQUEST CIRCUIT

1. OUTLINE OF DIAGNOSIS

Detect abnormal continuity in the starter SW1.
Judge as ON NG when the starter SW 1 signal remains ON.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V
Engine speed	> 500 rpm

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Starter SW1 voltage	≥ Battery voltage × 0.85

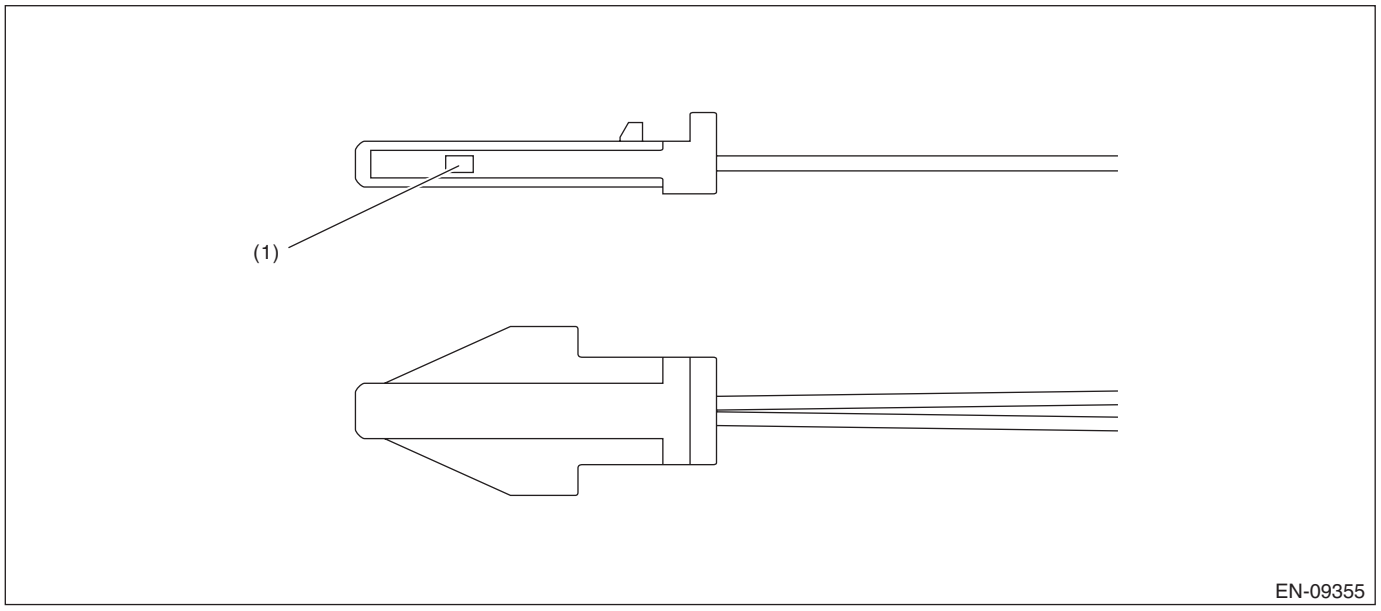
Time Needed for Diagnosis: 30000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DJ:DTC P0516 BATTERY TEMPERATURE SENSOR CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of battery temperature sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) Sensor element

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	> 1000 ms
Engine speed	> 500 rpm
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.1294 V

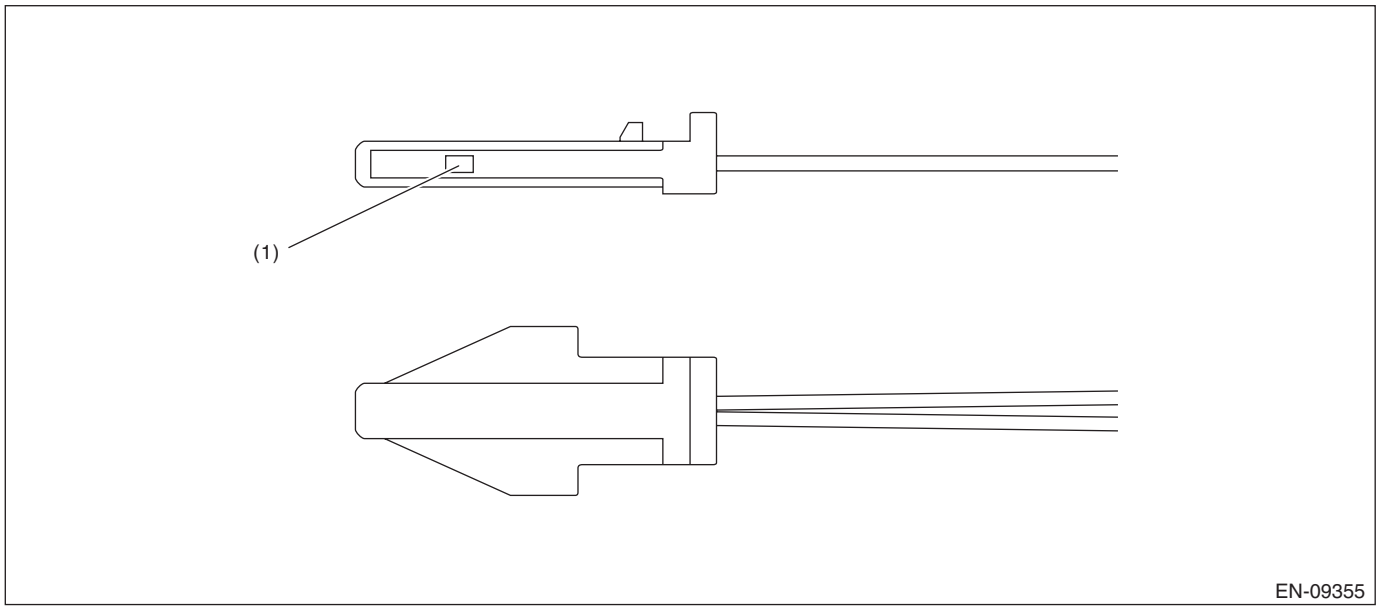
Time Needed for Diagnosis: 500 ms
Malfunction Indicator Light Illumination: Malfunction indicator light does not illuminate when malfunction occurs.

DK:DTC P0517 BATTERY TEMPERATURE SENSOR CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of battery temperature sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) Sensor element

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	> 1000 ms
Engine speed	> 500 rpm
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.668 V

Time Needed for Diagnosis: 500 ms
Malfunction Indicator Light Illumination: Malfunction indicator light does not illuminate when malfunction occurs.

DL:DTC P0560 SYSTEM VOLTAGE

1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of back-up power supply circuit.
Judge as NG when the backup power voltage is low.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Engine speed	≥ 500 rpm

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Voltage of back-up power supply	≤ 3.5 V

Time Needed for Diagnosis: 2500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DM:DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of microcomputer (RAM).
If it is possible to write data to the whole area of RAM in the initial routine, and is possible to read the same data, it is judged as OK, and if not, NG.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

Diagnosis with the initial routine.

3. GENERAL DRIVING CYCLE

Perform the diagnosis as soon as the ignition switch is turned to ON.

4. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Write the specified value into the RAM.	The written value cannot be read.

Time Needed for Diagnosis: Less than 0.512 second
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DN:DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR

1. OUTLINE OF DIAGNOSIS

Judge as NG when SUM value of ROM is outside the standard value.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
ECM initialization	Run

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

Judge as NG if the criteria below are met.

Judgment Value

Malfunction Criteria	Threshold Value
SUM value of ROM	Malfunction

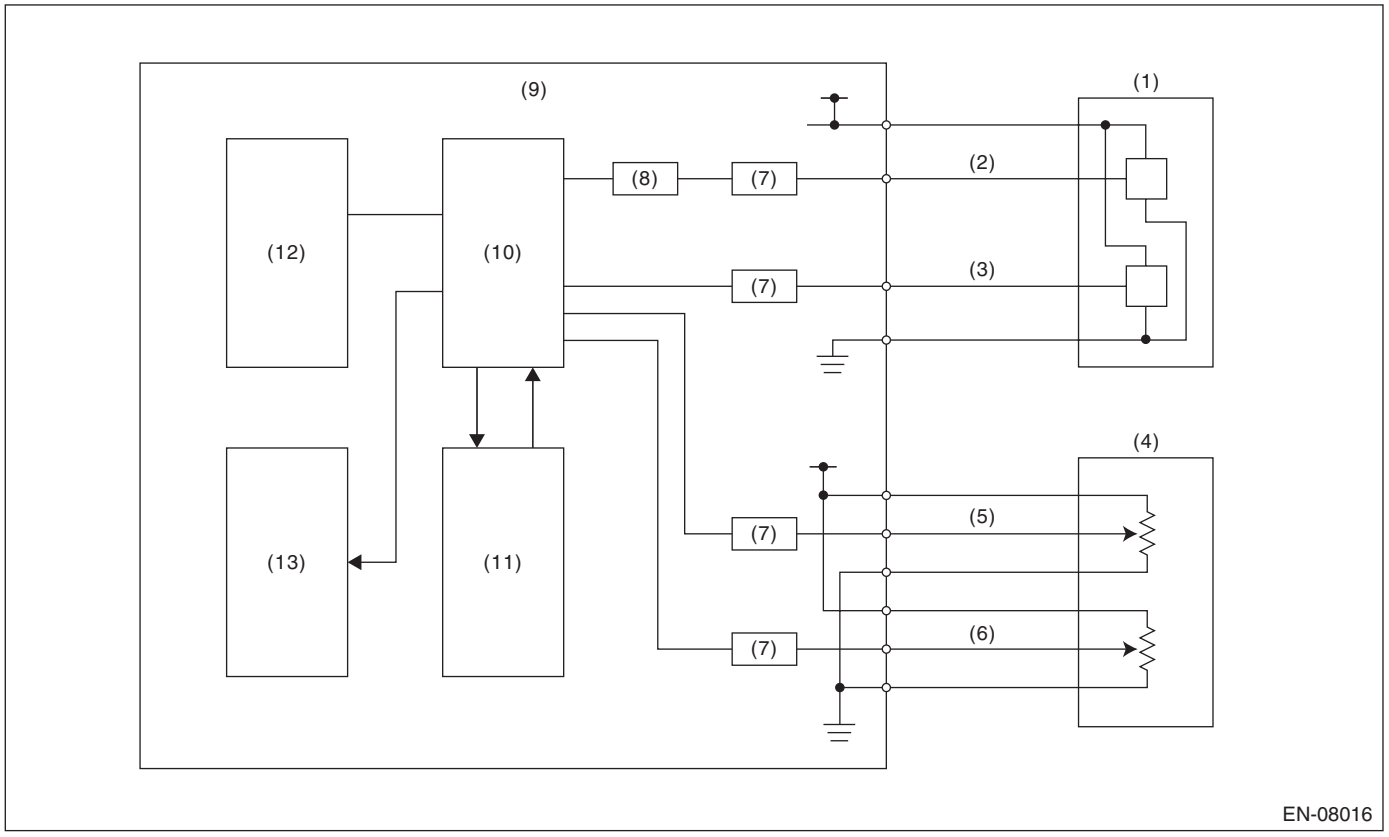
Time Needed for Diagnosis: 0.512 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DO:DTC P0606 CONTROL MODULE PROCESSOR

1. OUTLINE OF DIAGNOSIS

Judge as NG when any one of the followings is established.
(1) If the CPU operation is abnormal (instruction/flow check).
(2) If the output IC operation is abnormal (output driver malfunction).

2. COMPONENT DESCRIPTION



(1) Throttle position sensor
(2) Throttle position sensor 1
(3) Throttle position sensor 2
(4) Accelerator pedal position sensor
(5) Accelerator pedal position sensor 1
(6) Accelerator pedal position sensor 2
(7) I/F circuit
(8) Amplifier circuit
(9) Engine control module (ECM)
(10) CPU
(11) Monitoring IC
(12) EEPROM
(13) Output IC

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
(1) Ignition switch	ON
(1) ETC control	Permission
(2) Ignition switch	ON
(2) Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as OK and clear the NG if any of the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
(1) Main CPU calculation result	The result and expected value match
(2) Communication between output ICs	Possible to communicate
(3) Step of calculation	Expected step of calculation
(4)-1 Motor relay cut-off signal from observation IC	ON
(4)-2 As defined by	
Instruction error	Detect
or	
Instruction error	Detect
(5) Driver IC bus signal	Did not change
(6) Written data in the CAN register	≠ Read data

Time Needed for Diagnosis:

(1): 2 time(s)
(2): 512 ms
(3): 504 ms
(4): 48 ms
(5): 2500 ms
(6): Less than 1 s

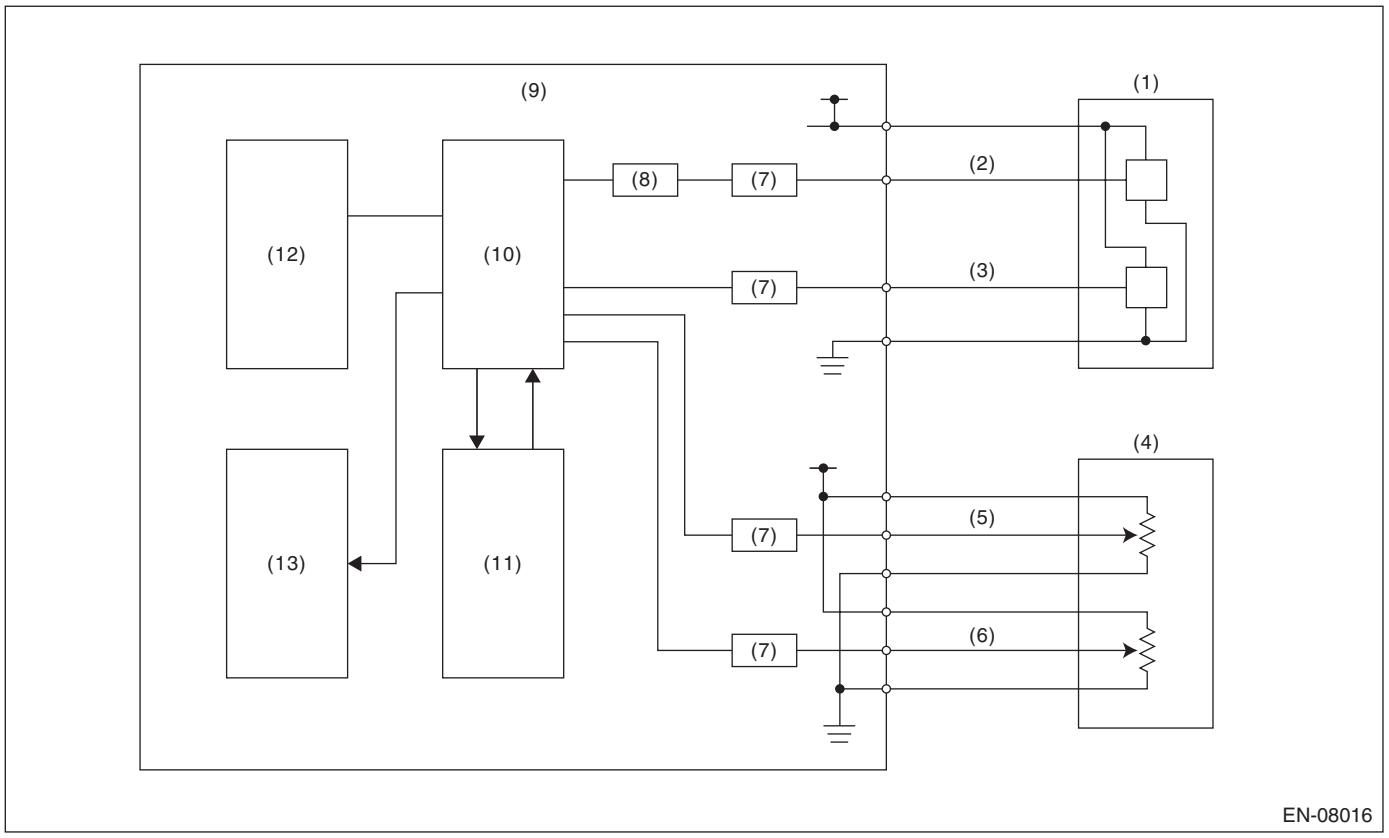
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DP:DTC P060A INTERNAL CONTROL MODULE MONITORING PROCESSOR PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Judge as NG when the monitoring IC operation is abnormal. (Monitoring IC malfunction)

2. COMPONENT DESCRIPTION



(1) Throttle position sensor
(2) Throttle position sensor 1
(3) Throttle position sensor 2
(4) Accelerator pedal position sensor
(5) Accelerator pedal position sensor 1
(6) Accelerator pedal position sensor 2
(7) I/F circuit
(8) Amplifier circuit
(9) Engine control module (ECM)
(10) CPU
(11) Monitoring IC
(12) EEPROM
(13) Output IC

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
(1) Battery voltage	≥ 6 V
(1) CPU intentionally sends a motor cut-off command to the observation IC	ON
(2) Battery voltage	≥ 6 V
(2) CPU intentionally sends an incorrect data	ON
(3) Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as OK and clear the NG when the malfunction criteria below are met.

Judgment Value

Malfunction Criteria	Threshold Value
(1) Throttle position Memory throttle position when monitoring	≥ 2 °
(2) Motor cut-off signal from observation IC	= Not Detected
(3) Written data in the observation IC register	≠ Not Detected

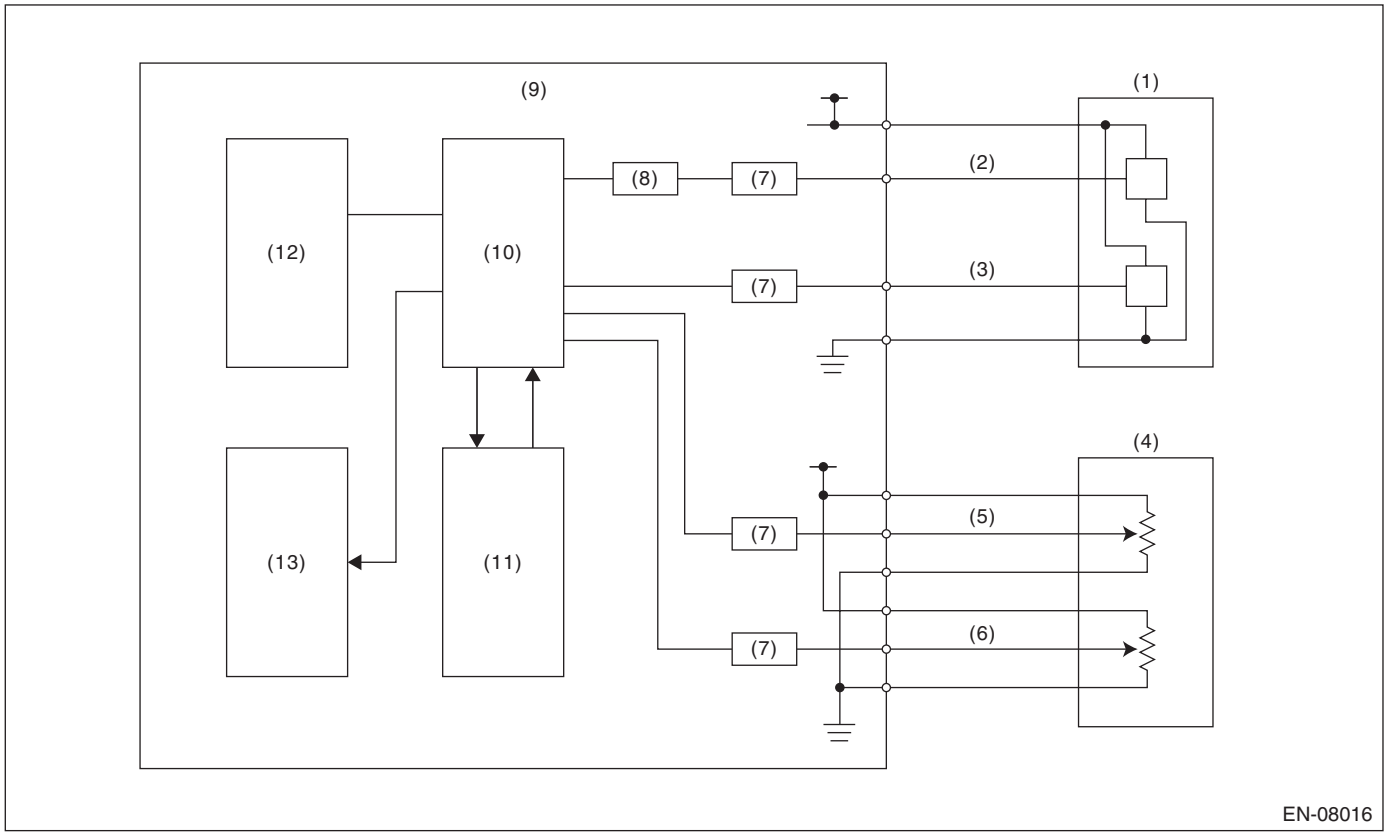
Time Needed for Diagnosis:
(1): 24 ms
(2): 24 ms
(3): 200 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DQ:DTC P060B INTERNAL CONTROL MODULE A/D PROCESSING PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Judge as NG when any one of the followings is established.
(1) If the input amplifier circuit of throttle position sensor 1 is abnormal (quadruple amplification problem).
(2) If the A/D converter operation is abnormal (ADC malfunction).

2. COMPONENT DESCRIPTION



(1) Throttle position sensor
(2) Throttle position sensor 1
(3) Throttle position sensor 2
(4) Accelerator pedal position sensor
(5) Accelerator pedal position sensor 1
(6) Accelerator pedal position sensor 2
(7) I/F circuit
(8) Amplifier circuit
(9) Engine control module (ECM)
(10) CPU
(11) Monitoring IC
(12) EEPROM
(13) Output IC

3. ENABLE CONDITIONS

Diagnosis 1

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V
Target voltage	= 0 V

Diagnosis 2

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V
Target voltage	= 5 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Diagnosis 1

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Actual voltage	> 0.01953125 V

Time Needed for Diagnosis: 200 ms

Diagnosis 2

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Actual voltage	> 4.979248047 V

Time Needed for Diagnosis: 200 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DR:DTC P0616 STARTER RELAY CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect abnormal continuity in the starter SW.
Judge as OFF NG when the starter SW signal remains OFF.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V
Engine speed increases from 0 to more than 500 rpm	
Vehicle speed	< 1 km/h
Starter relay command	ON

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

Judge as OFF NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
The ECM did not detect the following. Measured ECM input voltage which is supplied from 12V battery system through the starter relay	≥ 12V battery system voltage × 0.85V

Time Needed for Diagnosis: Less than 1 second
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DS:DTC P0617 STARTER RELAY CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect abnormal continuity in the starter SW.
Judge as ON NG when the starter SW signal remains ON.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V
Engine speed	> 500 rpm
Starter relay command	OFF

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Measured ECM input voltage which is supplied from 12V battery system through the starter relay	≥ 12V battery system voltage × 0.85V

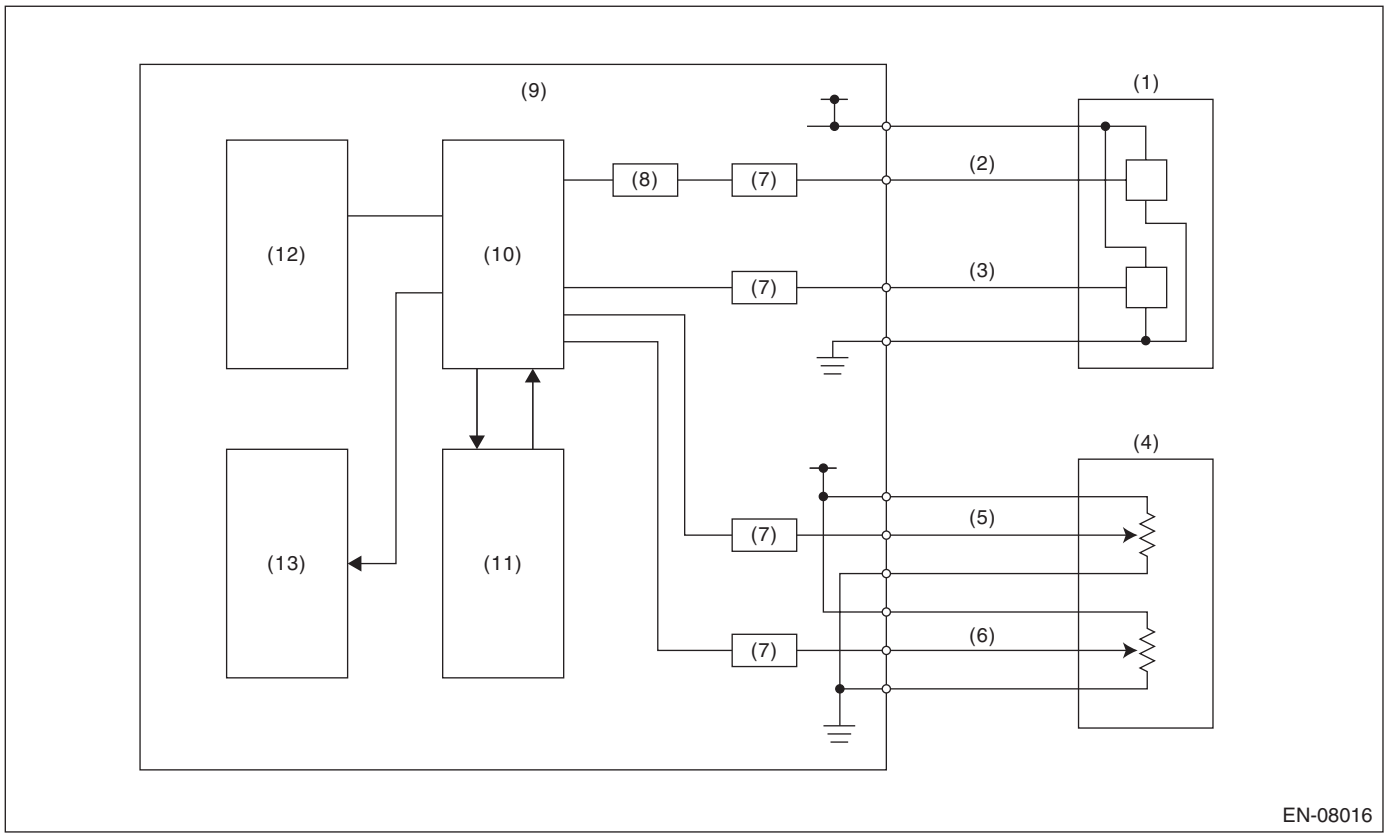
Time Needed for Diagnosis: 30000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DT:DTC P062F INTERNAL CONTROL MODULE EEPROM ERROR

1. OUTLINE OF DIAGNOSIS

Judge as NG when the EEPROM operation is abnormal. (EEPROM malfunction)

2. COMPONENT DESCRIPTION



(1) Throttle position sensor
(2) Throttle position sensor 1
(3) Throttle position sensor 2
(4) Accelerator pedal position sensor
(5) Accelerator pedal position sensor 1
(6) Accelerator pedal position sensor 2
(7) I/F circuit
(8) Amplifier circuit
(9) Engine control module (ECM)
(10) CPU
(11) Monitoring IC
(12) EEPROM
(13) Output IC

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as OK and clear the NG when the malfunction criteria below are met.

Judgment Value

Malfunction Criteria	Threshold Value
Writing-check (EEPROM)	Error

Time Needed for Diagnosis: 2 times
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DU:DTC P0685 ECM/PCM POWER RELAY CONTROL CIRCUIT/OPEN

1. OUTLINE OF DIAGNOSIS

Detect the main relay stuck to ON.
Judge as NG when ECM keeps operating for more than predetermined time although the main relay does not turn to OFF after ignition switch is turned to OFF.

2. COMPONENT DESCRIPTION

The main relay controls current of coils by receiving instructions from the ignition switch and ELCM to switch ECM to ON/OFF.

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Main relay	OFF instruction

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once when the enable conditions are established with the ignition switch OFF → ON.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
ECM status	In operation

Time Needed for Diagnosis: 2500 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

DV:DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST)

1. OUTLINE OF DIAGNOSIS

Judge as NG when there is CAN communication with the TCM and there is a MIL lighting request.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
MIL lighting request from TCM	Yes

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V

Time Needed for Diagnosis: 128 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DW:DTC P081A STARTER DISABLE CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect abnormal continuity in the starter cut relay.
Judge as NG when the starter cut relay output line is open.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V
Engine speed	Increase from 0 rpm to 500 rpm or more
Vehicle speed	< 1 km/h (0.6 MPH)
Starter cut relay command	OFF

3. GENERAL DRIVING CYCLE

Perform the diagnosis only once after the enable conditions have been established.

4. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Starter cut relay control voltage that exceeds battery voltage × 0.34	Not detected

Time Needed for Diagnosis: Less than 1 second
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DX:DTC P0851 PARK/NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of neutral SW.
Judge as NG when the ECM neutral terminal input differs from the reception data from TCM.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Starter relay feedback voltage	< Battery voltage × 0.35
Engine speed	≥ 500 rpm
Data received from TCM	≠ “P” range/“N” range

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Neutral position switch voltage	≤ Battery voltage × 0.19

Time Needed for Diagnosis: 64 ms × 100 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

DY:DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of neutral SW.
Judge as NG when there is no change in the neutral SW even if the driving shift was applied. (There is neutral SW ON/OFF inversion from the vehicle speed and engine speed.)

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Starter relay	OFF

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

4. DIAGNOSTIC METHOD

Judge as NG when times between the change of neutral SW and the establishment of standard value below is predetermined times or more.

Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal (transit time from a to b as below)	LOW (ON) continues.
Change of driving condition	a) to b)
a) Engine speed 550 rpm — 850 rpm & vehicle speed 0 km/h (0 MPH)	
b) Engine speed 1550 rpm — 2100 rpm & vehicle speed ≥ 64 km/h (39.8 MPH)	

Time Needed for Diagnosis: 3 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.
Time Needed for Diagnosis: Less than 1 second

DZ:DTC P0852 PARK/NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of neutral SW.
Judge as NG when the ECM neutral terminal input differs from the reception data from TCM.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Starter relay feedback voltage	< Battery voltage × 0.35
Engine speed	≥ 500 rpm
Data received from TCM	≠ “P” range/“N” range

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Neutral position switch voltage	≤ Battery voltage × 0.6

Time Needed for Diagnosis: 64 ms × 100 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

EA:DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of neutral SW.
Judge as NG when there is no change in the neutral SW even if the driving shift was applied. (There is neutral SW ON/OFF inversion from the vehicle speed and engine speed.)

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Starter relay	OFF

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

4. DIAGNOSTIC METHOD

Judge as NG when times between the change of neutral SW and the establishment of standard value below is predetermined times or more.

Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal (transit time from a to b as below)	HIGH (OFF) continues.
Change of driving condition	a) to b)
a) Engine speed 550 rpm — 850 rpm & vehicle speed 0 km/h (0 MPH)	
b) Engine speed 1550 rpm — 2100 rpm & vehicle speed ≥ 64 km/h (39.8 MPH)	

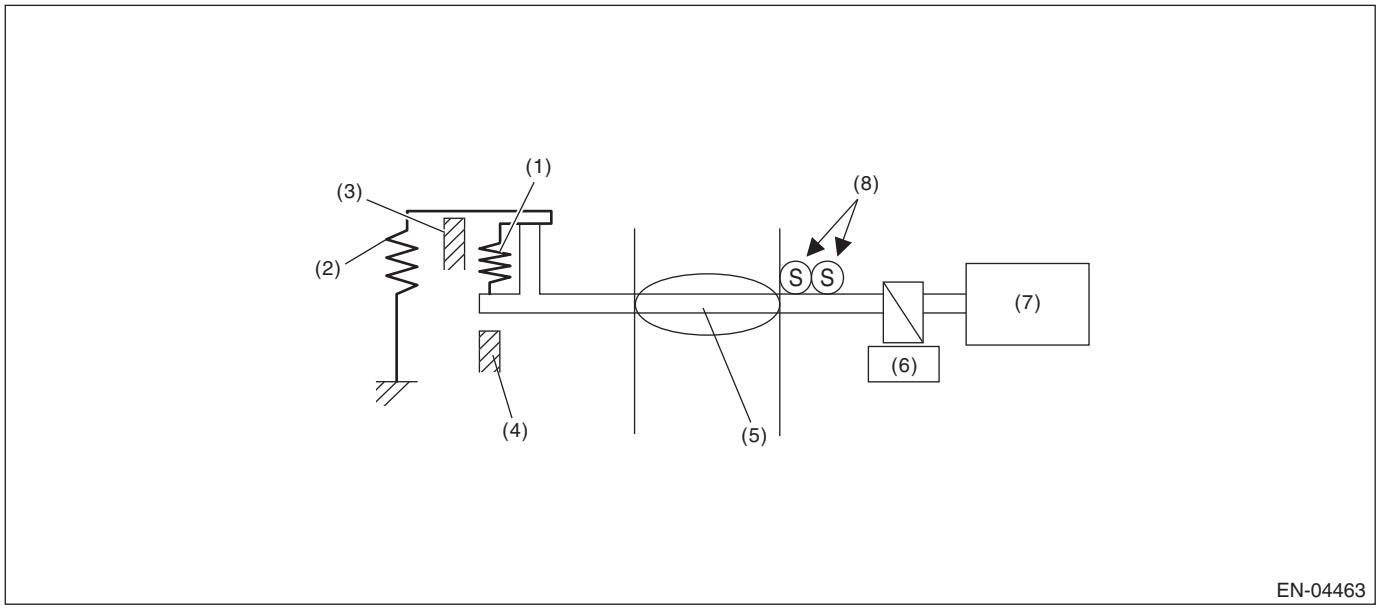
Time Needed for Diagnosis: 3 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

EB:DTC P1160 RETURN SPRING FAILURE

1. OUTLINE OF DIAGNOSIS

Judge as NG when the valve is opened more than the default opening angle, but does not move to the close direction with the motor power stopped.

2. COMPONENT DESCRIPTION



(1) Opener spring
(2) Return spring
(3) Intermediate stopper
(4) Full closed stopper
(5) Throttle valve
(6) Gear
(7) DC motor
(8) Main and sub throttle position sensor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V
Elapsed time after throttle control power supply off	= 1.6 s

4. GENERAL DRIVING CYCLE

- Ignition switch ON → OFF
- Ignition switch OFF → ON (Only after clearing memory)

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Throttle position (Main Sensor) at power supply off' – Throttle position (Main Sensor)	< 2 °

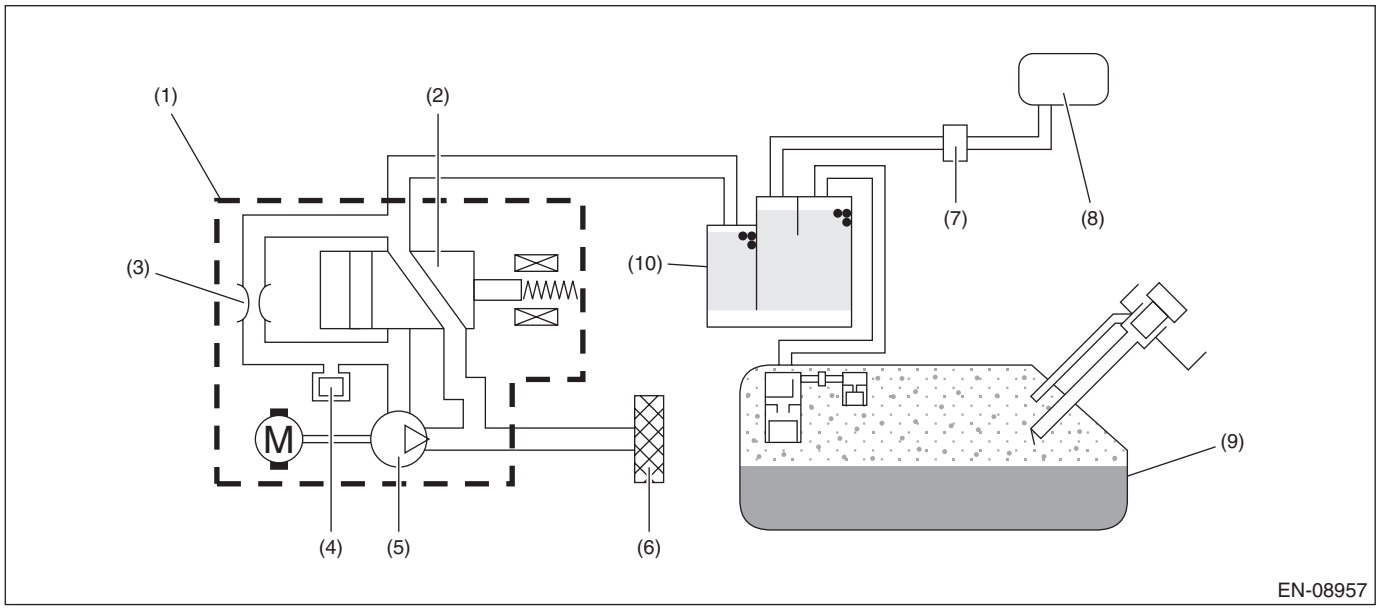
Time Needed for Diagnosis: Less than 1 second
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

EC:DTC P1449 EVAPORATIVE EMISSION CONT. SYS. AIR FILTER CLOG

1. OUTLINE OF DIAGNOSIS

Detect the drain filter clogging by the pressure change during purge introduction.
Judge as drain filter clogging malfunction if the pressure in the evaporative emission system piping suddenly decreases by the purging.

2. COMPONENT DESCRIPTION



(1) ELCM
(2) Switching valve
(3) Reference orifice (0.02 inch orifice)
(4) Pressure sensor
(5) Vacuum pump
(6) Drain filter
(7) Purge control solenoid valve
(8) Intake manifold
(9) Fuel tank
(10) Canister

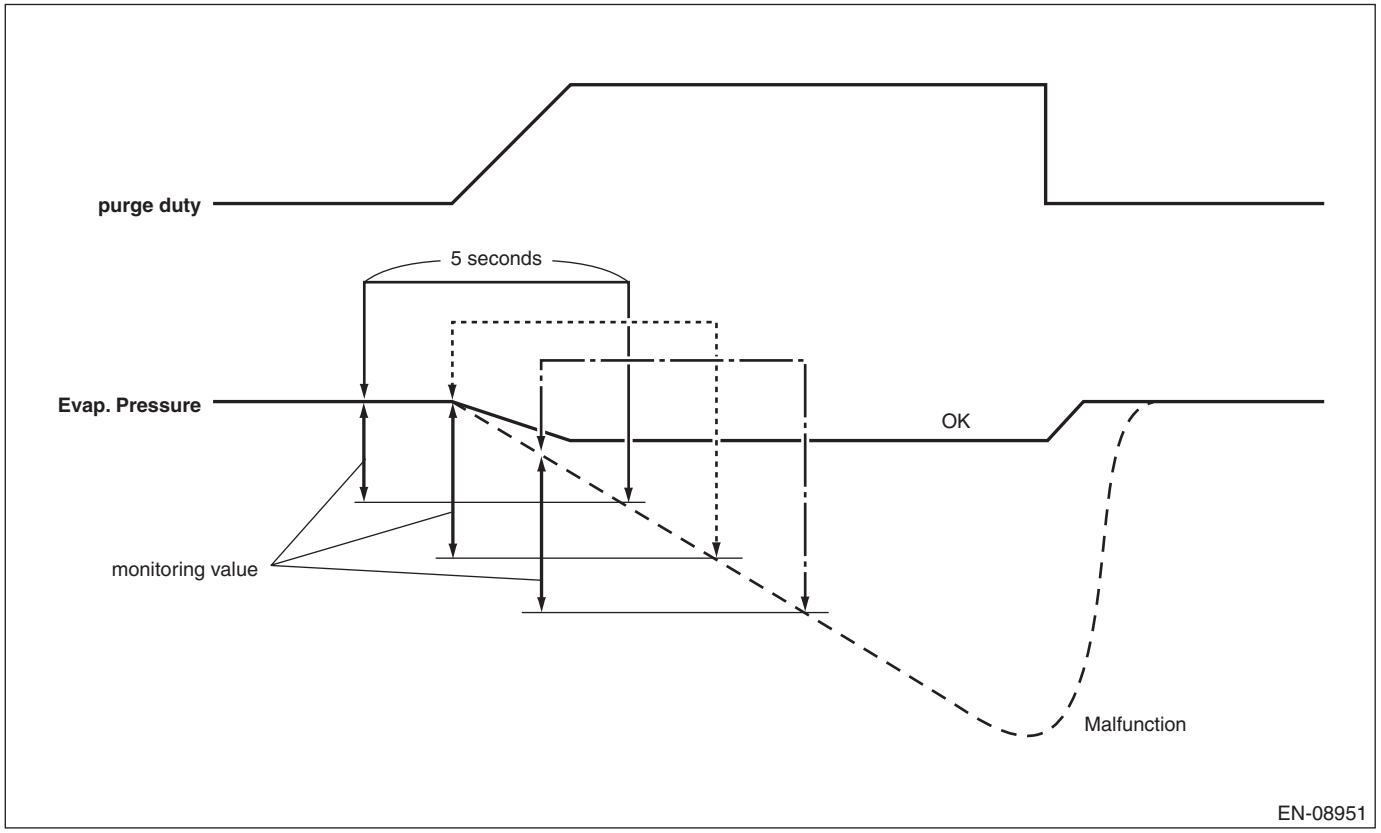
3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after the ignition switch ON	≥ 20000 ms
• ELCM vacuum pump	Not in operation
• ELCM switching valve	Open

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when purging is performed after 20000 ms have passed since the engine started.

5. DIAGNOSTIC METHOD



Calculate the difference between the ELCM pressure sensor output value as of 5 seconds ago and the current one, and if the value is greater than judgment value, detect and judge as filter clogging trouble.
Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
|Pressure sensor output value as of 5 seconds ago – Current pressure sensor output value|	> Value from Map
Number of above conditions established	> 2 time(s)

Map

Vehicle speed km/h (MPH)	0 (0)	20 (12.4)	40 (24.9)	60 (37.3)	80 (49.7)	100 (62.1)	120 (74.6)	300 (186.4)
|Pressure sensor output value as of 5 seconds ago – Current pressure sensor output value| kPa (mmHg, inHg)	1.4 (10.352 , 0.4)	1.4 (10.352 , 0.4)	1.4 (10.352 , 0.4)	1.4 (10.352 , 0.4)	1.4 (10.352 , 0.4)	1.4 (10.352 , 0.4)	1.4 (10.352 , 0.4)	2.4 (18.287 , 0.7)

Time Needed for Diagnosis: Approx. 5 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

ED:DTC P1451 EVAPORATIVE EMISSION CONT. SYS.

1. OUTLINE OF DIAGNOSIS

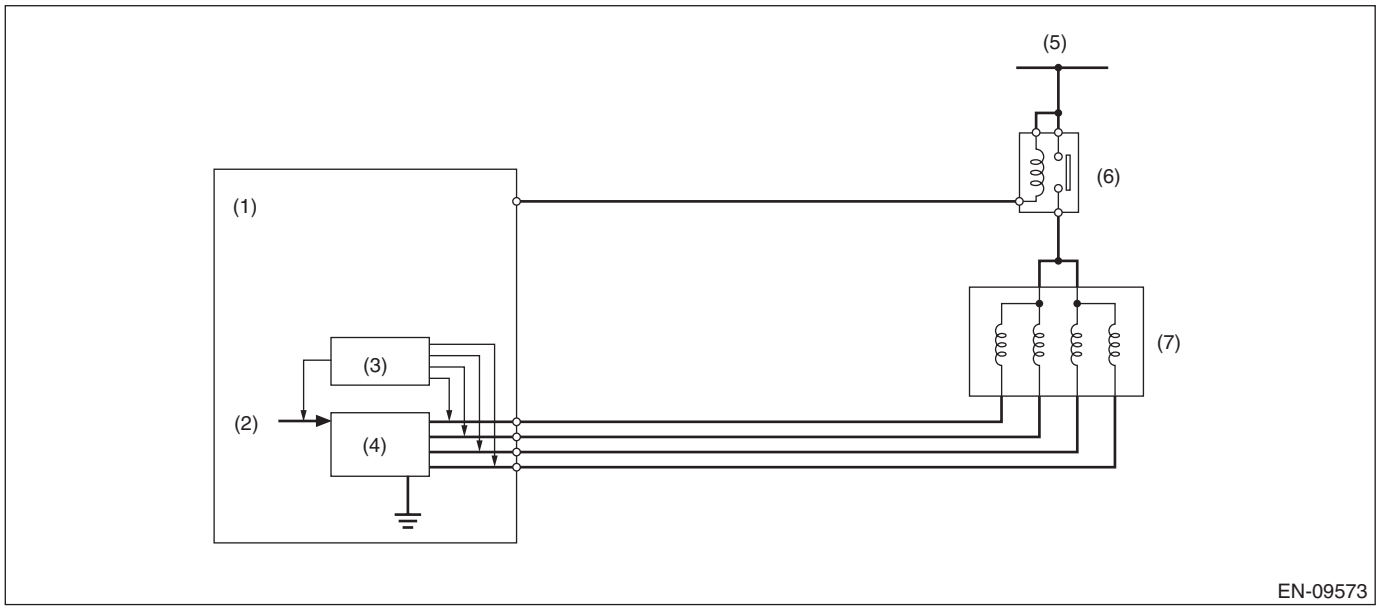
NOTE:
For the detection standard, refer to DTC P0455. <Ref. to GD(H4DO w/o HEV)-119, DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

EE:DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT)

1. OUTLINE OF DIAGNOSIS

- Detects open or short circuit of EGR.
- Judge as NG when the ECM output level differs from the actual terminal level.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Computer unit (CPU)
(3) Detecting circuit
(4) Switch circuit
(5) Battery voltage
(6) Main relay
(7) EGR control valve

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	≥ 1 s
Battery voltage	≥ 10.9 V
EGR control signal	OFF

4. GENERAL DRIVING CYCLE

Perform diagnosis continuously during EGR operation.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
EGR control voltage	≤ Battery voltage × 0.34V

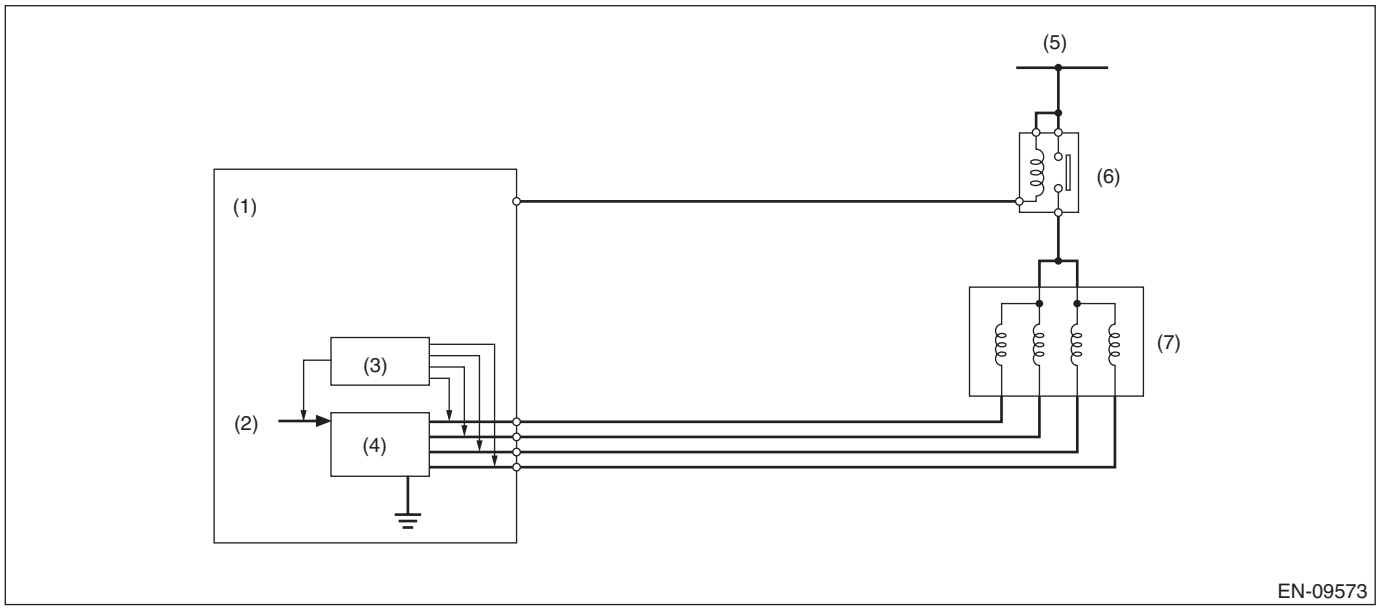
Time Needed for Diagnosis: 2500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

EF:DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT)

1. OUTLINE OF DIAGNOSIS

- Detects open or short circuit of EGR.
- Judge as NG when the ECM output level differs from the actual terminal level.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Computer unit (CPU)
(3) Detecting circuit
(4) Switch circuit
(5) Battery voltage
(6) Main relay
(7) EGR control valve

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	≥ 1 s
Battery voltage	≥ 10.9 V
EGR control signal	OFF

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
EGR control current	≥ 6 A

Time Needed for Diagnosis: 2500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

EG:DTC P1494 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P1492. <Ref. to GD(H4DO w/o HEV)-161, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

EH:DTC P1495 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P1493. <Ref. to GD(H4DO w/o HEV)-162, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

EI: DTC P1496 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P1492. <Ref. to GD(H4DO w/o HEV)-161, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

EJ:DTC P1497 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P1493. <Ref. to GD(H4DO w/o HEV)-162, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

EK:DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P1492. <Ref. to GD(H4DO w/o HEV)-161, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

EL:DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT)

1. OUTLINE OF DIAGNOSIS

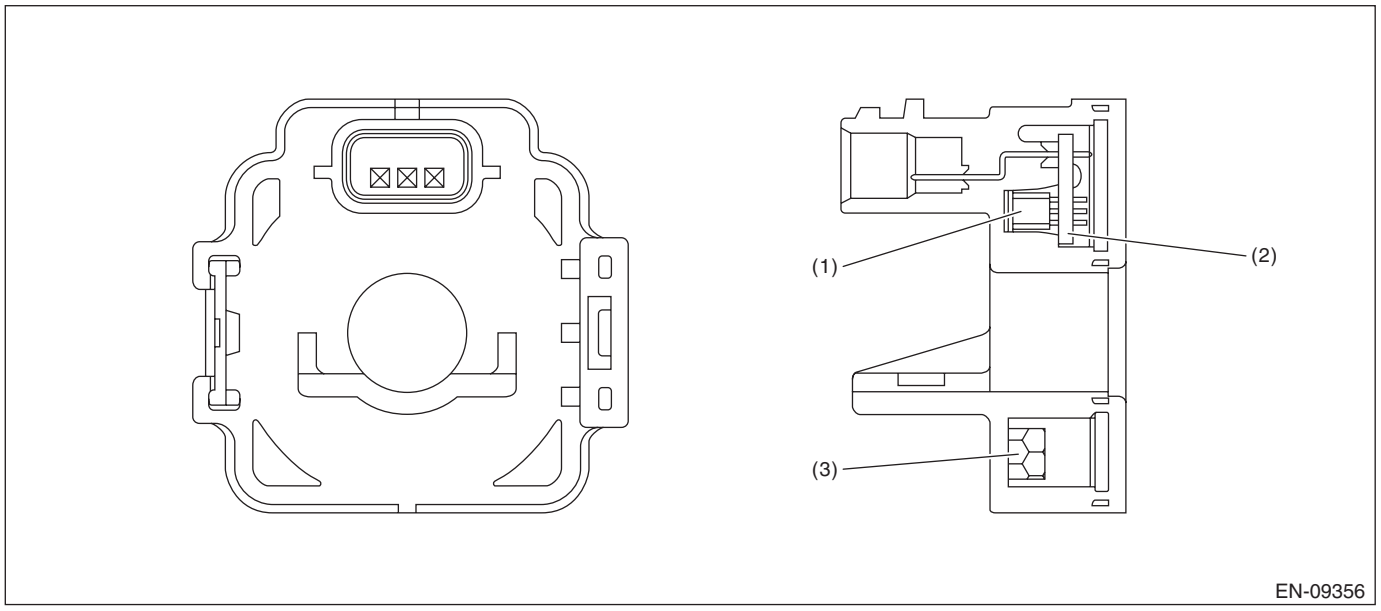
NOTE:
For the detection standard, refer to DTC P1493. <Ref. to GD(H4DO w/o HEV)-162, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

EM:DTC P1530 BATTERY CURRENT SENSOR CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of battery current sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) Hall IC (2) Chip condenser (3) Core

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	> 1000 ms
Engine speed	> 500 rpm
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.2148 V

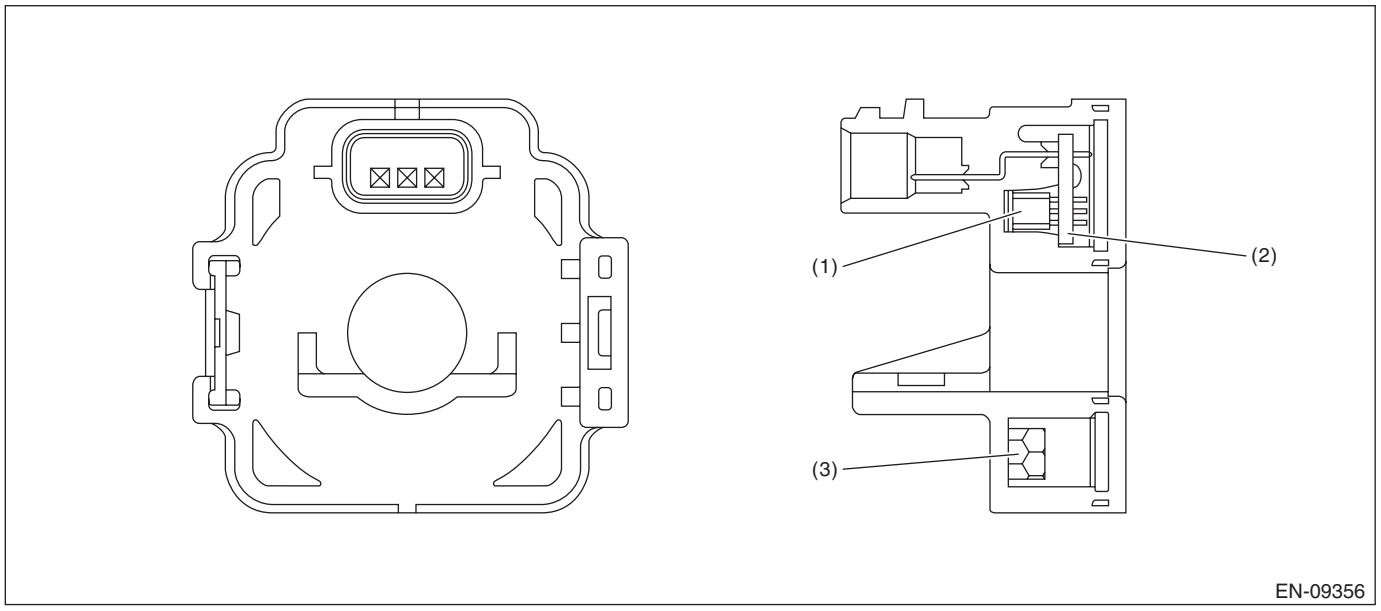
Time Needed for Diagnosis: 500 ms
Malfunction Indicator Light Illumination: Malfunction indicator light does not illuminate when malfunction occurs.

EN:DTC P1531 BATTERY CURRENT SENSOR CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of battery current sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) Hall IC (2) Chip condenser (3) Core

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	> 1000 ms
Engine speed	> 500 rpm
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.717 V

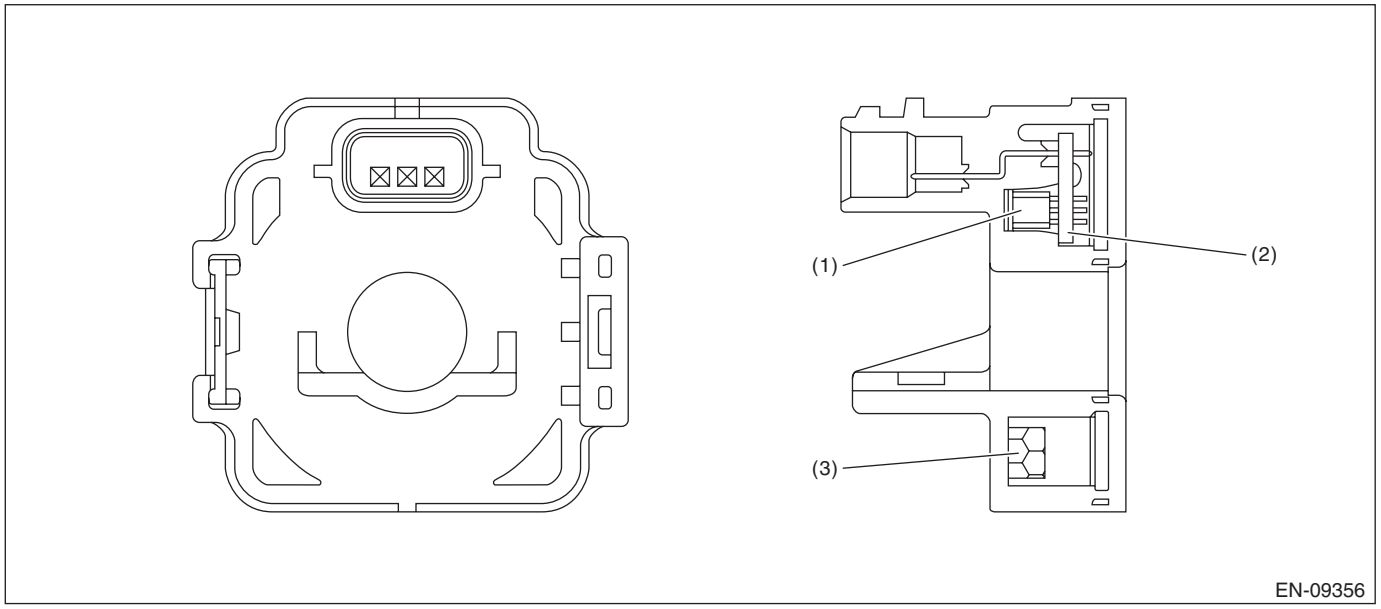
Time Needed for Diagnosis: 500 ms
Malfunction Indicator Light Illumination: Malfunction indicator light does not illuminate when malfunction occurs.

EO:DTC P1532 BATTERY CHARGING SYSTEM

1. OUTLINE OF DIAGNOSIS

Detect the output property and malfunction of battery current sensor.
Judge as NG when there is no variation (stuck) under a condition where the battery current sensor output should have changed or when difference between output and battery current value is larger than expected (characteristics malfunction).

2. COMPONENT DESCRIPTION



(1) Hall IC (2) Chip condenser (3) Core

3. ENABLE CONDITIONS

- Stuck

Secondary Parameters	Enable Conditions
Ignition switch	ON
During switchover of regulating voltage	High condition judgment *1 ←→ Low condition judgment *2 However, the generator target duty has not experienced the following during switchover. 40 % ≤ Generator target duty < 60 %
*1 High condition judgment	
Continuous time during which all the conditions listed below are met	≥ 5000 ms
• Battery voltage	≥ 13.7 V
• Generator final output duty	≥ 60 %
• Engine speed	≥ 600 rpm
*2 Low condition judgment	
Continuous time during which all the conditions listed below are met	≥ 5000 ms
• Battery voltage	< 13.2 V
• Generator final output duty	< 40 %
or	
• Engine speed	< 600 rpm

- Characteristics malfunction

Secondary Parameters	Enable Conditions
Ignition switch	ON
During switchover of regulating voltage	High condition judgment is established. Target duty ≥ 60 % → target duty < 40 % or Low condition judgment is established. Target duty < 40 % → target duty ≥ 60 %

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Stuck

Judge as NG when the following conditions repeat 10 time(s) or more.

Judgment Value

Malfunction Criteria	Threshold Value
Difference between maximum and minimum value of output voltage	< 0.07 V

Time Needed for Diagnosis: Less than 1 second

Malfunction Indicator Light Illumination: Malfunction indicator light does not illuminate when malfunction occurs.

• Characteristic malfunction (charging side)

Judge as NG when time of establishment of following conditions is predetermined time or more within 30000 ms after enable conditions are not established → established.

(In case of NG judgment, NG is retained during the driving cycle.)

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	2.6 V ≤ Output voltage < 5 V
and	
Battery voltage	< 13.2 V

Time Needed for Diagnosis: 26000 ms

Malfunction Indicator Light Illumination: Malfunction indicator light does not illuminate when malfunction occurs.

• Characteristic malfunction (discharging side)

Judge as NG when time of establishment of following conditions is predetermined time or more within 30000 ms after enable conditions are not established → established.

(In this case, target duty ≥ 60 % has not been experienced within 30000 ms since enable conditions is not established → established.)

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	0 V ≤ Output voltage < 2.4 V
and	
Battery voltage	≥ 13.7 V

Time Needed for Diagnosis: 26000 ms

Malfunction Indicator Light Illumination: Malfunction indicator light does not illuminate when malfunction occurs.

EP:DTC P2004 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of tumble generator valve motor function.
Judge open fixing malfunction when the opening degree is large even after finishing the tumble generator valve closing driving.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Tumble generator valve “close” signal output time	≥ 1600 ms

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
TGV position As defined by: TGV angle position sensor voltage > = 2.5V	= Open

Time Needed for Diagnosis: 3000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

EQ:DTC P2005 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 2)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of tumble generator valve motor function.
Judge open fixing malfunction when the opening degree is large even after finishing the tumble generator valve closing driving.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time of TGV commanded* to "closed"	1600 ms

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
TGV position	= Open
As defined by: TGV angle position sensor voltage > = 2.5V	≥ 1600 ms

Time Needed for Diagnosis: 3000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

ER:DTC P2006 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of tumble generator valve motor function.
Judge close fixing malfunction when the opening degree is small even after finishing the tumble generator valve open driving.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time of TGV commanded* to "open"	≥ 1600 ms

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
TGV position As defined by: TGV angle position sensor voltage < 2.5V	= Closed

Time Needed for Diagnosis: 3000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

ES:DTC P2007 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 2)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of tumble generator valve motor function.
Judge close fixing malfunction when the opening degree is small even after finishing the tumble generator valve open driving.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time of TGV commanded* to "open"	≥ 1600 ms

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
TGV position As defined by: TGV angle position sensor voltage < 2.5V	= Closed

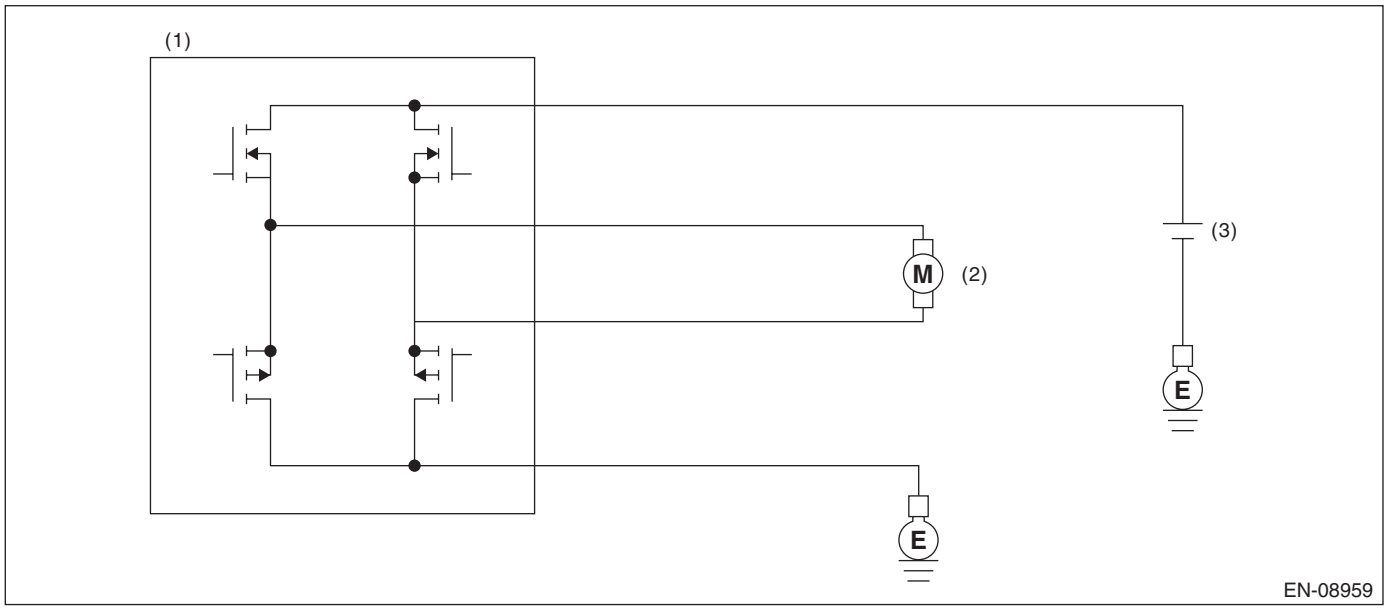
Time Needed for Diagnosis: 3000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

ET:DTC P2009 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of tumble generator valve motor.
Judge as NG when the overcurrent signal is sent from IC after tumble generator valve driving IC diagnosis.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM) (2) Tumble generator valve (3) Battery

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
TGV command	= Open or = closed

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Overcurrent signal from driver IC Short circuit to GND is detected when IC current > 16 A or Short circuit to B+ is detected when IC current > 14 A	= ON

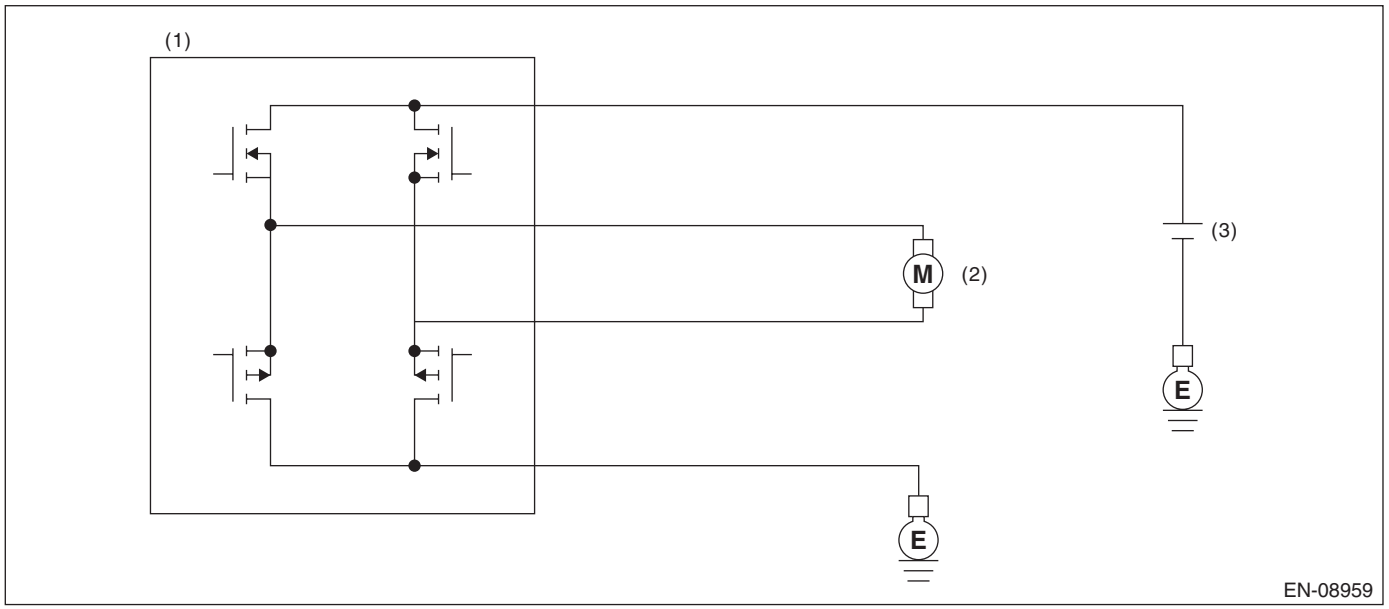
Time Needed for Diagnosis: 1 second
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

EU:DTC P2012 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 2)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of tumble generator valve motor.
Judge as NG when the overcurrent signal is sent from IC after tumble generator valve driving IC diagnosis.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM) (2) Tumble generator valve (3) Battery

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
TGV command	= Open or = closed

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Overcurrent signal from driver IC Short circuit to GND is detected when IC current > 16 A or Short circuit to B+ is detected when IC current > 14 A	= ON

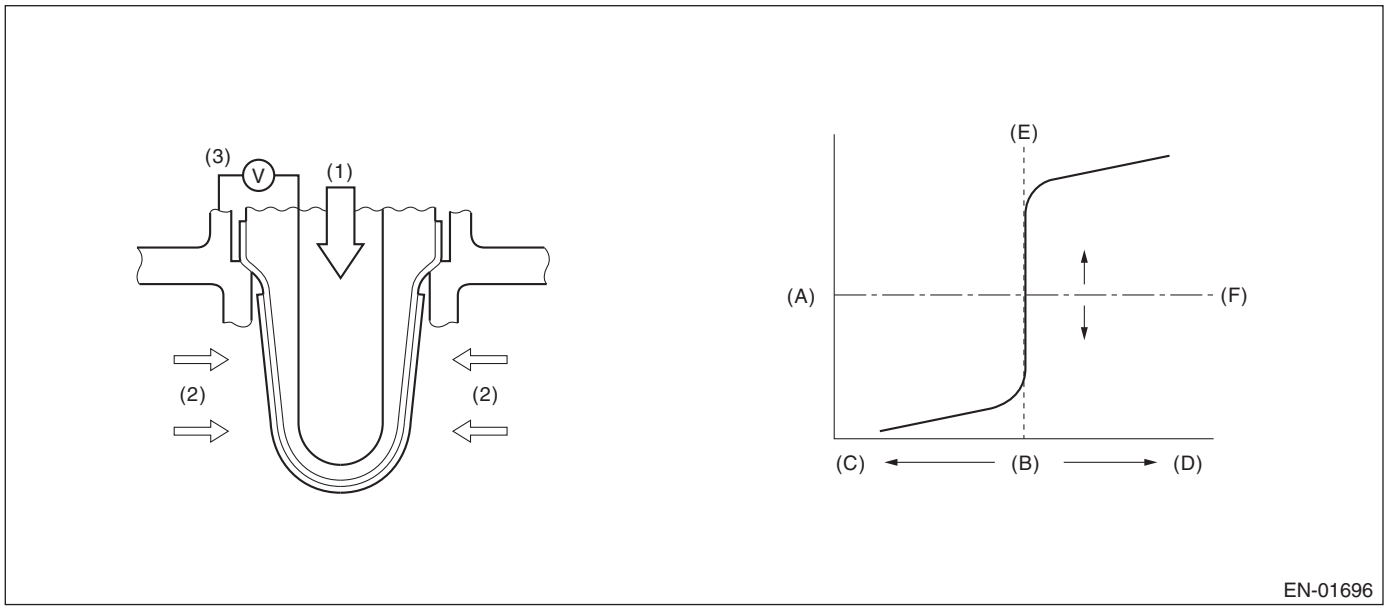
Time Needed for Diagnosis: 1 second
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

EV:DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel system from the size of the sub feedback learning value.
Control the sub feedback learning and judge as NG when the learning value is in the lean zone.

2. COMPONENT DESCRIPTION



(A)	Electromotive force	(B)	Air fuel ratio	(C)	Lean
(D)	Rich	(E)	Theoretical air fuel ratio	(F)	Comparative voltage
(1)	Atmosphere	(2)	Exhaust gas	(3)	Electromotive force

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Conditions for carrying out the sub feedback learning	Complete
Continuous time when all conditions are established.	≥ 1 s

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the vehicle is idling or running at a constant speed of 80 km/h (50 MPH) or more.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sub feedback learning value	< –0.04 (CVT model) < –0.04 (MT model)

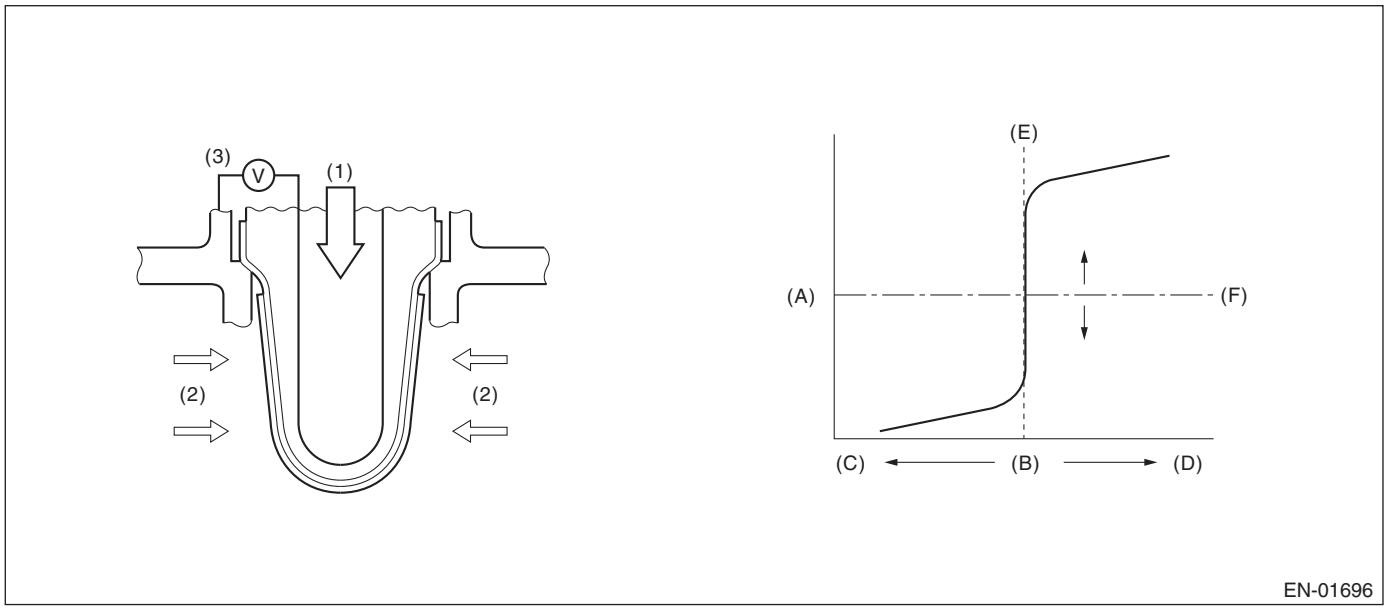
Time Needed for Diagnosis: 1 s × 1 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

EW:DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel system from the size of the sub feedback learning value.
Sub feedback learning is being performed. When the learning value goes to the rich side, judge as NG.

2. COMPONENT DESCRIPTION



(A)	Electromotive force	(B)	Air fuel ratio	(C)	Lean
(D)	Rich	(E)	Theoretical air fuel ratio	(F)	Comparative voltage
(1)	Atmosphere	(2)	Exhaust gas	(3)	Electromotive force

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Conditions for carrying out the sub feedback learning	Complete
Continuous time when all conditions are established.	≥ 1 s

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the vehicle is idling or running at a constant speed of 80 km/h (50 MPH) or more.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sub feedback learning value	≥ 0.04 (CVT model) ≥ 0.04 (MT model)

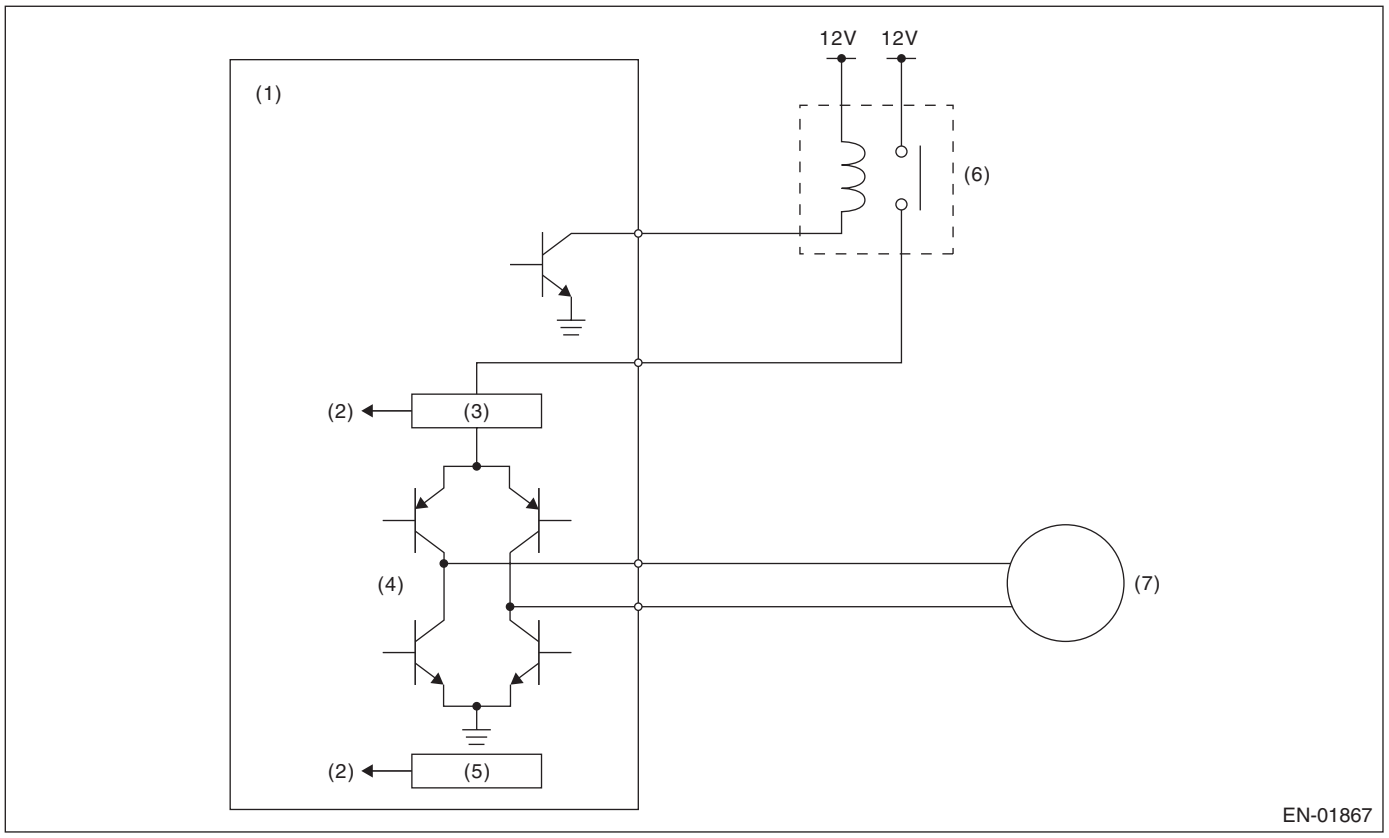
Time Needed for Diagnosis: 1 s × 1 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

EX:DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/ PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Judge as NG when the motor current becomes large or drive circuit is heated.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Detecting circuit
(3) Overcurrent detection circuit
(4) Drive circuit
(5) Temperature detection circuit
(6) Electronic throttle control relay
(7) Motor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6.2 V
Electronic throttle control relay output	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Overcurrent signal from the electronic throttle control drive IC	ON

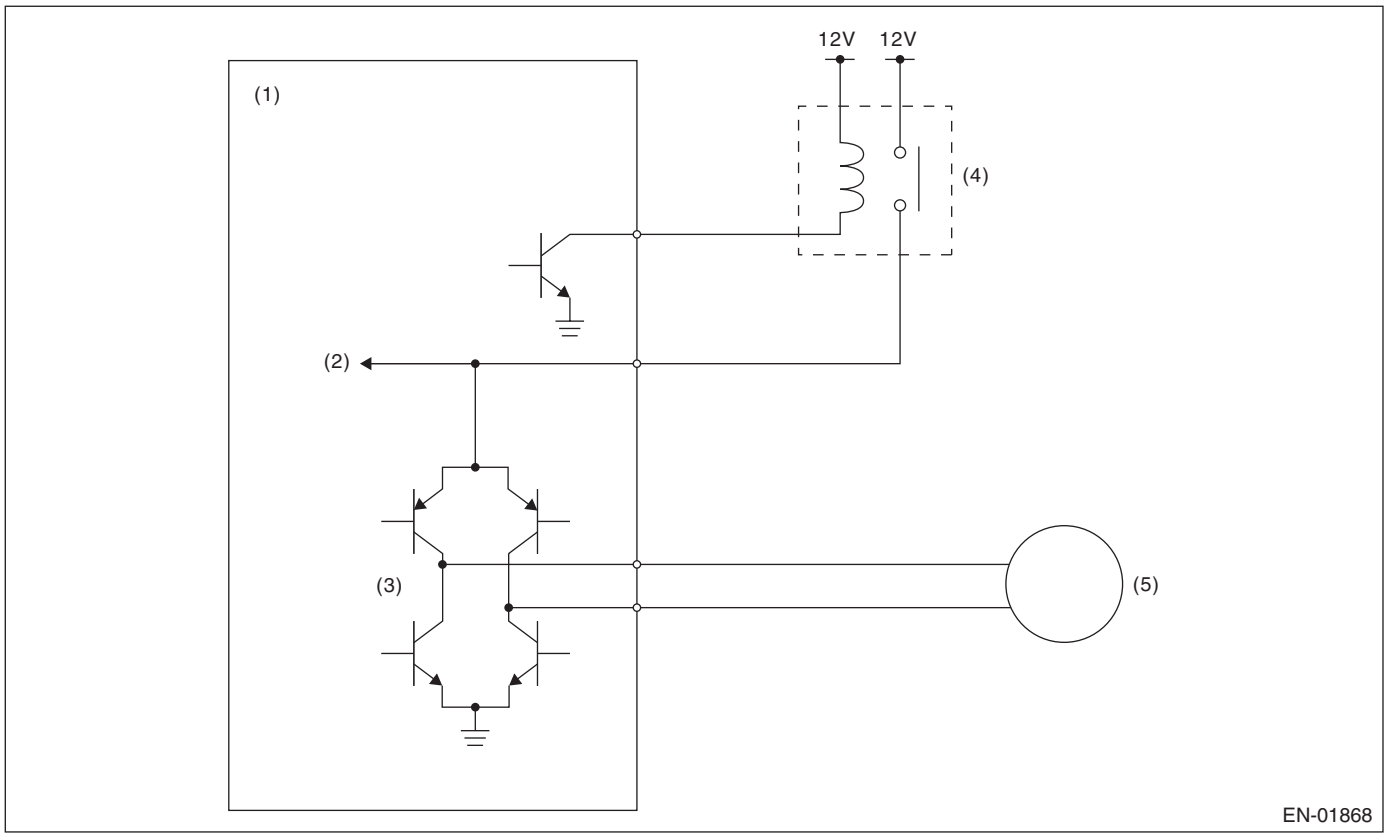
Time Needed for Diagnosis: 512 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

EY:DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Judge as NG when the electronic throttle control power is not supplied even when ECM sets the electronic throttle control relay to ON.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Voltage detection circuit
(3) Drive circuit
(4) Electronic throttle control relay
(5) Motor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 11 V
Electronic throttle control relay output	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Motor power voltage	≤ 5 V

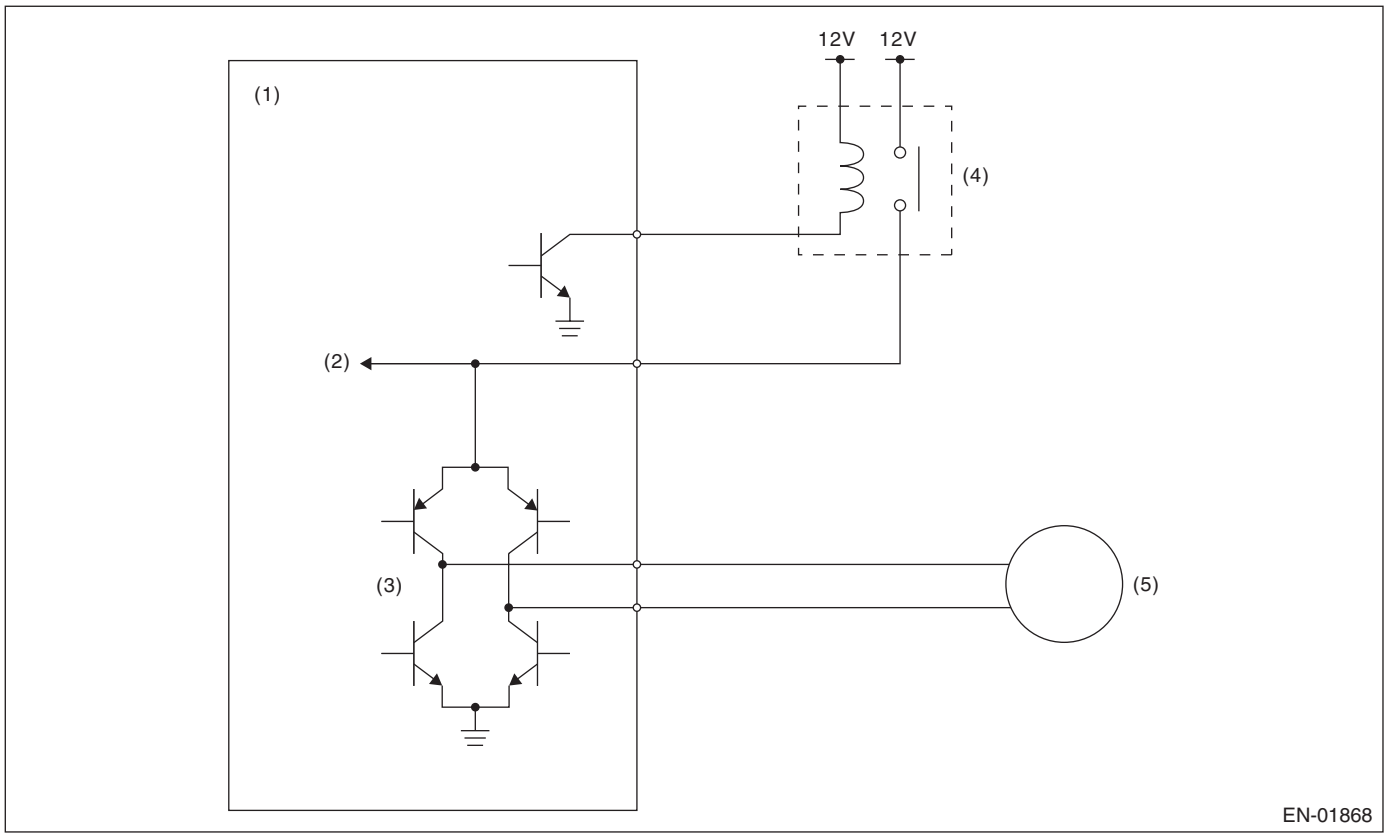
Time Needed for Diagnosis: 352 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

EZ:DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Judge as NG when the electronic throttle control power is supplied even when ECM sets the electronic throttle control relay to OFF.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Voltage detection circuit
(3) Drive circuit
(4) Electronic throttle control relay
(5) Motor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V
Electronic throttle control relay output	OFF

4. GENERAL DRIVING CYCLE

- When ignition switch ON → OFF
- Ignition switch OFF → ON (Only after clearing memory)

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Motor power voltage	≥ 5 V

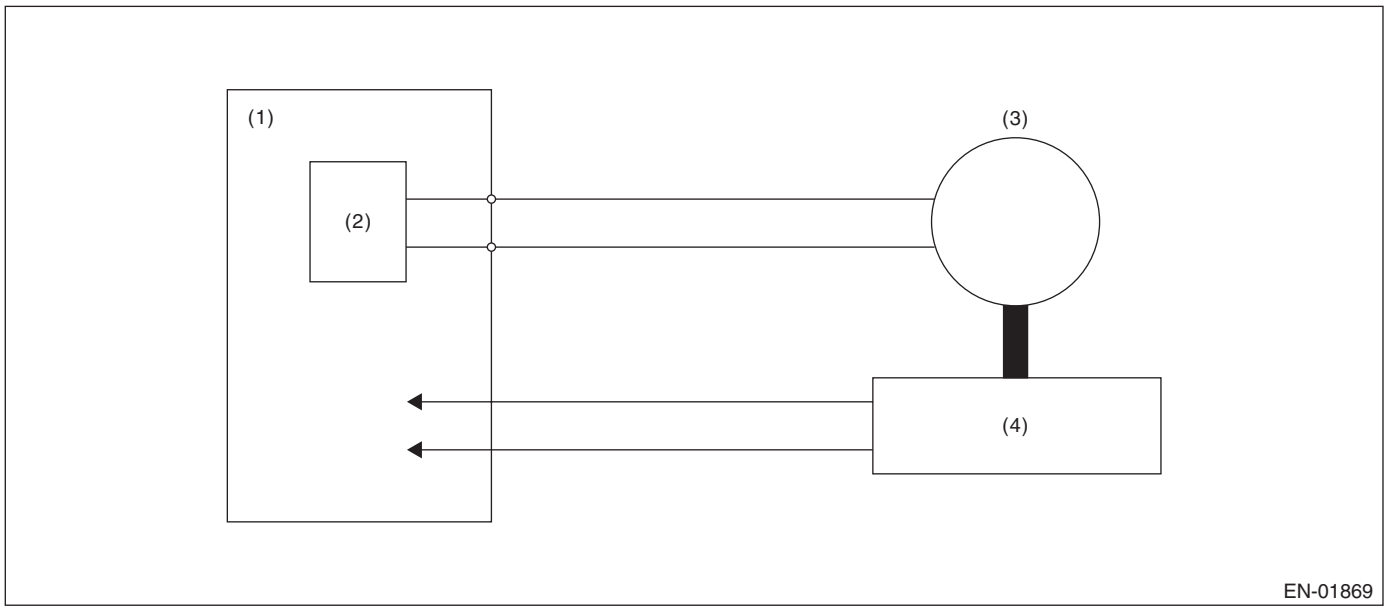
Time Needed for Diagnosis: 600 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

FA:DTC P2109 THROTTLE/PEDAL POSITION SENSOR “A” MINIMUM STOP PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Judge as NG when full close point learning cannot conducted or abnormal value is detected.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Drive circuit
(3) Motor
(4) Throttle position sensor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Minimum stop position	< -4.020% or > -4.020%
| Throttle default position – Throttle minimum stop position |	< 1.162 °

4. GENERAL DRIVING CYCLE

Perform the diagnosis at full closed point learning.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
12V battery system voltage	< 6 V

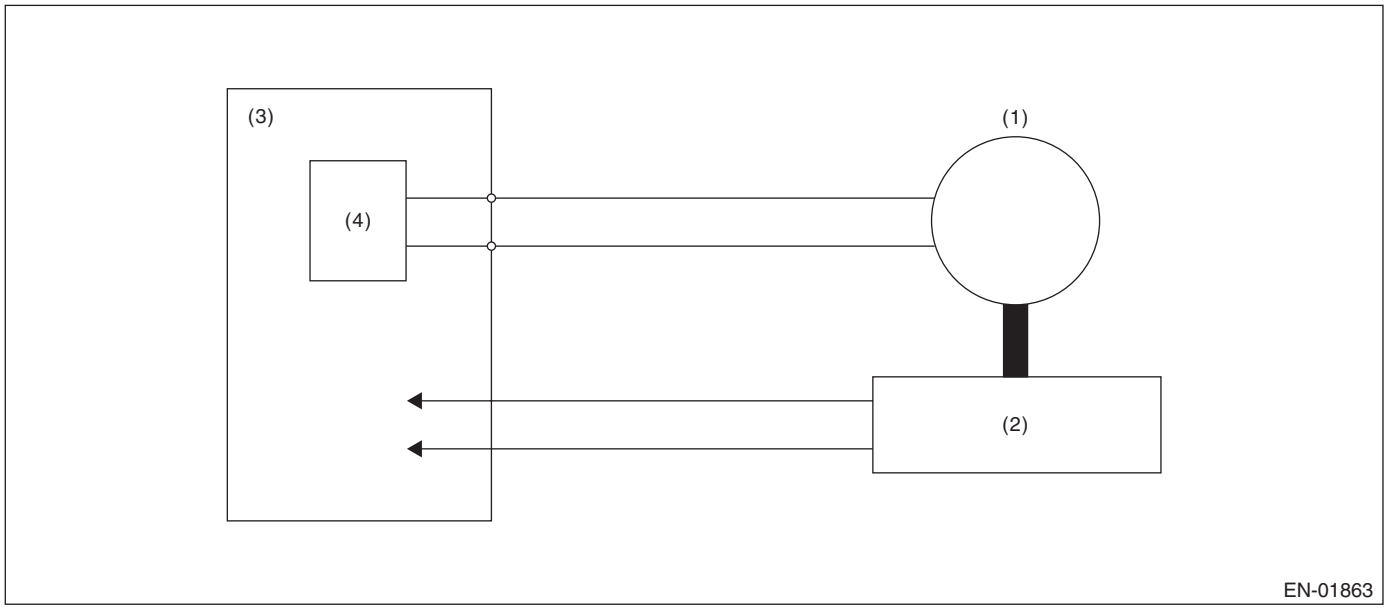
Time Needed for Diagnosis: 8 ms — 80 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

FB:DTC P2119 THROTTLE ACTUATOR CONTROL THROTTLE BODY RANGE/ PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Judge as NG when the target opening angle and actual opening angle is mismatched or the current to motor is the specified duty or more for specified time continuously.

2. COMPONENT DESCRIPTION



(1) Motor
(2) Throttle position sensor
(3) Engine control module (ECM)
(4) Drive circuit

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
12V battery system voltage	6.2 V
Throttle motor relay command	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously when the electronic throttle control is operating.

5. DIAGNOSTIC METHOD

Judge as OK and clear the NG when the malfunction criteria below are met.

Diagnosis 1

Judgment Value

Malfunction Criteria	Threshold Value
Output duty to drive circuit	≥ 95 %

Time Needed for Diagnosis:

- Engine speed ≥ 500 rpm: 2000 ms
- Engine speed < 500 rpm: 5000 ms

Diagnosis 2

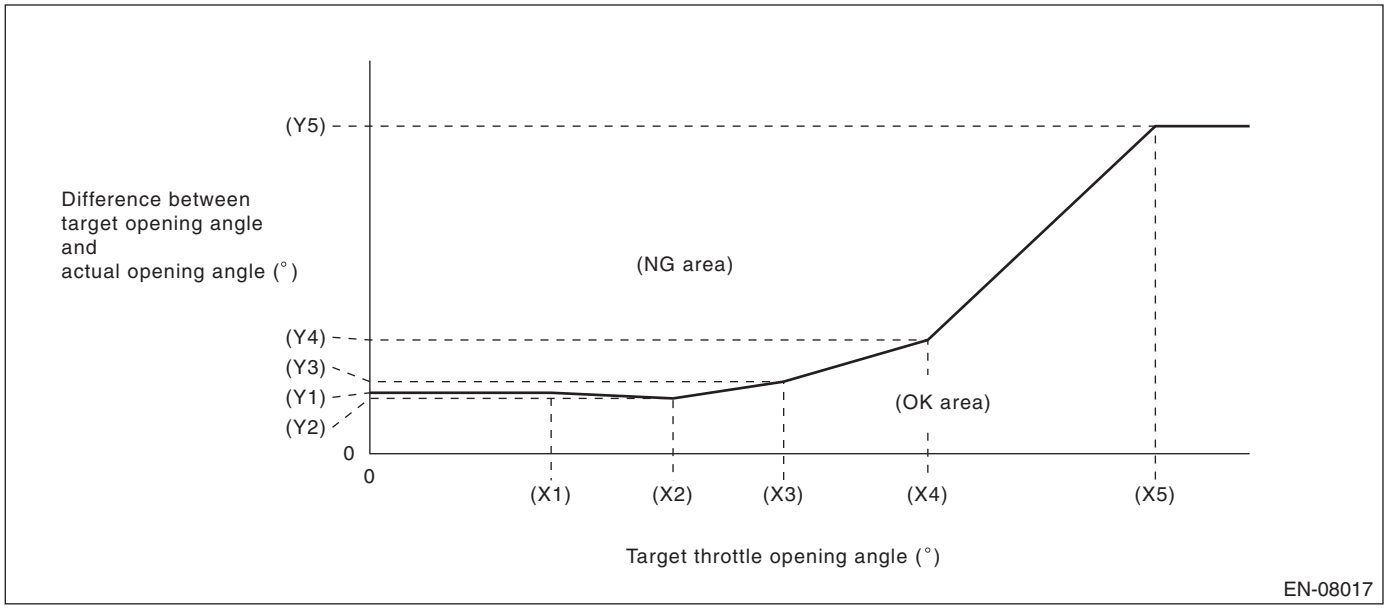
Judgment Value

Malfunction Criteria	Threshold Value
Difference between target opening angle and actual opening angle	Within NG range of **Details of Judgment value**

Time Needed for Diagnosis:

- Engine speed ≥ 500 rpm: Refer to **Details of Judgment time**.
- Engine speed < 500 rpm: 5000 ms

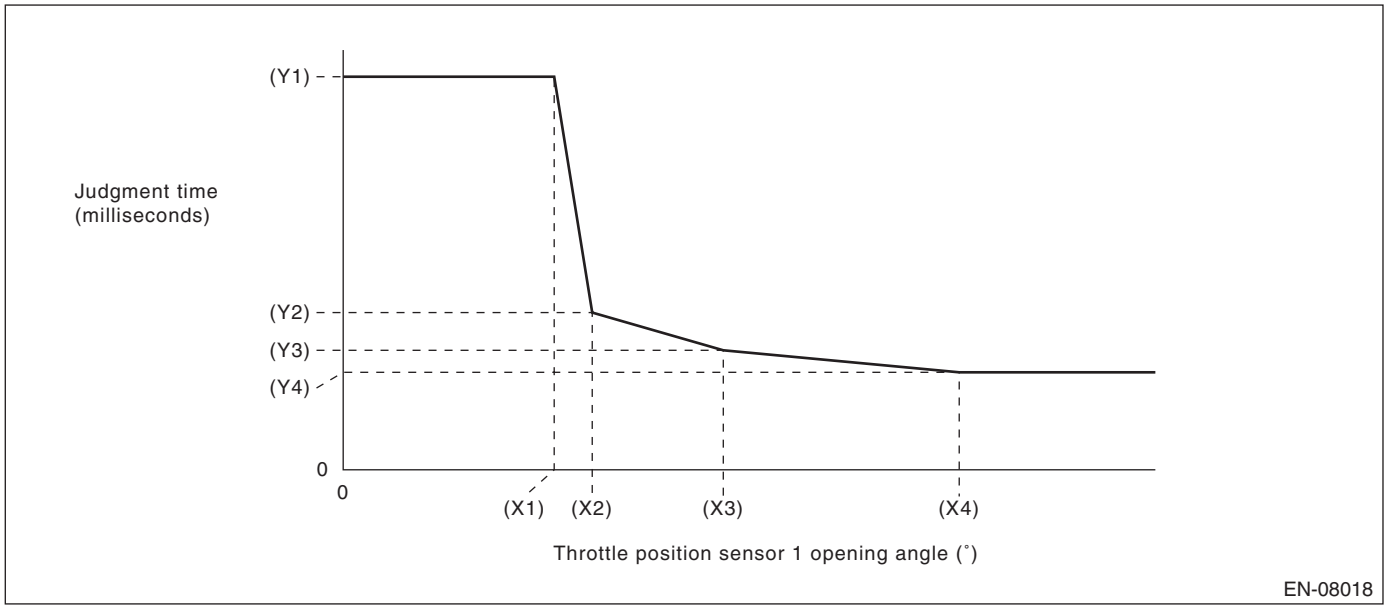
Details of Judgment Value



(X1) 6.915 °
(X2) 11.565 °
(X3) 15.785 °
(X4) 21.285 °
(X5) 29.965 °

(Y1) 4.65 °
(Y2) 4.22 °
(Y3) 5.5 °
(Y4) 8.68 °
(Y5) 25 °

Details of Judgment time



(X1) 8.049999237 °
(X2) 9.5 °
(X3) 14.5 °
(X4) 23.5 °

(Y1) 1000 ms
(Y2) 400 ms
(Y3) 304 ms
(Y4) 248 ms

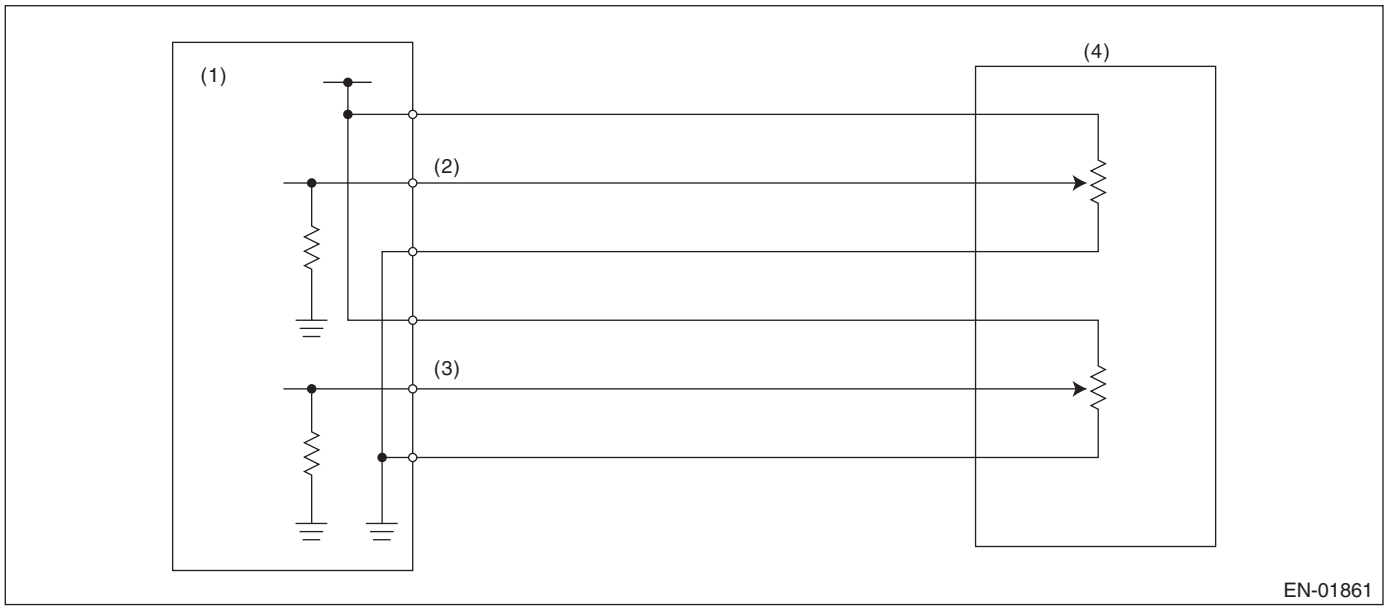
NOTE:
Judgment time when actual opening angle ≤ target opening angle is always 1000 milliseconds.
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

FC:DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT LOW INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 1.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Accelerator pedal position sensor 1 signal
(3) Accelerator pedal position sensor 2 signal
(4) Accelerator pedal position sensor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	< 0.298 V

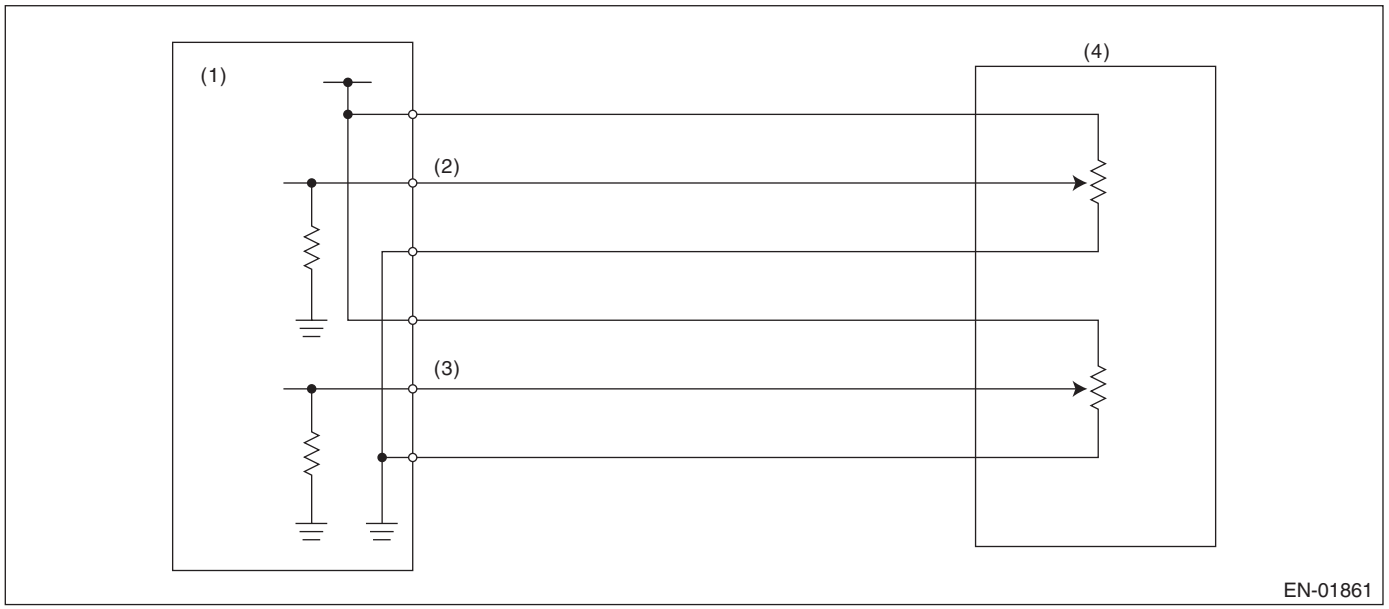
Time Needed for Diagnosis: 100 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

FD:DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT HIGH INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 1.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Accelerator pedal position sensor 1 signal
(3) Accelerator pedal position sensor 2 signal
(4) Accelerator pedal position sensor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	≥ 4.737 V

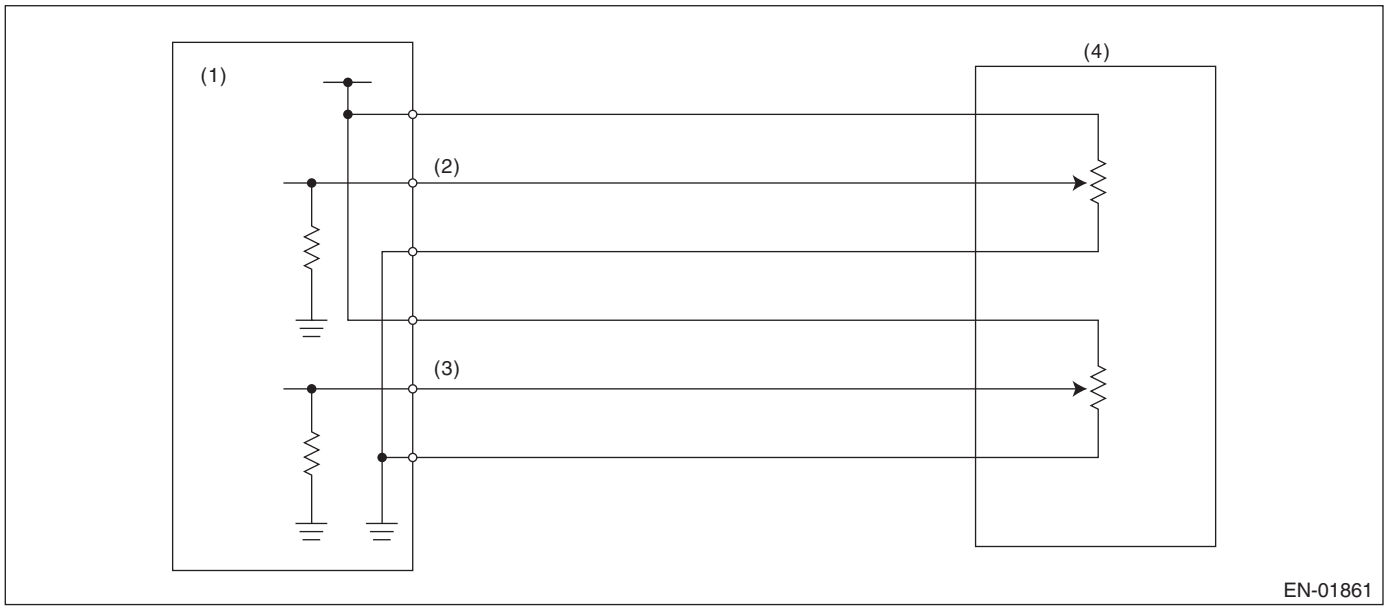
Time Needed for Diagnosis: 32 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

FE:DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT LOW INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 2.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Accelerator pedal position sensor 1 signal
(3) Accelerator pedal position sensor 2 signal
(4) Accelerator pedal position sensor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	< 0.298 V

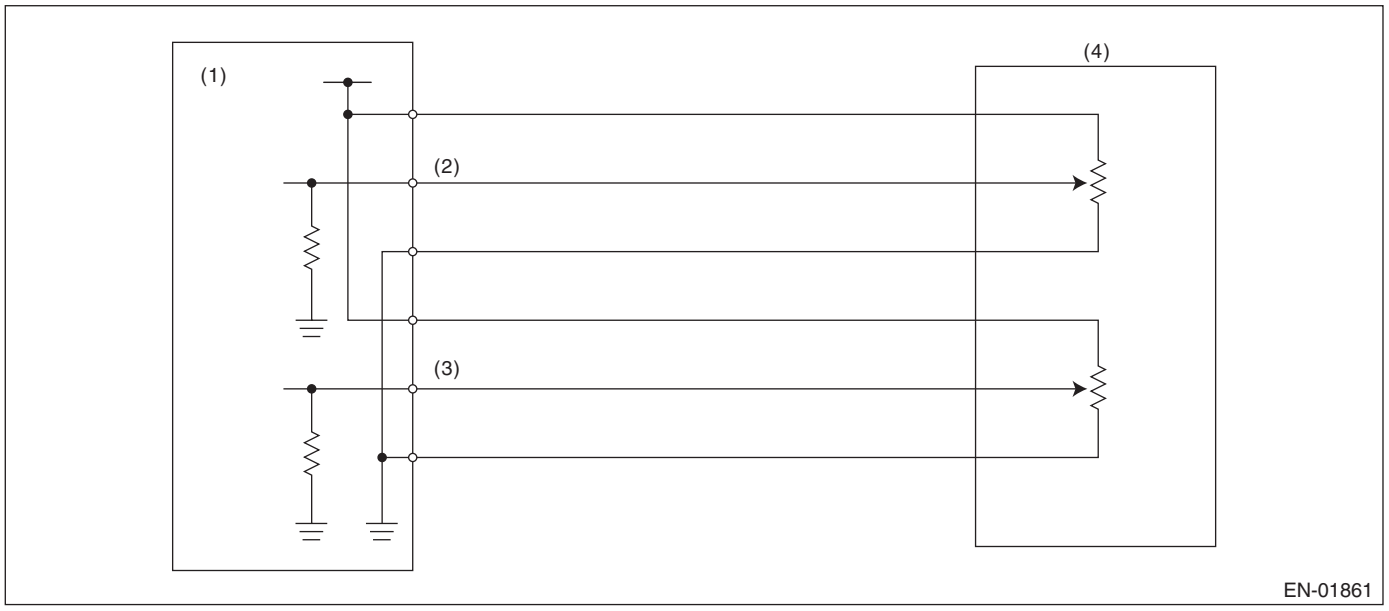
Time Needed for Diagnosis: 100 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

FF: DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT HIGH INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 2.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Accelerator pedal position sensor 1 signal
(3) Accelerator pedal position sensor 2 signal
(4) Accelerator pedal position sensor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	≥ 4.737 V

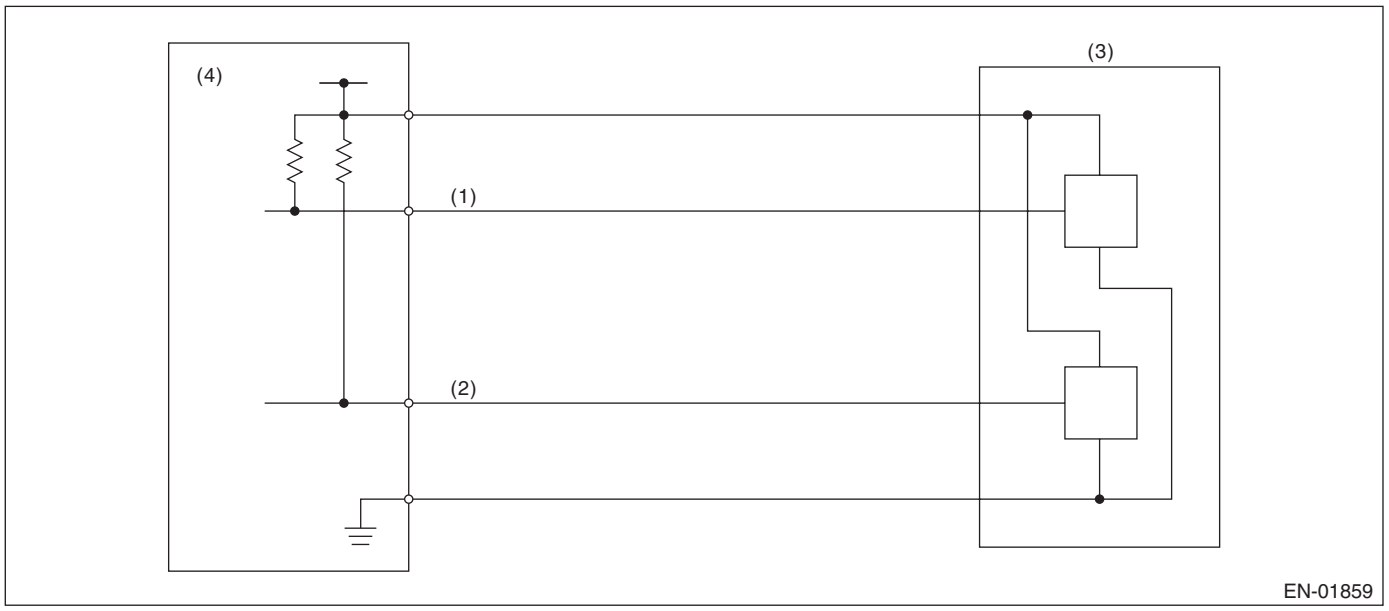
Time Needed for Diagnosis: 100 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

FG:DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A”/“B” VOLTAGE CORRELATION

1. OUTLINE OF DIAGNOSIS

Judge as NG when the signal level of throttle position sensor 1 is different from the throttle position sensor 2.

2. COMPONENT DESCRIPTION



(1) Throttle position sensor 1 signal
(2) Throttle position sensor 2 signal
(3) Throttle position sensor
(4) Engine control module (ECM)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

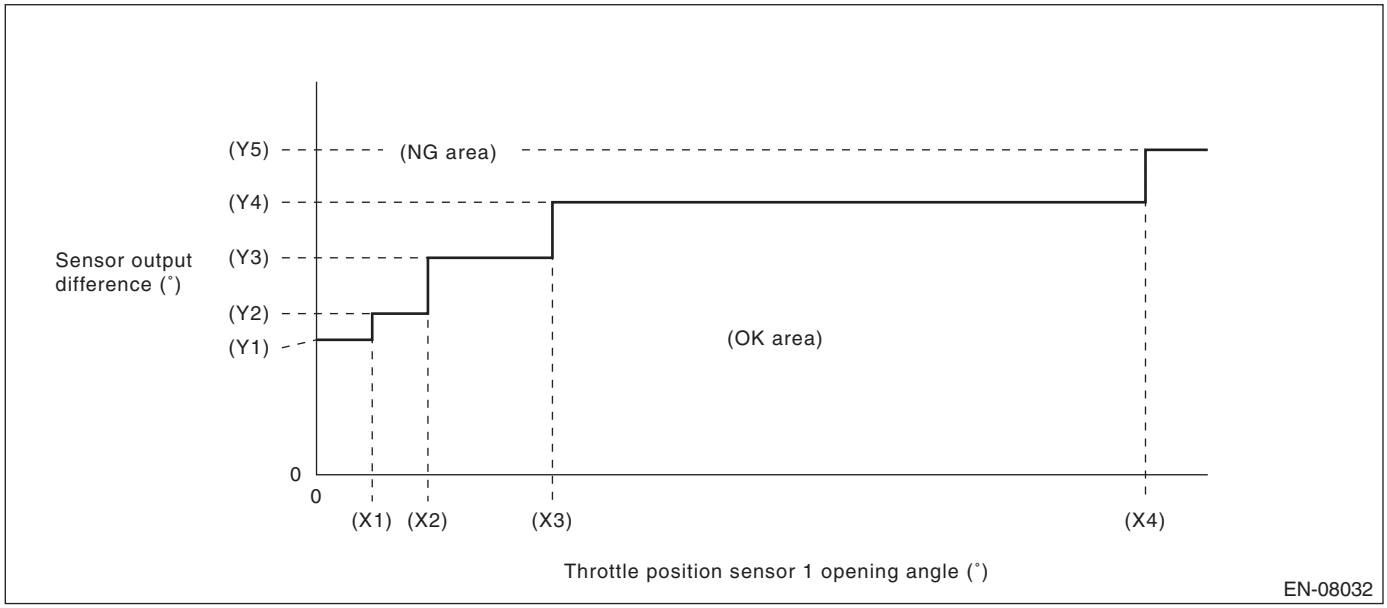
5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	Within NG range of **Details of Judgment value**

Details of Judgment Value



(X1) 2.125 °
(X2) 4.25 °
(X3) 9 °
(X4) 31.625 °

(Y1) 4.736 °
(Y2) 5.736 °
(Y3) 7.861 °
(Y4) 9.986 °
(Y5) 11.986 °

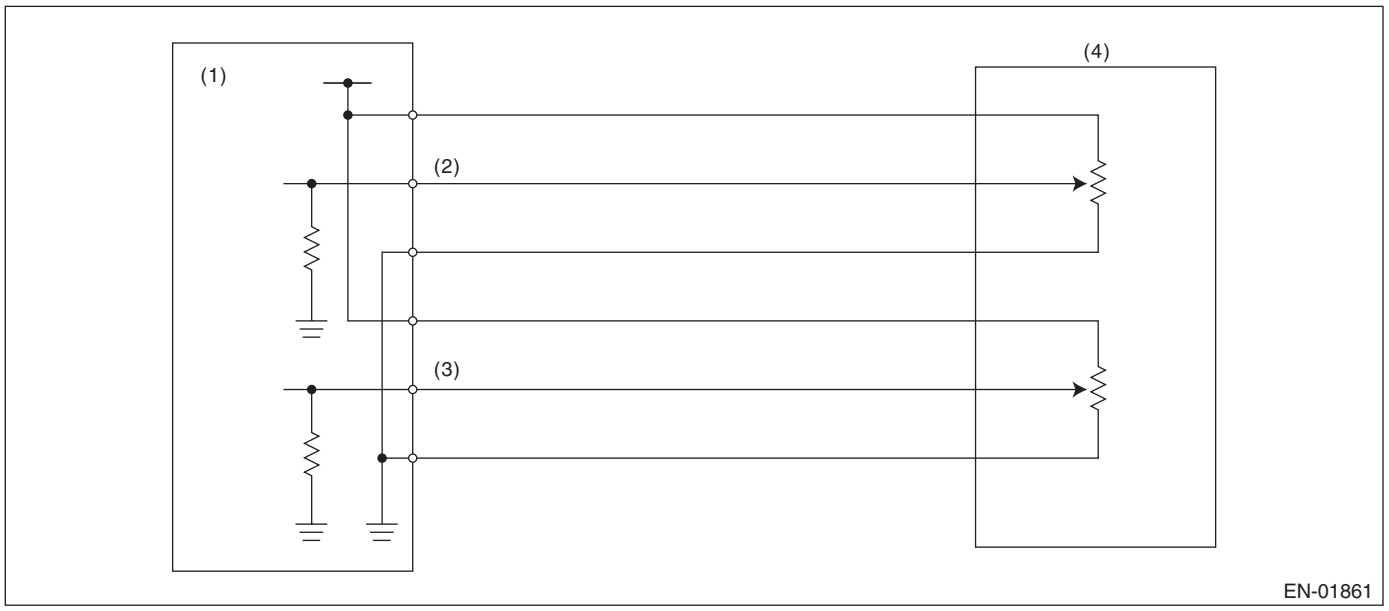
Time Needed for Diagnosis: 212 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

FH:DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION

1. OUTLINE OF DIAGNOSIS

Judge as NG when the signal level of throttle position sensor 1 is different from the throttle position sensor 2.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Accelerator pedal position sensor 1 signal
(3) Accelerator pedal position sensor 2 signal
(4) Accelerator pedal position sensor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

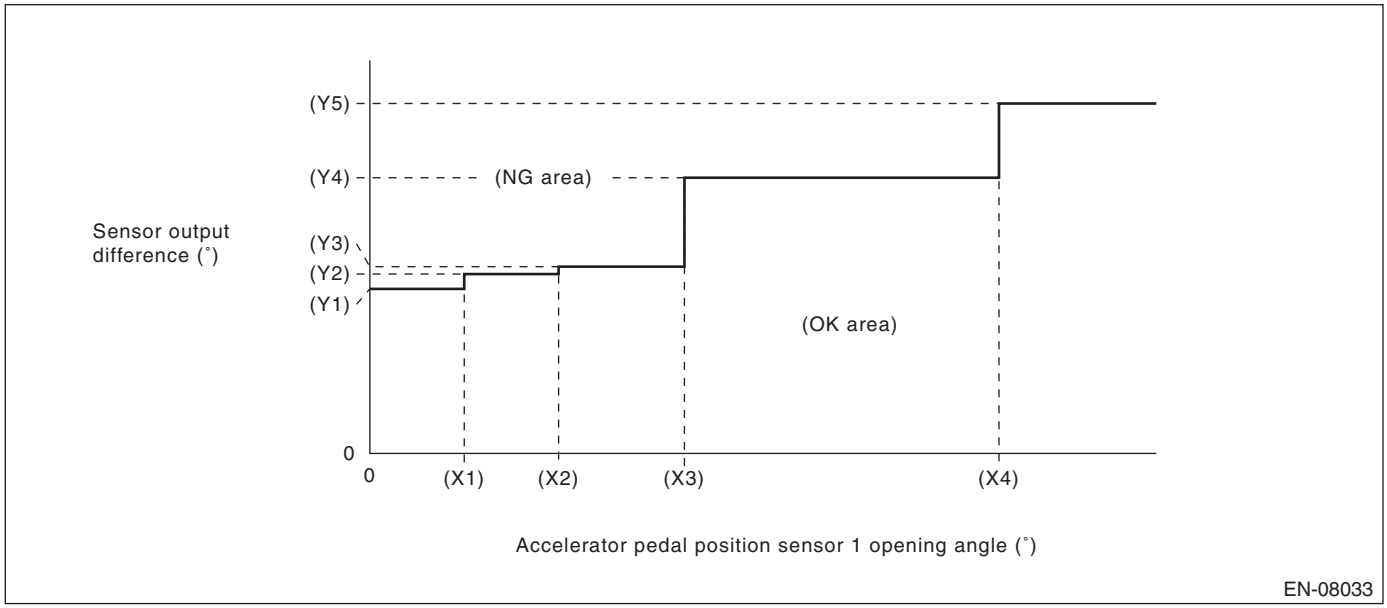
5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	Within NG range of **Details of Judgment value**

Details of Judgment Value



(X1) 0.6 °
(X2) 1.2 °
(X3) 2 °
(X4) 4 °

(Y1) 1.465 °
(Y2) 1.597 °
(Y3) 1.663 °
(Y4) 2.455 °
(Y5) 3.116 °

Time Needed for Diagnosis: 116 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

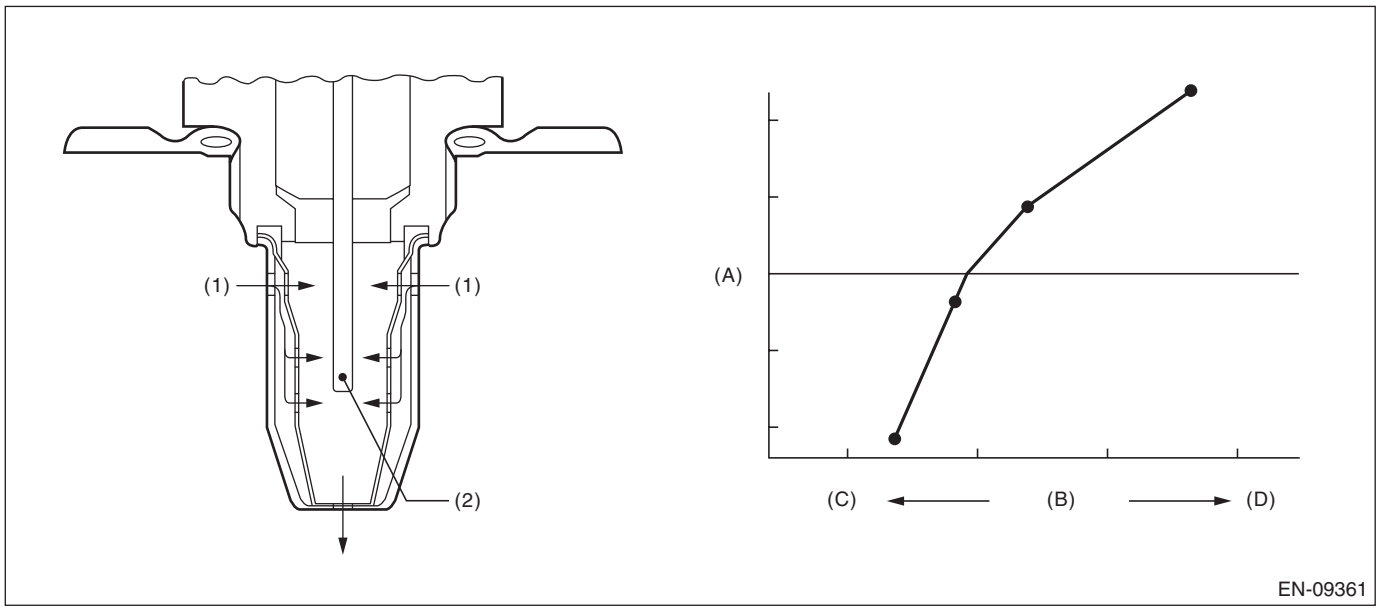
FI: DTC P2195 O2 SENSOR SIGNAL BIASED/STUCK LEAN (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect that λ value remains low.
Judge as NG when lambda value is abnormal in accordance with λ value of front oxygen (A/F) sensor and running conditions such as vehicle speed, amount of intake air, engine coolant temperature, sub feedback control, etc.

λ value = Actual air fuel ratio/Theoretical air fuel ratio
λ > 1: Lean
λ < 1: Rich

2. COMPONENT DESCRIPTION



(A) Electromotive force (B) Air fuel ratio (C) Rich
(D) Lean

(1) Exhaust gas (2) ZrO_2

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Time needed for all secondary parameters to be in enable conditions	≥ 4096 ms
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75.1 kPa (563 mmHg, 22.2 inHg)
Rear oxygen sensor sub feedback	Execution
Rear oxygen sensor output voltage – Feedback target voltage	– 0.2 V — 0.1 V
or rear oxygen sensor sub feedback compensation coefficient	On Min.
or rear oxygen sensor sub feedback compensation coefficient	On Max.
Elapsed time after starting the engine	≥ 0 ms
Engine coolant temperature	≥ –40 °C (–40 °F)
Vehicle speed	≥ 0 km/h (0 MPH)
Amount of intake air	≥ 6 g/s (0.21 oz/s)
Targeted lambda value load compensation coefficient	–1 — 1.000

4. GENERAL DRIVING CYCLE

Perform diagnosis continuously at a constant speed of 0 km/h (0 MPH) or more after 0 ms have passed since the engine started.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
λ value	< 0.85

Time Needed for Diagnosis: 10000 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

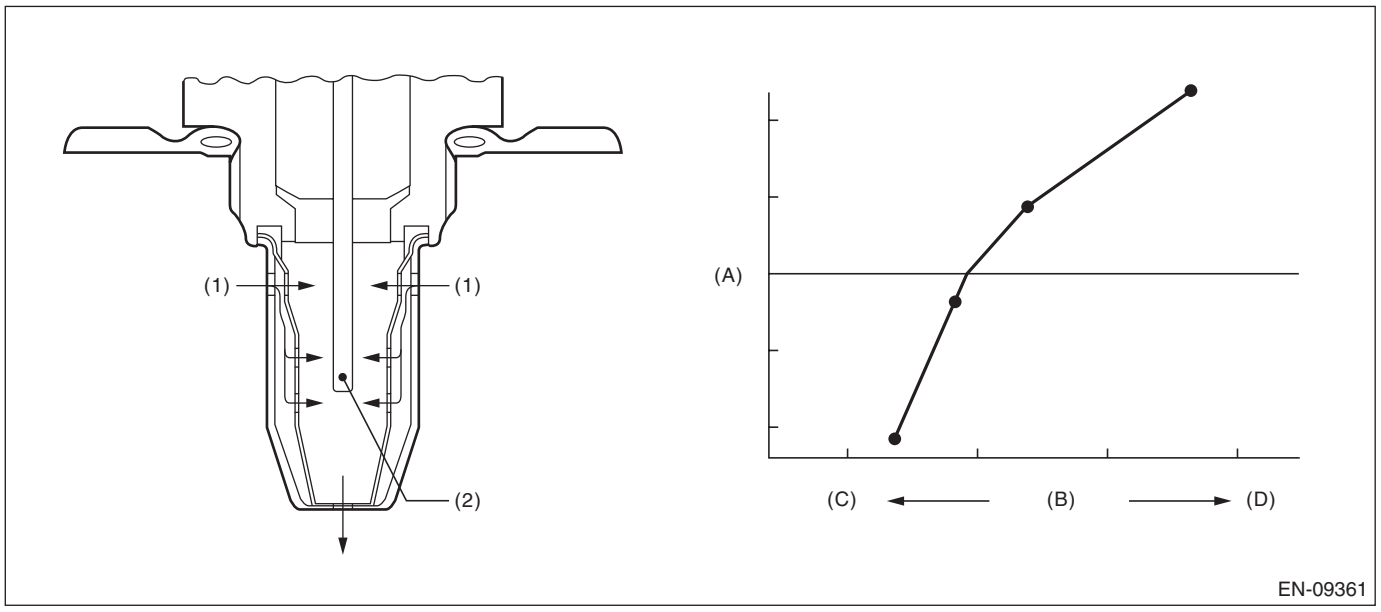
FJ: DTC P2196 O2 SENSOR SIGNAL BIASED/STUCK RICH (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect that λ value remains high.
Judge as NG when lambda value is abnormal in accordance with λ value of front oxygen (A/F) sensor and running conditions such as vehicle speed, amount of intake air, engine coolant temperature, sub feedback control, etc.

λ value = Actual air fuel ratio/Theoretical air fuel ratio
λ > 1: Lean
λ < 1: Rich

2. COMPONENT DESCRIPTION



(A) Electromotive force (B) Air fuel ratio (C) Rich
(D) Lean

(1) Exhaust gas (2) ZrO_2

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Time needed for all secondary parameters to be in enable conditions	≥ 4096 ms
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75.1 kPa (563 mmHg, 22.2 inHg)
Rear oxygen sensor sub feedback	Execution
Rear oxygen sensor output voltage – Feedback target voltage	– 0.2 V — 0.1 V
or rear oxygen sensor sub feedback compensation coefficient	On Min.
or rear oxygen sensor sub feedback compensation coefficient	On Max.
Elapsed time after starting the engine	≥ 0 ms
Engine coolant temperature	≥ –40 °C (–40 °F)
Vehicle speed	≥ 0 km/h (0 MPH)
Amount of intake air	≥ 6 g/s (0.21 oz/s)
Targeted lambda value load compensation coefficient	–1 — 1.000

4. GENERAL DRIVING CYCLE

Perform diagnosis continuously at a constant speed of 0 km/h (0 MPH) or more after 0 ms have passed since the engine started.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
λ value	> 1.15

Time Needed for Diagnosis: 10000 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

FK:DTC P219A BANK 1 AIR-FUEL RATIO IMBALANCE

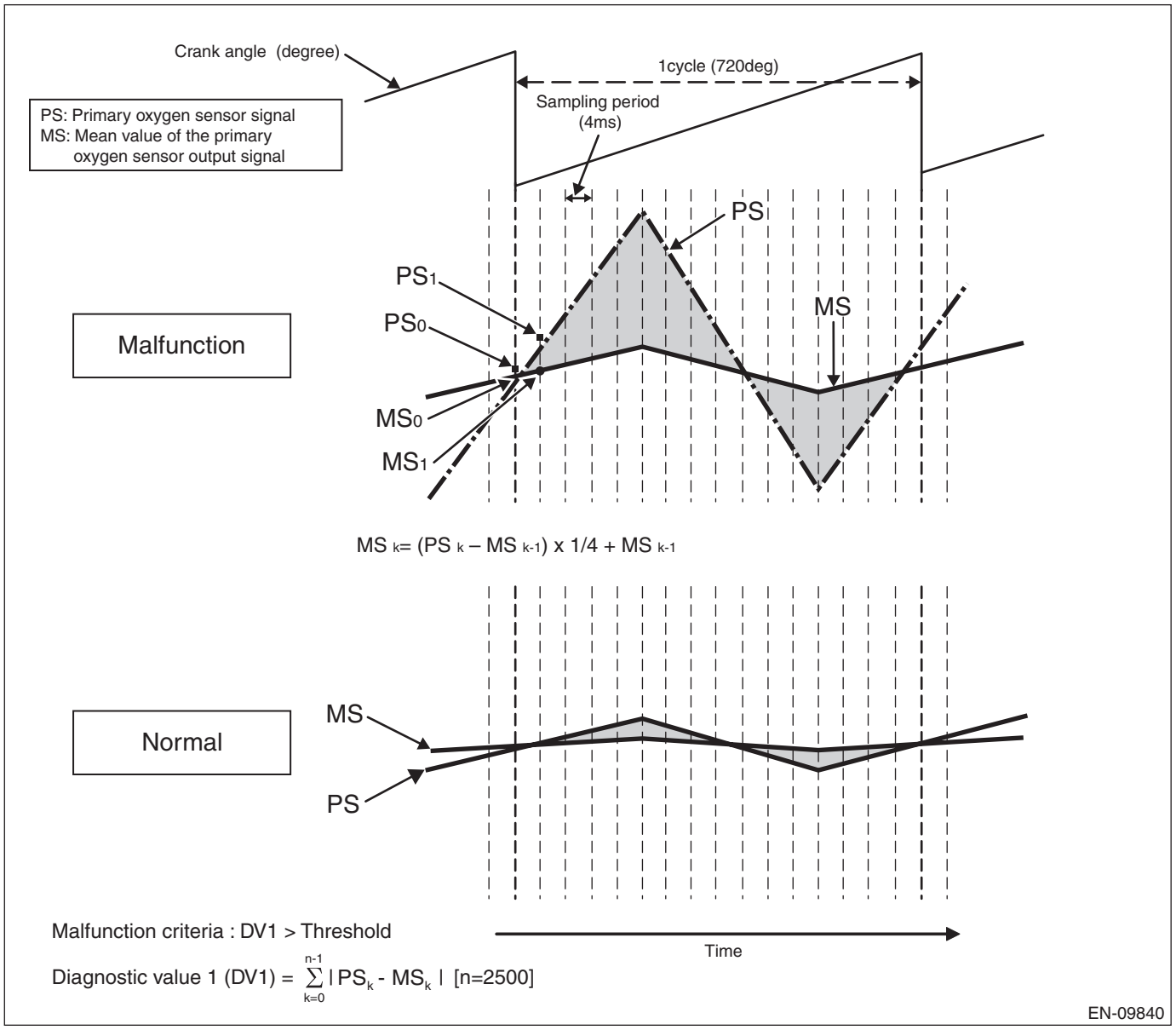
1. OUTLINE OF DIAGNOSIS

This diagnostic monitor performs a functional check of the fuel system to determine an air-fuel ratio cylinder imbalance.
This diagnosis is composed of two monitors.
The outline of “monitor A1” is as follows. When an air-fuel ratio cylinder imbalance occurs, the primary oxygen sensor output signal will oscillate with increased amplitude. This monitor utilizes this behavior to make a diagnosis. The monitor integrates the difference between the amplification value and the mean value of the first oxygen sensor output signal and compares it to a threshold to make a judgment.
The outline of “monitor B1” is as follows. Similarly, when an imbalance occurs, the engine speed also fluctuates with increased amplitude. This monitor utilizes this behavior to make a diagnosis. For reference, it should be noted that this imbalance monitor method is actually similar to the current misfire diagnostic monitor, and the parameter “domg360” (units: degrees CA) is shared between the imbalance and misfire monitors. The imbalance monitor is performed during idle condition when the engine is warm. The monitor integrates the count of “domg360” which exceeds a threshold in 1000 revolution.
When both the “monitor A1” value and the “monitor B1” value exceed a predetermined threshold, this monitor determines a malfunction and stores a fault code.

Monitor A1

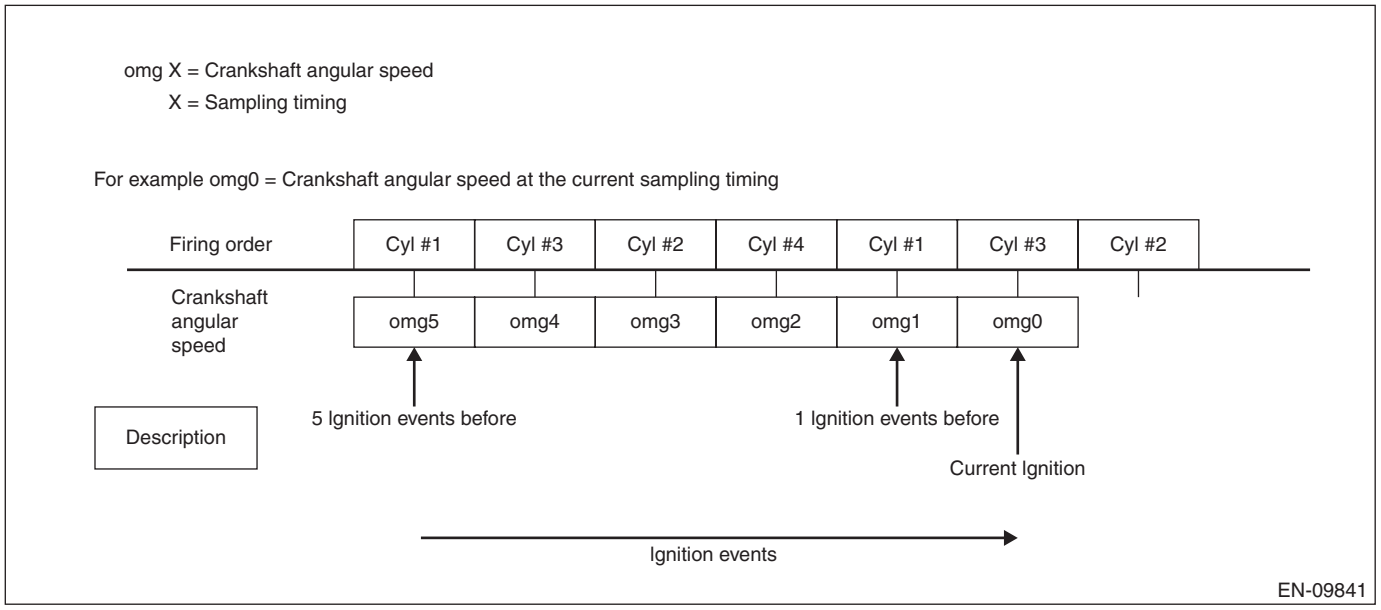
When there is an air-fuel ratio cylinder imbalance malfunction, the primary oxygen sensor output fluctuates widely compared with a normal sensor, as shown by the chain line in Figure 1 below. This monitor makes a diagnosis based on this phenomenon. Each primary oxygen sensor signal (PS) and mean value of the primary oxygen sensor signal (MS) is calculated from the primary oxygen sensor signal. The absolute values of (PS – MS) are sampled every 4 ms as shown in the figure. Diagnostic value 1 (DV1) is obtained by integrating the absolute value of (PS – MS) for 2500 times. A malfunction is determined when DV1 exceeds the threshold. The judgment values are determined experimentally.

Figure 1. Compare malfunctioned primary oxygen sensor output with a normal sensor

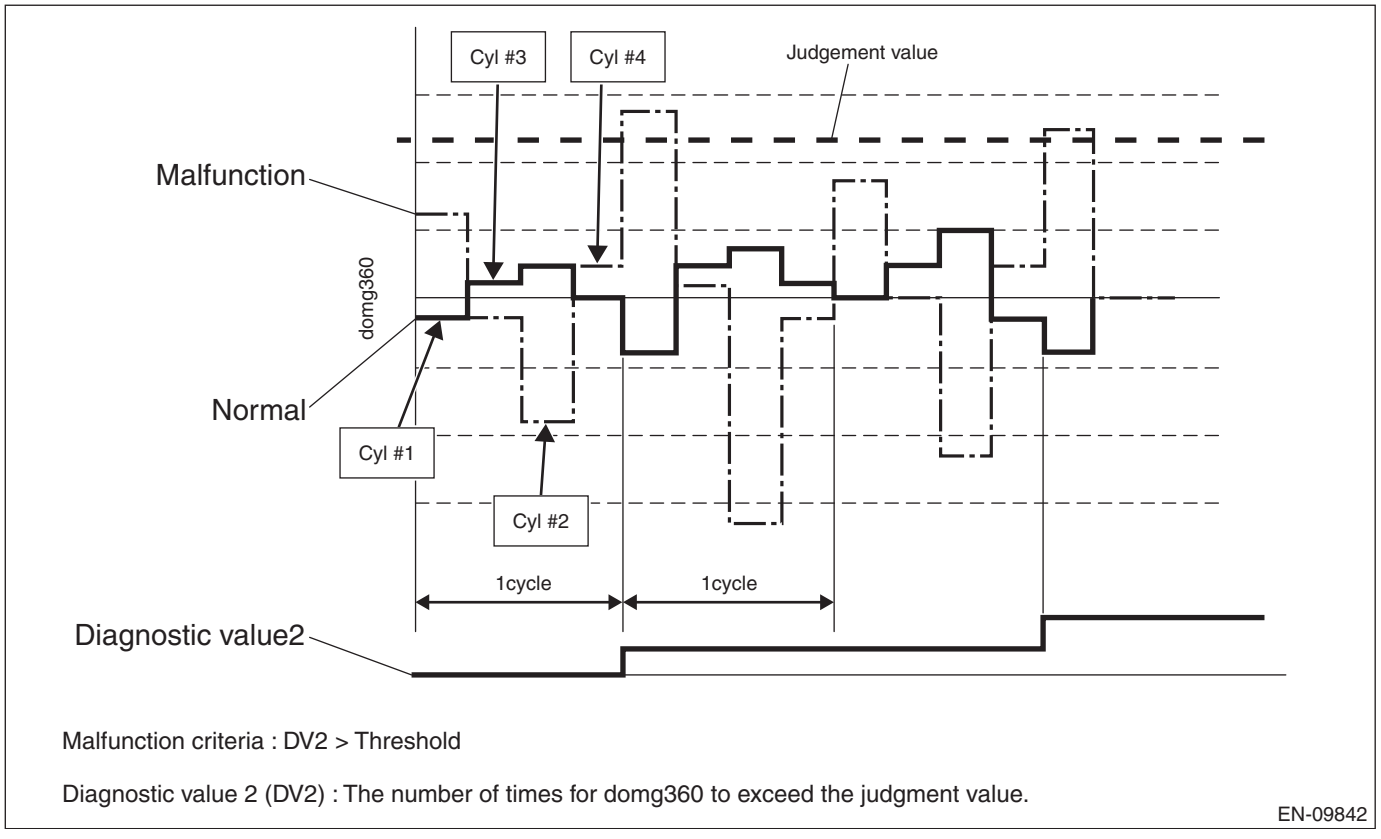


Monitor B1

Method used: Difference method of 360 degrees CA
Monitor value: domg360 = (omg 1 – omg 0) – (omg 3 – omg 2) = angular speed
Each crankshaft angular speed is defined as Figure 2 below.
Figure 2. Description of domg360 output



This method uses the fact that the domg360 of lean conditioned cylinder caused by imbalance malfunction indicates big value, as shown by the chain line in Figure 3 below.
The number of times for domg360 to exceed the judgment value in 1000 revolutions (500 cycles) is calculated as diagnostic value 2 (DV2). A malfunction is determined when DV2 exceeds the threshold.
Figure 3. Compare malfunctioned domg360 output with a normal output



2. ENABLE CONDITIONS

Monitor A1: Primary oxygen sensor fluctuation

Secondary Parameters	Enable Conditions
Closed loop control with primary oxygen sensor	Active
Engine speed	> 1400 rpm and < 3000 rpm
Engine coolant temperature	> –40 °C (–40 °F)
Intake air mass	≥ 0.7 g/rev (0.02 oz/rev) (CVT model) ≥ 0.7 g/rev (0.02 oz/rev) (MT model)

Monitor B1: Crankshaft speed fluctuation

Secondary Parameters	Enable Conditions
Misfire diagnosis monitor	Active
Engine coolant temperature	> –40 °C (–40 °F)
Accelerator pedal position	= 0%
Vehicle speed	≤ 1.93 km/h (1.2 MPH)
Engine speed	> 0 rpm and < 10000 rpm (CVT model) > 0 rpm and < 10000 rpm (MT model)
Intake air mass per revolution	< 2 g/rev (0.07 oz/rev) (CVT model) < 2 g/rev (0.07 oz/rev) (MT model)

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

Judge as NG when Monitor A1 and Monitor B1 are both NG, and when either is OK, judge as OK.
Monitor A1

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Diagnostic value 1 (DV1)	> Threshold value 1 (TV1)

Threshold value 1 (TV1):

$$\sum_{k=0}^{n-1} Map_k \qquad [n=2500]$$

EN-09888

Map (CVT model)

		Engine load (g/rev (oz/rev))					
		0.7 (0.02)	0.8 (0.03)	0.9 (0.03)	1 (0.04)	1.1 (0.04)	1.2 (0.04)
Engine speed (rpm)	1400	0.0092	0.0141	0.0172	0.0172	0.0172	0.0172
	1600	0.0160	0.0208	0.0210	0.0210	0.0210	0.0210
	1800	0.0119	0.0148	0.0212	0.0212	0.0212	0.0212
	2000	0.0119	0.0175	0.0265	0.0318	0.0318	0.0318
	2200	0.0111	0.0166	0.0269	0.0341	0.0341	0.0341
	2400	0.0138	0.0185	0.0268	0.0327	0.0327	0.0327
	2600	0.0168	0.0226	0.0313	0.0353	0.0353	0.0353
	2800	0.0170	0.0213	0.0317	0.0324	0.0324	0.0324
	3000	0.0133	0.0166	0.0300	0.0363	0.0363	0.0363

Map (MT model)

		Engine load (g/rev (oz/rev))					
		0.7 (0.02)	0.8 (0.03)	0.9 (0.03)	1 (0.04)	1.1 (0.04)	1.2 (0.04)
Engine speed (rpm)	1400	0.0092	0.0141	0.0172	0.0172	0.0172	0.0172
	1600	0.0160	0.0208	0.0210	0.0210	0.0210	0.0210
	1800	0.0119	0.0148	0.0212	0.0212	0.0212	0.0212
	2000	0.0119	0.0175	0.0265	0.0318	0.0318	0.0318
	2200	0.0111	0.0166	0.0269	0.0341	0.0341	0.0341
	2400	0.0138	0.0185	0.0268	0.0327	0.0327	0.0327
	2600	0.0168	0.0226	0.0313	0.0353	0.0353	0.0353
	2800	0.0170	0.0213	0.0317	0.0324	0.0324	0.0324
	3000	0.0133	0.0166	0.0300	0.0363	0.0363	0.0363

Time Needed for Diagnosis:
- 4 ms × 2500 time(s) (CVT model)
- 4 ms × 2500 time(s) (MT model)

Monitor B1

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Diagnostic Value2 (DV2)	> 65535 time(s) (CVT model) > 65535 time(s) (MT model)

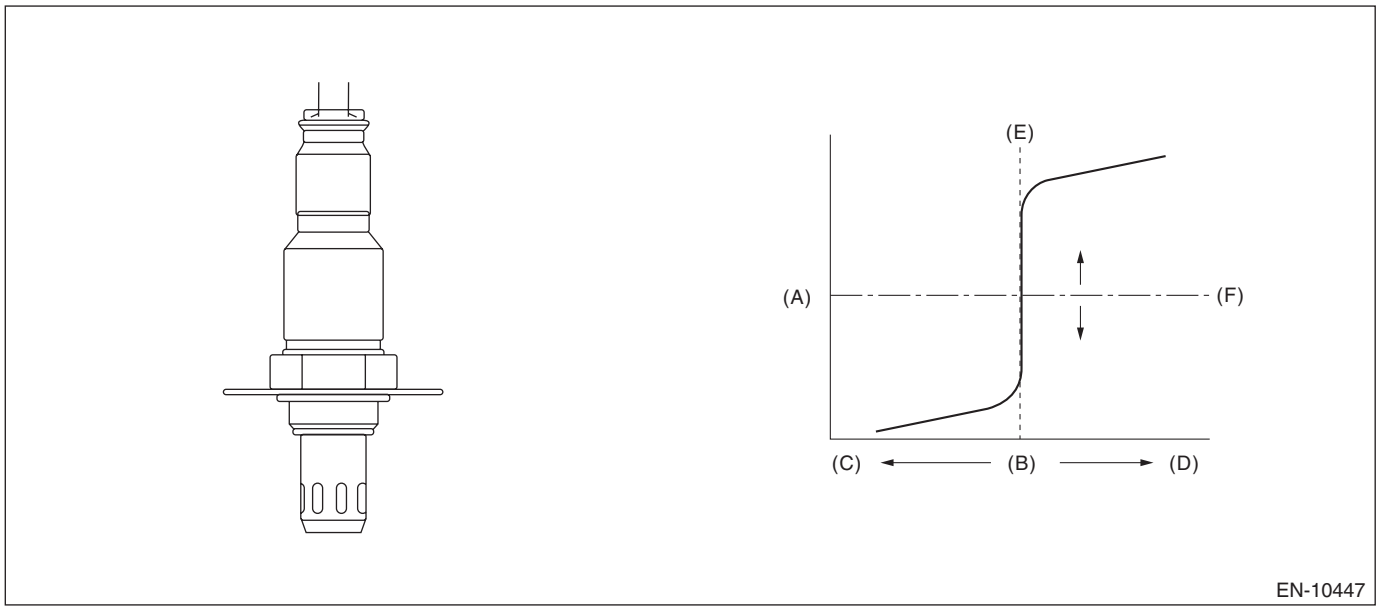
Time Needed for Diagnosis: 1000 engine revs.
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

FL: DTC P2270 O2 SENSOR SIGNAL BIASED/STUCK LEAN (BANK 1 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

Detect the stuck of rear oxygen sensor voltage in lean state.
When rear oxygen sensor voltage remains below the threshold value for predetermined time, diagnosis interrupts target air fuel ratio for control and raises output voltage.
Judge as NG detecting the stuck in lean state when rear oxygen sensor voltage remains below the threshold value even after the interrupt control.

2. COMPONENT DESCRIPTION



(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich
(E) Theoretical air fuel ratio
(F) Comparative voltage

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Sub feedback	In operation
Amount of intake air	≥ 8 g/s (0.28 oz/s) (CVT model) ≥ 8 g/s (0.28 oz/s) (MT model)
Estimated temperature of the rear oxygen sensor element	≥ 500 °C (932 °F) (CVT model) ≥ 500 °C (932 °F) (MT model)
Enable conditions at interrupt control are as follows	
Air fuel ratio reduced from target air fuel ratio	= Value of Map
Continuous time when rear oxygen sensor output voltage is less than 0.55 V	≥ 5000 ms (CVT model) ≥ 15000 ms (MT model)

Map (CVT model)

Output voltage of rear oxygen sensor V	0.000	0.150	0.200	0.400	0.600
Air fuel ratio reduced from target air fuel ratio %	-0.150	-0.150	-0.040	-0.040	-0.040

Map (MT model)

Output voltage of rear oxygen sensor V	0.000	0.150	0.200	0.400	0.600
Air fuel ratio reduced from target air fuel ratio %	-0.150	-0.150	-0.040	-0.040	-0.040

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once after the enable conditions have been established.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage of rear oxygen sensor	< 0.55 V

Time Needed for Diagnosis:

- 15000 ms (CVT model)
- 25000 ms (MT model)

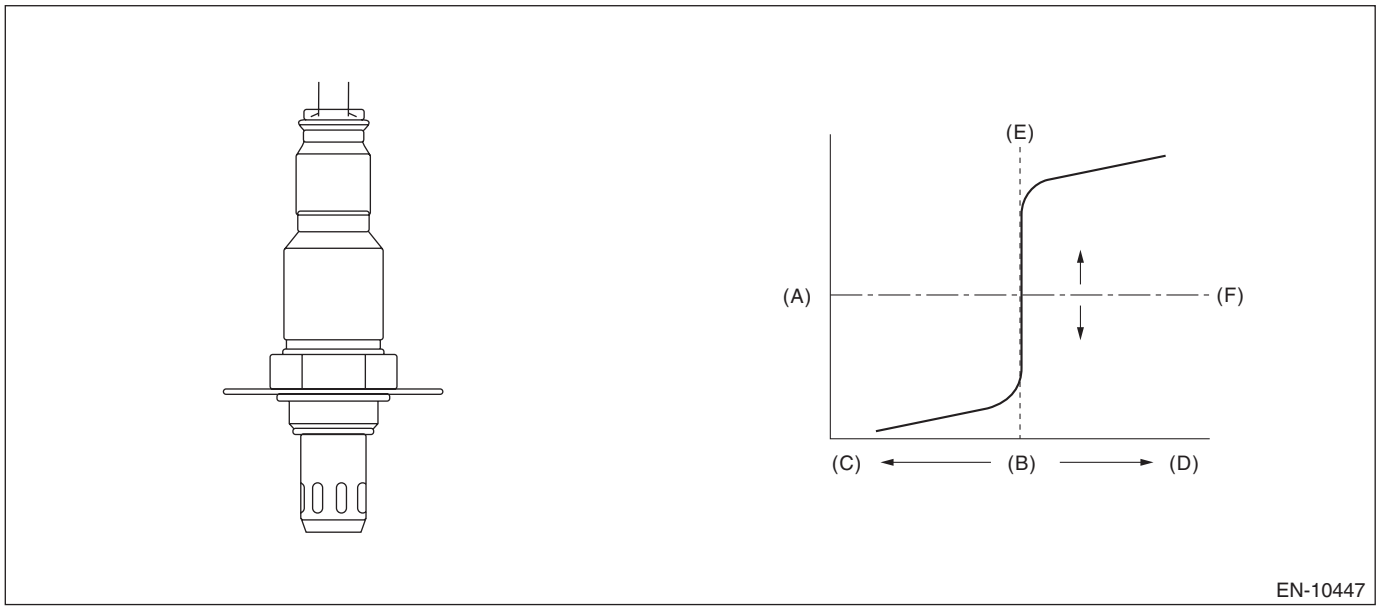
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

FM:DTC P2271 O2 SENSOR SIGNAL BIASED/STUCK RICH (BANK 1 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

Detect the stuck of rear oxygen sensor voltage in rich state.
Detect the stuck in rich state and judge as NG if rear oxygen sensor voltage remains above the threshold value for predetermined time.

2. COMPONENT DESCRIPTION



(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich
(E) Theoretical air fuel ratio
(F) Comparative voltage

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Fuel cut time	≥ 5000 ms
Estimated temperature of the rear oxygen sensor element	≥ 500 °C (932 °F) (CVT model) ≥ 500 °C (932 °F) (MT model)

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once after the enable conditions have been established.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage of rear oxygen sensor	> 0.15 V

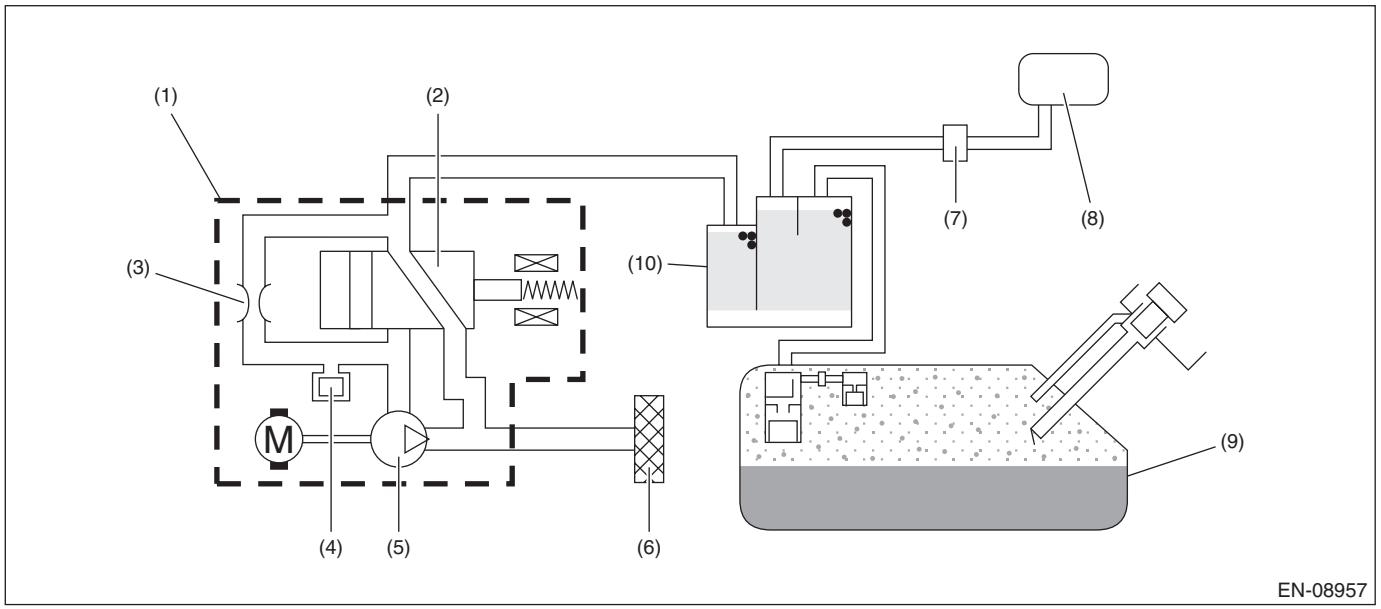
Time Needed for Diagnosis: 500 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

FN:DTC P2401 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP CONTROL CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the ELCM vacuum pump.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) ELCM
(2) Switching valve
(3) Reference orifice (0.02 inch orifice)
(4) Pressure sensor
(5) Vacuum pump
(6) Drain filter
(7) Purge control solenoid valve
(8) Intake manifold
(9) Fuel tank
(10) Canister

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9
Evaporative emission system leak detection pump command	= OFF

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Measured EVAP system leak detection pump voltage	≤ 12V battery system voltage × 0.34 V

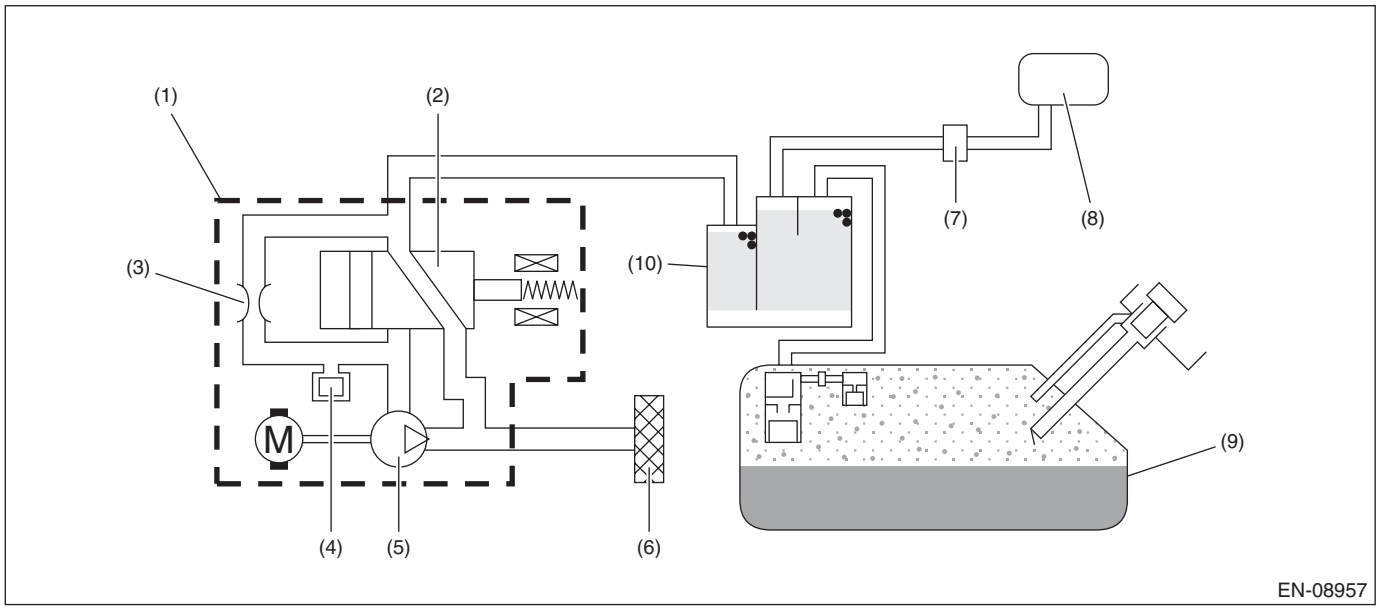
Time Needed for Diagnosis: 2500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

FO:DTC P2402 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP CONTROL CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the ELCM vacuum pump.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) ELCM
(2) Switching valve
(3) Reference orifice (0.02 inch orifice)
(4) Pressure sensor
(5) Vacuum pump
(6) Drain filter
(7) Purge control solenoid valve
(8) Intake manifold
(9) Fuel tank
(10) Canister

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Measured EVAP system leak detection pump current	≥ 12 A

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9
Terminal output voltage when ECM outputs ON signal	High

Time Needed for Diagnosis: 2500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

FP:DTC P2404 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP SENSE CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

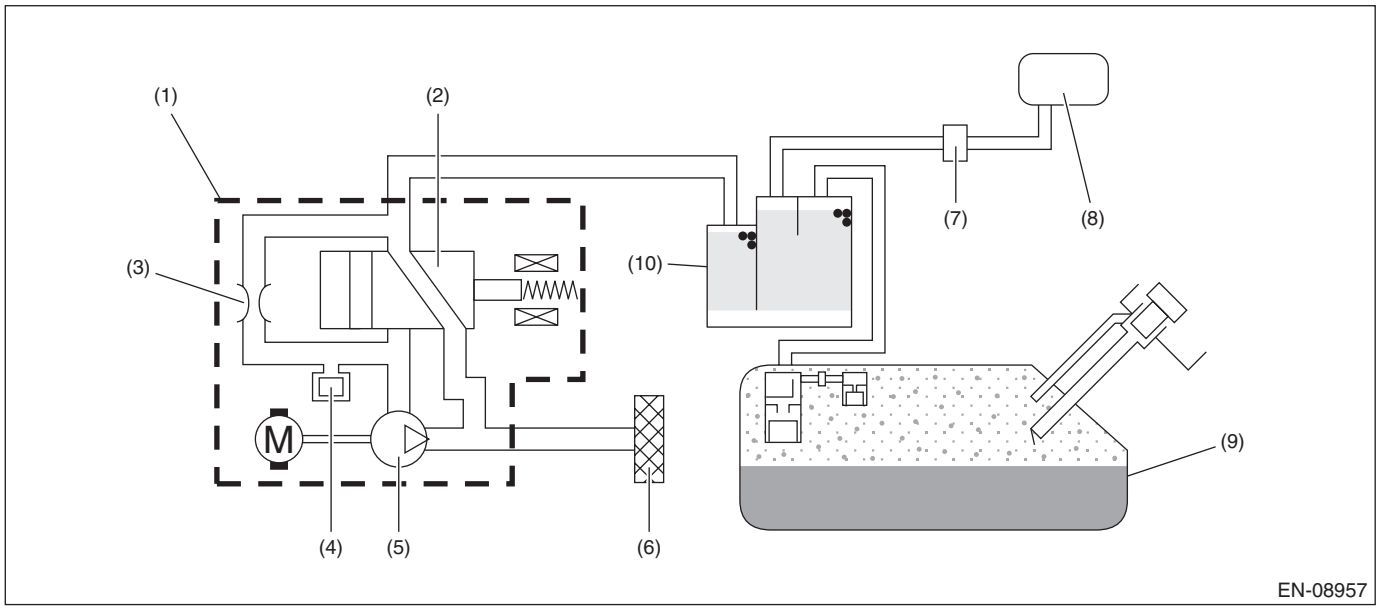
NOTE:
For the detection standard, refer to DTC P0455. <Ref. to GD(H4DO w/o HEV)-119, DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

FQ:DTC P2419 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the ELCM switching valve.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) ELCM
(2) Switching valve
(3) Reference orifice (0.02 inch orifice)
(4) Pressure sensor
(5) Vacuum pump
(6) Drain filter
(7) Purge control solenoid valve
(8) Intake manifold
(9) Fuel tank
(10) Canister

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Evaporative emission system switching valve command	Low

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Measured EVAP system switching valve voltage	12V battery system voltage × 0.34V

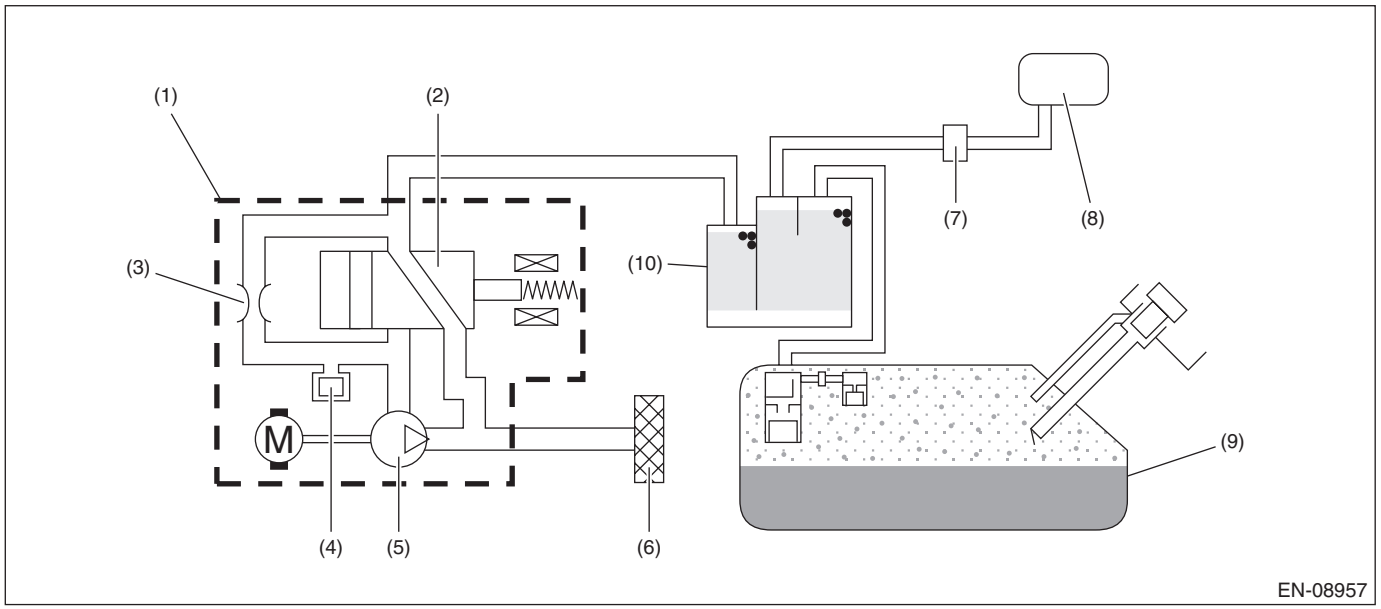
Time Needed for Diagnosis: 2500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

FR:DTC P2420 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the ELCM switching valve.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) ELCM
(2) Switching valve
(3) Reference orifice (0.02 inch orifice)
(4) Pressure sensor
(5) Vacuum pump
(6) Drain filter
(7) Purge control solenoid valve
(8) Intake manifold
(9) Fuel tank
(10) Canister

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Evaporative emission system switching valve command	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Measured EVAP system switching valve current	≥ 12 A

Time Needed for Diagnosis: 2500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

FS:DTC P2530 IGNITION SWITCH RUN POSITION CIRCUIT

1. OUTLINE OF DIAGNOSIS

Detect instantaneous open in ignition switch input circuit to ECM.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION

ECM monitors the voltage of the ignition switch input circuit. Judge as ignition switch ON when the voltage is the specified value or more.

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Engine speed	≥ 500 rpm

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after the enable conditions have been established.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established within the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Number of instantaneous opens in ignition switch input circuit	≥ 5 time(s)

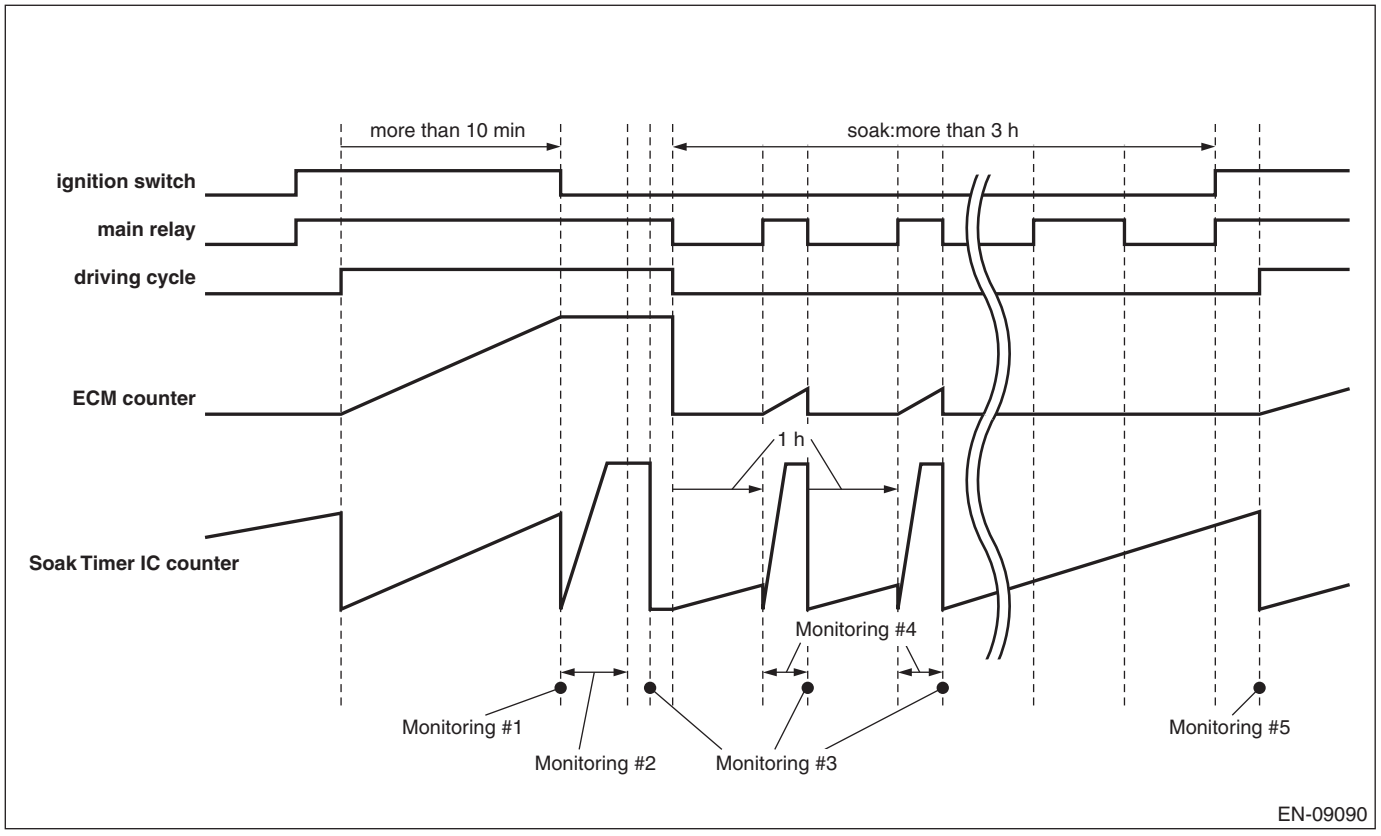
Time Needed for Diagnosis: 5000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

FT: DTC P2610 ECM/PCM INTERNAL ENGINE OFF TIMER PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect malfunction of soaking timer IC by the five diagnoses below.

Monitor Number	Explanation	Time required for diagnosis
Monitor #1 <Timer diagnosis>	Perform diagnosis of the soaking timer IC accuracy	196 ms
Monitor #2 <Full count diagnosis>	Perform diagnosis of the soaking timer IC counter function	4000 ms
Monitor #3 <Soaking timer IC setting diagnosis>	Perform diagnosis of communication between ECM and soaking timer IC	196 ms
Monitor #4 <Timer diagnosis (during soaking)>	Perform diagnosis of the soaking timer IC accuracy during soaking	3000 ms
Monitor #5 <Wake-up diagnosis>	Perform diagnosis of wake-up function	64 ms



2. COMPONENT DESCRIPTION

The soaking timer IC is built into the ECM.

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
<Timer diagnosis>	
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	> 600 s and < 61380 s
<Full count diagnosis>	
Battery voltage	≥ 10.9 V
ECM counter	≥ 4 s
<Soaking timer IC setting diagnosis>	
Battery voltage	≥ 10.9 V
<Timer diagnosis (during soaking)>	
Battery voltage	≥ 10.9 V
<Wake-up diagnosis>	
Soak time	> 3600 s

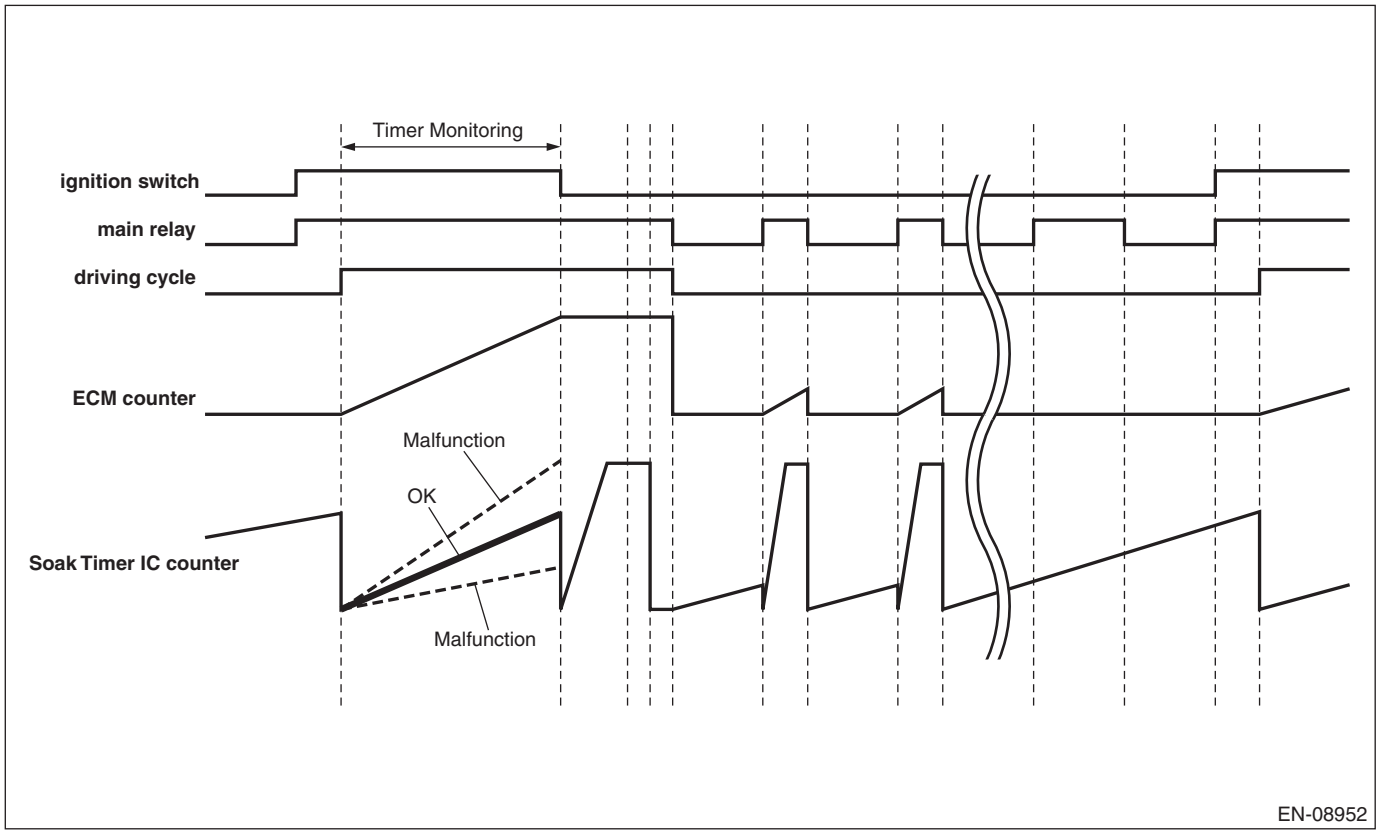
4. GENERAL DRIVING CYCLE

Perform the diagnosis only once when the ignition switch is OFF and when the ignition switch is ON after the soaking of one hour or more.

5. DIAGNOSTIC METHOD

<Timer diagnosis>

Start the count up operation of counters in ECM and in soaking timer IC when the engine is started.
Judge as timer malfunction if the difference between the counter in ECM and counter in soaking timer IC exceeds the allowable limit when the ignition switch is OFF.



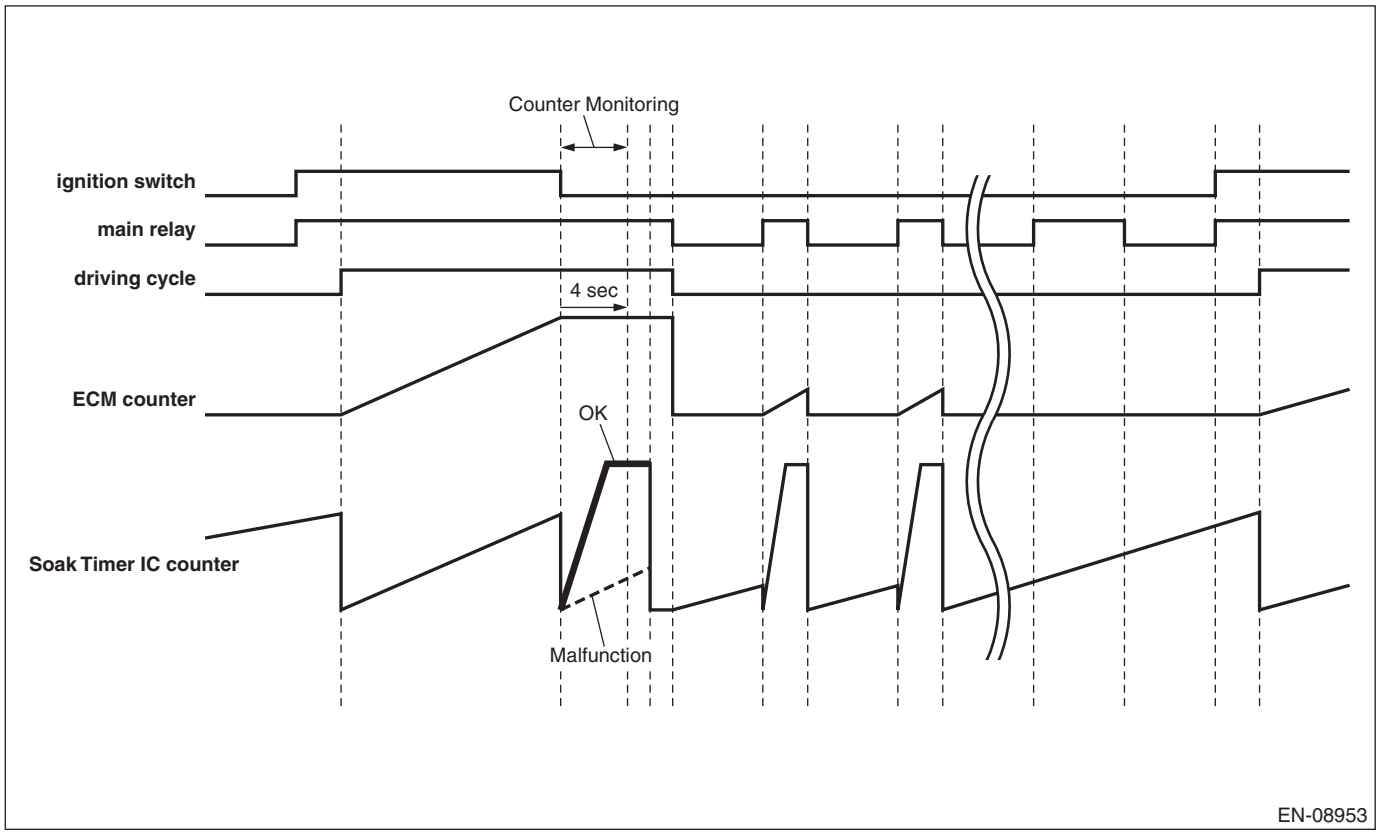
Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
| (ECM counter) – (Soak timer IC counter) | / ECM counter	> 0.24

<Full count diagnosis>

Reset the counter in soaking timer IC and start the count up operation.
Judge as full count diagnosis malfunction if counter in soaking timer IC is not $3FF (1023 count) after 4 seconds.



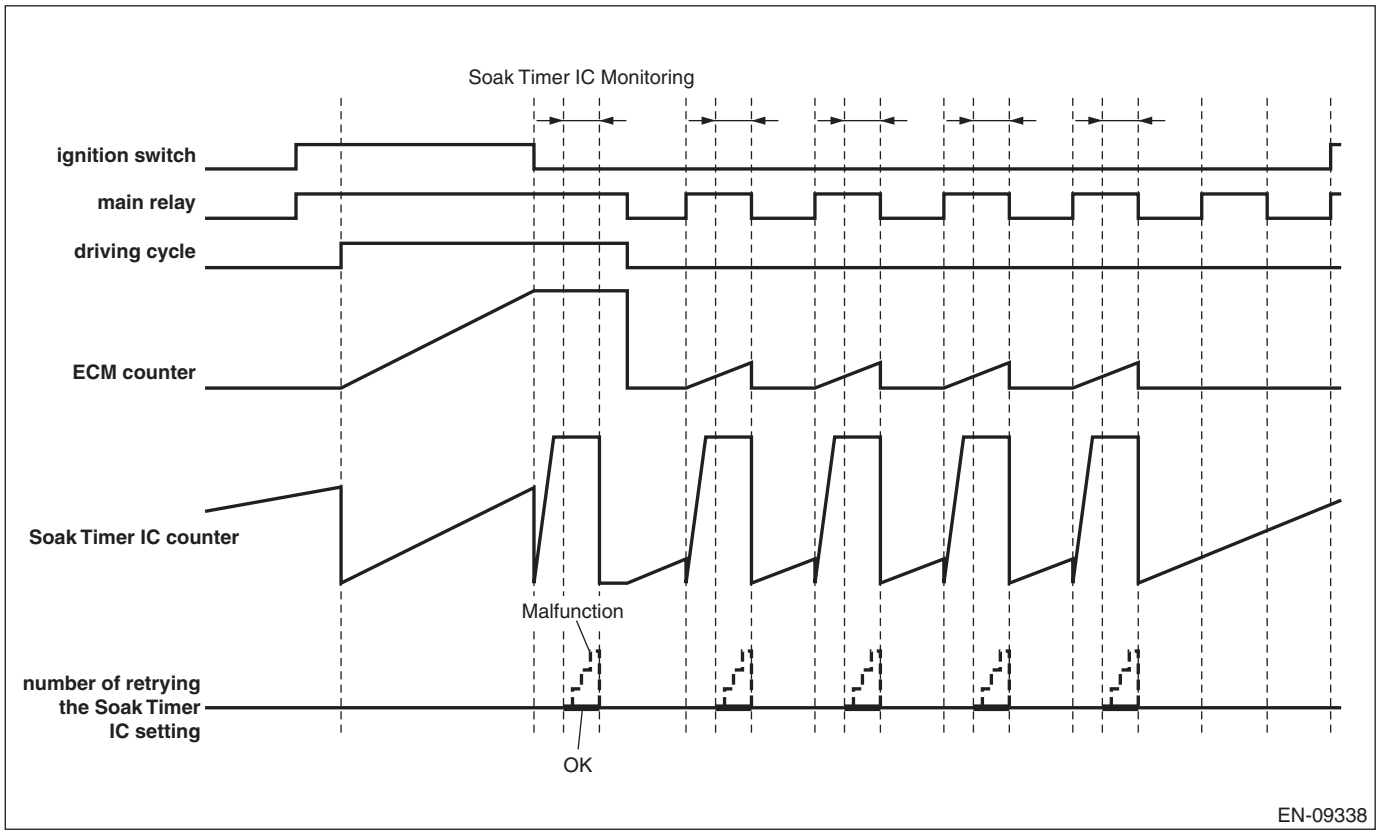
Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Soak timer IC counter	≠ $3FF (1023 count)

<Soaking timer IC setting diagnosis>

When setting the activation setting time to soaking timer IC, compare the writing value to soaking timer IC with read out value. Judge as malfunction if the values do not match 3 times in a row.



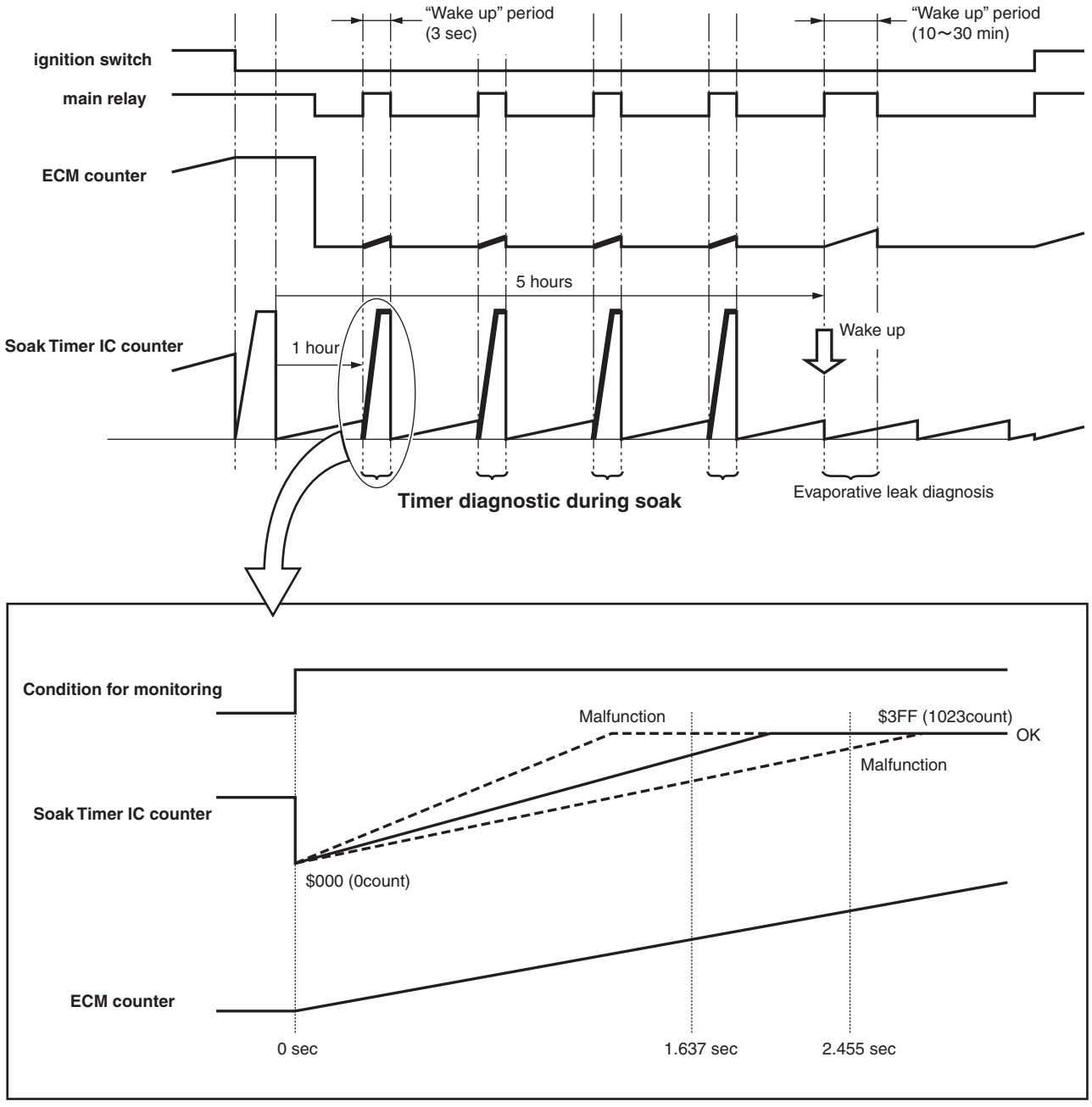
Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Value commanded by the ECM	≠ Value received by the soak timer IC

<Timer diagnosis (during soaking)>

Wake-up at the predetermined interval until 5, 7 or 9.5 hours have passed after the ignition switch is OFF, and compare the counter in soaking timer IC with the counter in ECM.
Judge as malfunction if the counter in soaking timer IC is counted up to maximum value (1023 counts) when the counter in ECM is 1637 ms, or if the counter in soaking timer IC is not counted up to maximum value (1023 counts) when the counter in ECM is 2455 ms.



EN-08981

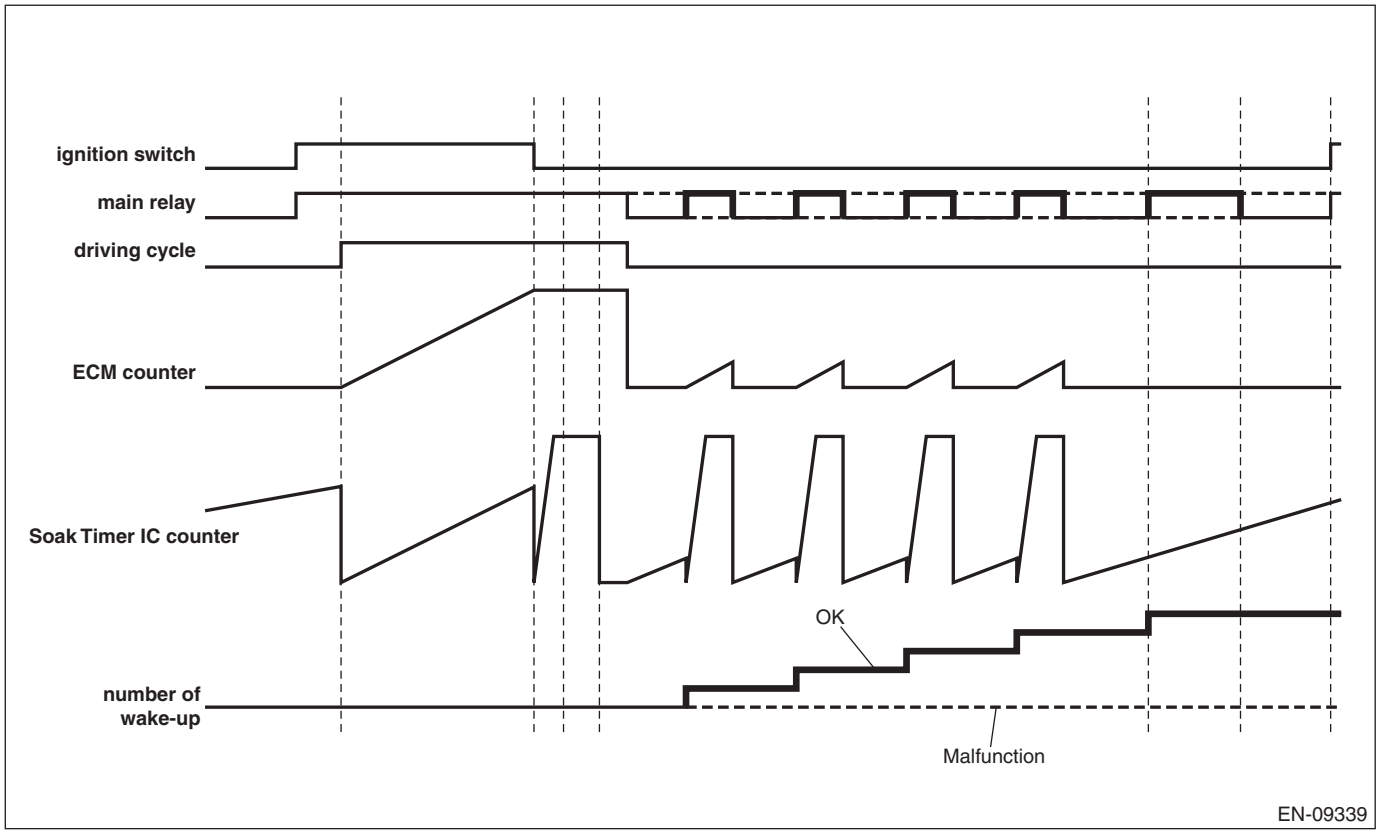
Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Soak timer IC counter when ECM counter ≤ 1.636 sec	= 1023 count
Soak timer IC counter when ECM counter ≥ 2.456 sec	≠ 1023 count

<Wake-up diagnosis>

Store the number of wake-up activation when the ECM wakes up by the soaking timer IC.
Next time when the ignition switch is ON, if the number of wake-up activation does not reach the predetermined value even though the counter in soaking timer IC operates 1 hour or more, judge as wake-up malfunction.



Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Number of wake-up function commanded from ECM to Soak-timer IC	≠ Number of actual wake-up ECM

Time Needed for Diagnosis: Approx. 5 — 9.5 hours
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

FU:DTC U0073 CONTROL MODULE COMMUNICATION BUS OFF

1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.
Judge as NG when CAN communication failure has occurred.

2. COMPONENT DESCRIPTION

(Common Specifications)
CAN Protocol 2.0 B (Active)
Frame Format: 11 Bit ID Frame (Standard Frame)
Conforms to ISO11898
Communication Speed: 500 kbps

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
CAN bus condition	Bus off

Time Needed for Diagnosis: 436 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

FV:DTC U0101 LOST COMMUNICATION WITH TCM

1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.
Judge as NG when CAN communication failure between TCM, VDC CM and combination meter has occurred.

2. COMPONENT DESCRIPTION

(Common Specifications)
CAN Protocol 2.0 B (Active)
Frame Format: 11 Bit ID Frame (Standard Frame)
Conforms to ISO11898
Communication Speed: 500 kbps

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
CAN data from TCM	= Lost

Time Needed for Diagnosis: 500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

FW:DTC U0122 LOST COMMUNICATION WITH VEHICLE DYNAMICS CONTROL MODULE

1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.
Judge as NG when CAN communication failure between TCM, VDC CM and combination meter has occurred.

2. COMPONENT DESCRIPTION

(Common Specifications)
CAN Protocol 2.0 B (Active)
Frame Format: 11 Bit ID Frame (Standard Frame)
Conforms to ISO11898
Communication Speed: 500 kbps

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
CAN data from vehicle dynamics control module	= Lost

Time Needed for Diagnosis: 500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

FX:DTC U0155 LOST COMMUNICATION WITH INSTRUMENT PANEL CLUSTER (IPC) CONTROL MODULE

1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.
Judge as NG when CAN communication failure between TCM, VDC CM and combination meter has occurred.

2. COMPONENT DESCRIPTION

(Common Specifications)
CAN Protocol 2.0 B (Active)
Frame Format: 11 Bit ID Frame (Standard Frame)
Conforms to ISO11898
Communication Speed: 500 kbps

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
CAN data from instrument panel cluster control module	= Lost

Time Needed for Diagnosis: 500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

FY:DTC U0402 INVALID DATA RECEIVED FROM TCM

1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.
Judge as NG when data received from TCM, VDC CM and combination meter is not normal.

2. COMPONENT DESCRIPTION

(Common Specifications)
CAN Protocol 2.0 B (Active)
Frame Format: 11 Bit ID Frame (Standard Frame)
Conforms to ISO11898
Communication Speed: 500 kbps

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
CAN data from TCM	Did not change
CAN data from TCM	Parity error

Time Needed for Diagnosis: 2 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

FZ: DTC U0416 INVALID DATA RECEIVED FROM VEHICLE DYNAMICS CONTROL MODULE

1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.
Judge as NG when data received from TCM, VDC CM and combination meter is not normal.

2. COMPONENT DESCRIPTION

(Common Specifications)
CAN Protocol 2.0 B (Active)
Frame Format: 11 Bit ID Frame (Standard Frame)
Conforms to ISO11898
Communication Speed: 500 kbps

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
CAN data from vehicle dynamics control module	Did not change

Time Needed for Diagnosis: 2 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

GA:DTC U0423 INVALID DATA RECEIVED FROM INSTRUMENT PANEL CLUSTER CONTROL MODULE

1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.
Judge as NG when data received from TCM, VDC CM and combination meter is not normal.

2. COMPONENT DESCRIPTION

(Common Specifications)
CAN Protocol 2.0 B (Active)
Frame Format: 11 Bit ID Frame (Standard Frame)
Conforms to ISO11898
Communication Speed: 500 kbps

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
CAN data from instrument panel cluster control module	Did not change

Time Needed for Diagnosis: 2 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

ENGINE 2 SECTION

This service manual has been prepared to provide SUBARU service personnel with the necessary information and data for the correct maintenance and repair of SUBARU vehicles.
This manual includes the procedures for maintenance, disassembling, reassembling, inspection and adjustment of components and diagnostics for guidance of experienced mechanics.
Please peruse and utilize this manual fully to ensure complete repair work for satisfying our customers by keeping their vehicle in optimum condition. When replacement of parts during repair work is needed, be sure to use SUBARU genuine parts.

All information, illustration and specifications contained in this manual are based on the latest product information available at the time of publication approval.

FUEL INJECTION (FUEL SYSTEMS)	FU(H4DO (HEV))
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)	EC(H4DO (HEV))
INTAKE (INDUCTION)	IN(H4DO (HEV))
MECHANICAL	ME(H4DO (HEV))
EXHAUST	EX(H4DO (HEV))
COOLING	CO(H4DO (HEV))
LUBRICATION	LU(H4DO (HEV))
SPEED CONTROL SYSTEMS	SP(H4DO (HEV))
IGNITION	IG(H4DO (HEV))
STARTING/CHARGING SYSTEMS	SC(H4DO (HEV))
ENGINE (DIAGNOSTICS)	EN(H4DO HEV)(diag)
GENERAL DESCRIPTION	GD(H4DO HEV)

FUJI HEAVY INDUSTRIES LTD.

FUEL INJECTION (FUEL SYSTEMS)

FU(H4DO(HEV))

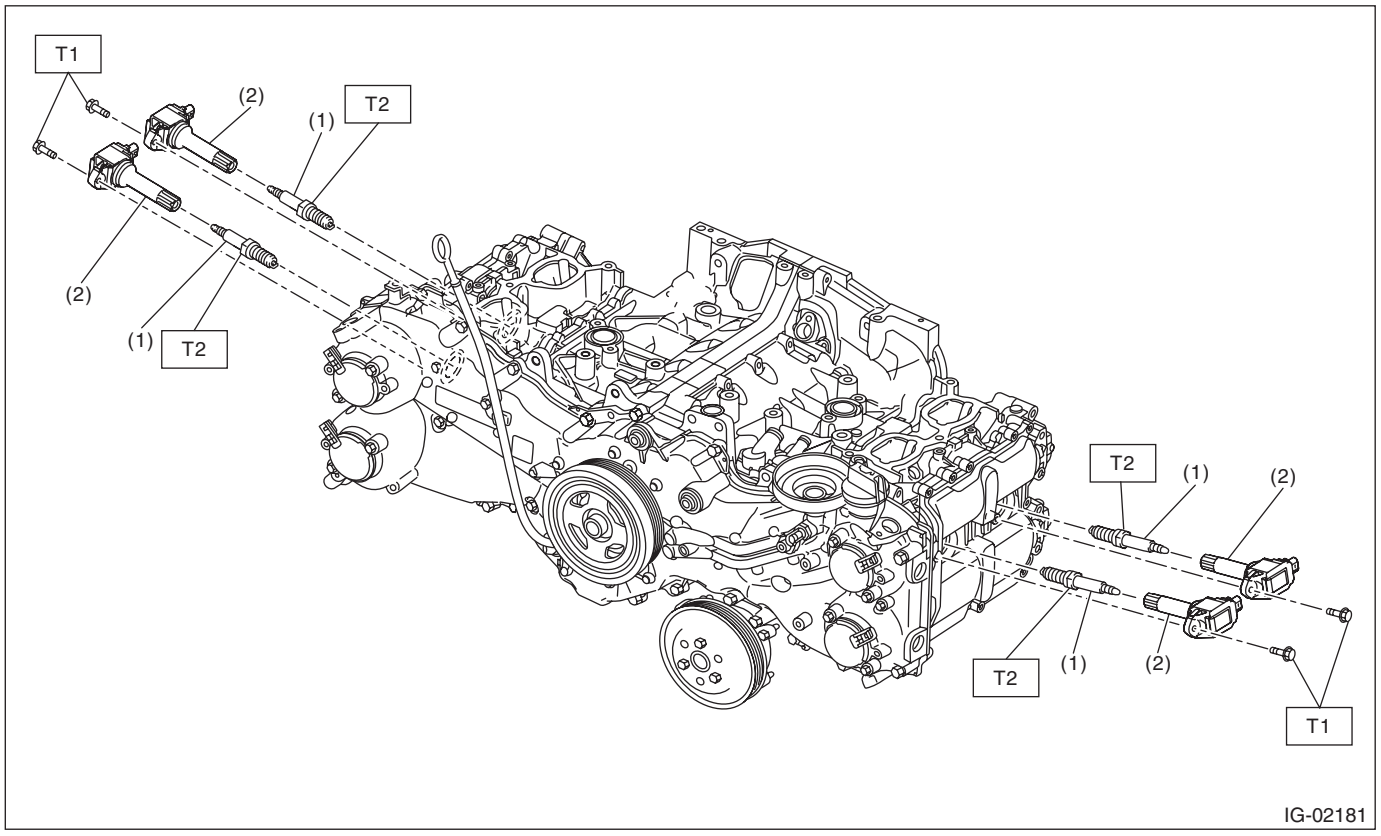
		Page
1.	General Description	2
2.	Throttle Body	14
3.	Intake Manifold	19
4.	Engine Wiring Harness	34
5.	Engine Coolant Temperature Sensor	41
6.	Engine Oil Temperature Sensor	44
7.	Crankshaft Position Sensor	46
8.	Crankshaft Position Sensor Plate	51
9.	Camshaft Position Sensor	52
10.	Oil Control Solenoid	56
11.	Knock Sensor	59
12.	Throttle Position Sensor	62
13.	Mass Air Flow and Intake Air Temperature Sensor	63
14.	Manifold Absolute Pressure Sensor	66
15.	Fuel Injector	69
16.	Tumble Generator Valve Assembly	73
17.	Tumble Generator Valve Actuator	76
18.	Front Oxygen (A/F) Sensor	78
19.	Rear Oxygen Sensor	82
20.	Engine Control Module (ECM)	85
21.	Main Relay	88
22.	IG Relay	90
23.	Oxygen Sensor Relay	92
24.	Electronic Throttle Control Relay	94
25.	Fuel Pump Relay	96
26.	Fuel	98
27.	Fuel Tank Protector	104
28.	Fuel Tank	105
29.	Fuel Filler Pipe	118
30.	Fuel Pump	122
31.	Fuel Level Sensor	128
32.	Fuel Sub Level Sensor	131
33.	Fuel Filter	138
34.	Fuel Delivery and Evaporation Lines	149
35.	Fuel System Trouble in General	158

1. General Description

A: SPECIFICATION

Item				Specifications
Ignition coil	Manufacturer and type	Gasoline engine model		Hitachi: EIC-2230
		HEV model		Diamond Electric: FK0438
	Ignition system			Independent ignition coil
Spark plug	Manufacturer and type	Gasoline engine model		NGK: SILZKAR7B11
		HEV model		NGK: DILZKAR7B11
	Thread size (diameter, pitch, length) mm			12, 1.25, 26.5
	Spark plug gap mm (in)		Standard	1.0 — 1.1 (0.039 — 0.043)
	Electrode			Iridium

B: COMPONENT



(1) Spark plug
(2) Ignition coil

Tightening torque: N·m (kgf-m, ft-lb)
T1: 8.5 (0.9, 6.3)
T2: 17.5 (1.8, 12.9)

C: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a work cap, and protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.

2. Spark Plug

A: REMOVAL

Spark plug:

Refer to "SPECIFICATION" for spark plug. <Ref. to IG(H4DO(w/o HEV))-2, SPECIFICATION, General Description.>

1. RH SIDE

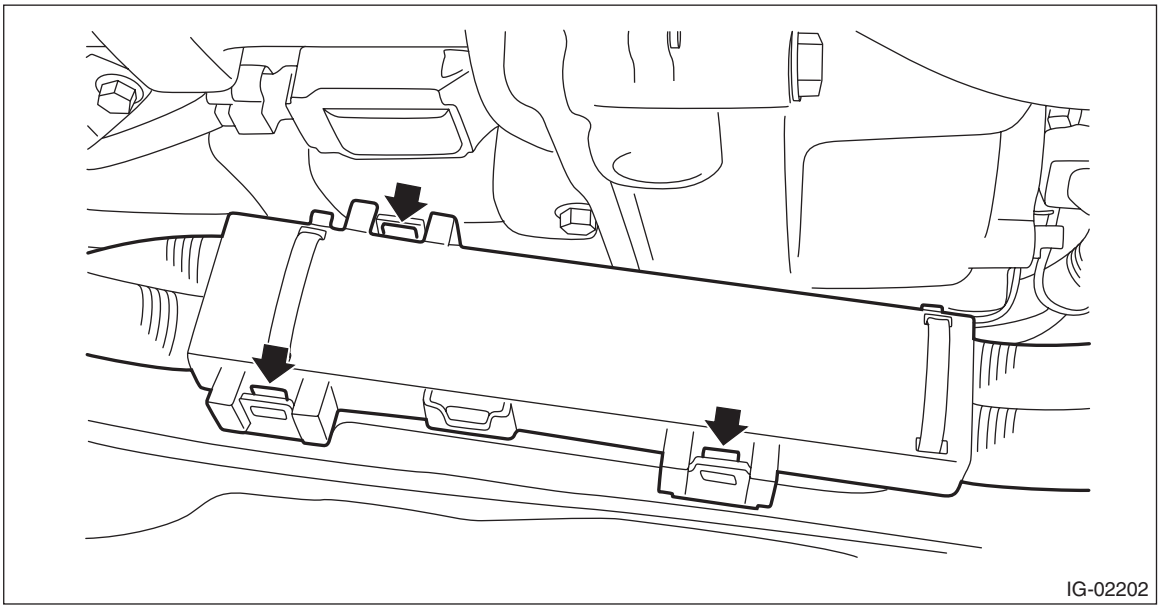
1) Disconnect the ground cable from battery. <Ref. to NT-5, BATTERY, NOTE, Note.>

NOTE:
For the 12 volt engine restart battery of HEV model, disconnect the ground terminal from 12V engine restart battery sensor.

2) Remove the air cleaner case. (Gasoline engine model) <Ref. to IN(H4DO(w/o HEV))-7, REMOVAL, Air Cleaner Case.>

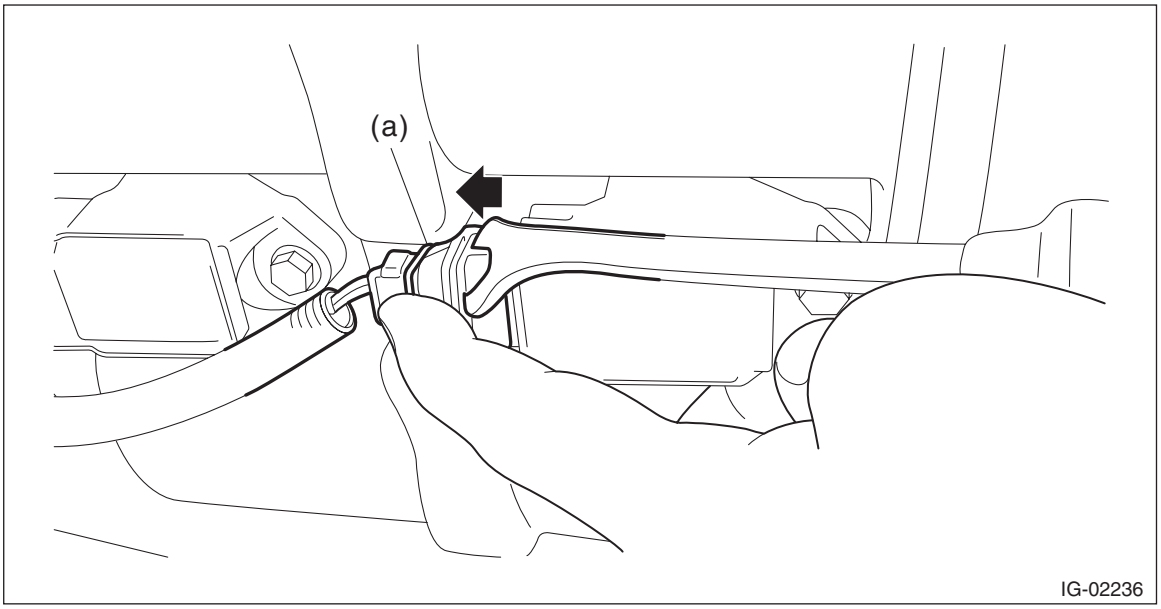
3) Remove the 12 volt engine restart battery. (HEV model) <Ref. to SC(H4DO(HEV))-40, 12 VOLT ENGINE RESTART BATTERY, REMOVAL, Battery.>

4) Remove the battery cable assembly from the battery cable bracket No. 2. (HEV model)

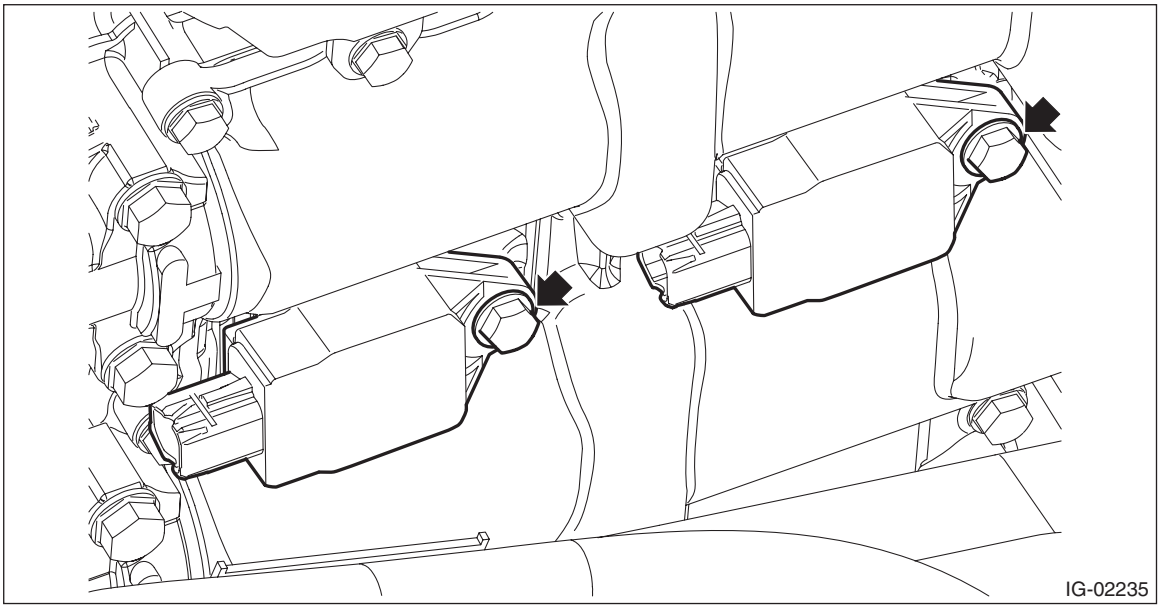


5) Disconnect the connector from ignition coil.

NOTE:
While pressing the spring (a) shown in the figure, slide it in the direction of the arrow with a clip remover.



6) Remove the ignition coil.



7) Remove the spark plug with a spark plug socket.

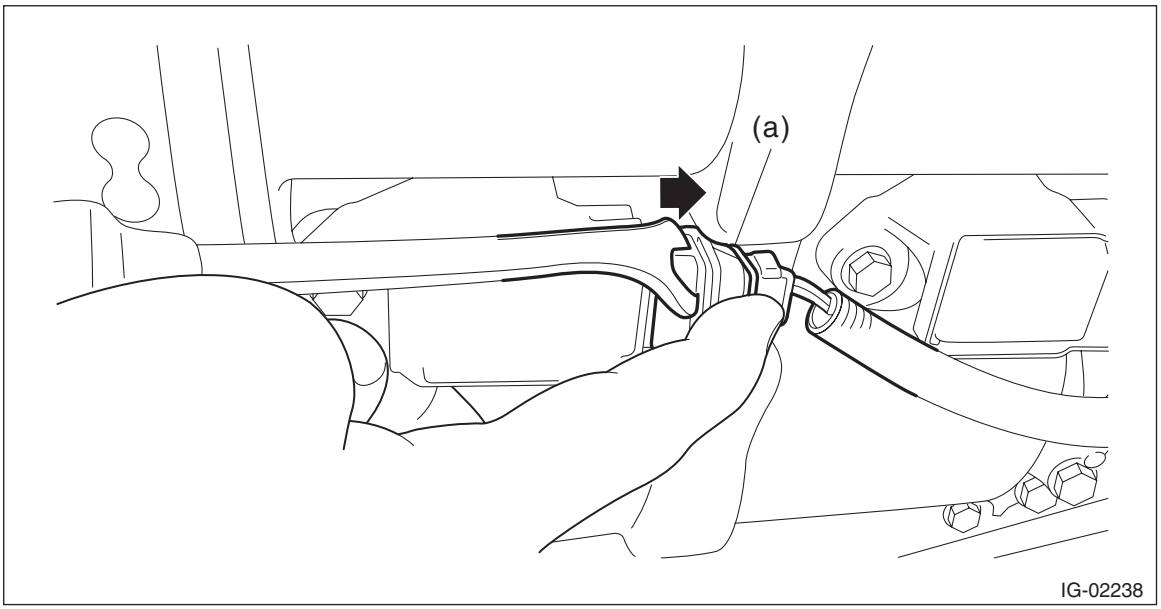
2. LH SIDE

1) Disconnect the ground cable from battery. <Ref. to NT-5, BATTERY, NOTE, Note.>

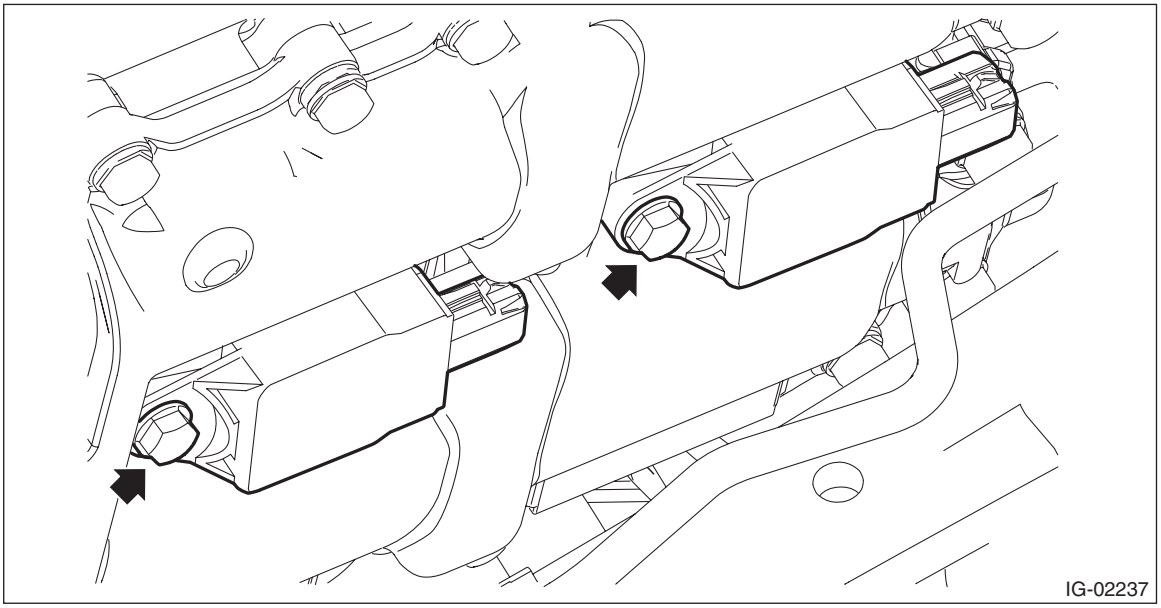
NOTE:
For the 12 volt engine restart battery of HEV model, disconnect the ground terminal from 12V engine restart battery sensor.

2) Disconnect the connector from ignition coil.

NOTE:
While pressing the spring (a) shown in the figure, slide it in the direction of the arrow with a clip remover.



3) Remove the ignition coil.



4) Remove the spark plug with a spark plug socket.

B: INSTALLATION

1. RH SIDE

Install in the reverse order of removal.

CAUTION:
Degrease the ignition coil installation portion and the mounting bolts.

Tightening torque:
Spark plug
17.5 N·m (1.8 kgf-m, 12.9 ft-lb)
Ignition coil
8.5 N·m (0.9 kgf-m, 6.3 ft-lb)

2. LH SIDE

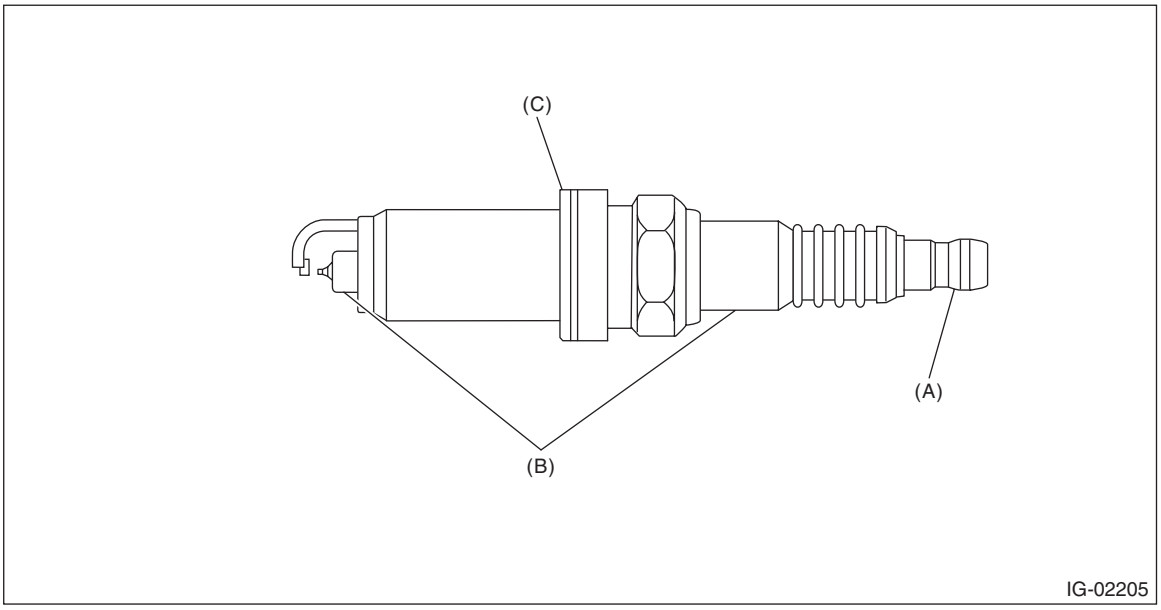
Install in the reverse order of removal.

CAUTION:
Degrease the ignition coil installation portion and the mounting bolts.

Tightening torque:
Spark plug
17.5 N·m (1.8 kgf-m, 12.9 ft-lb)
Ignition coil
8.5 N·m (0.9 kgf-m, 6.3 ft-lb)

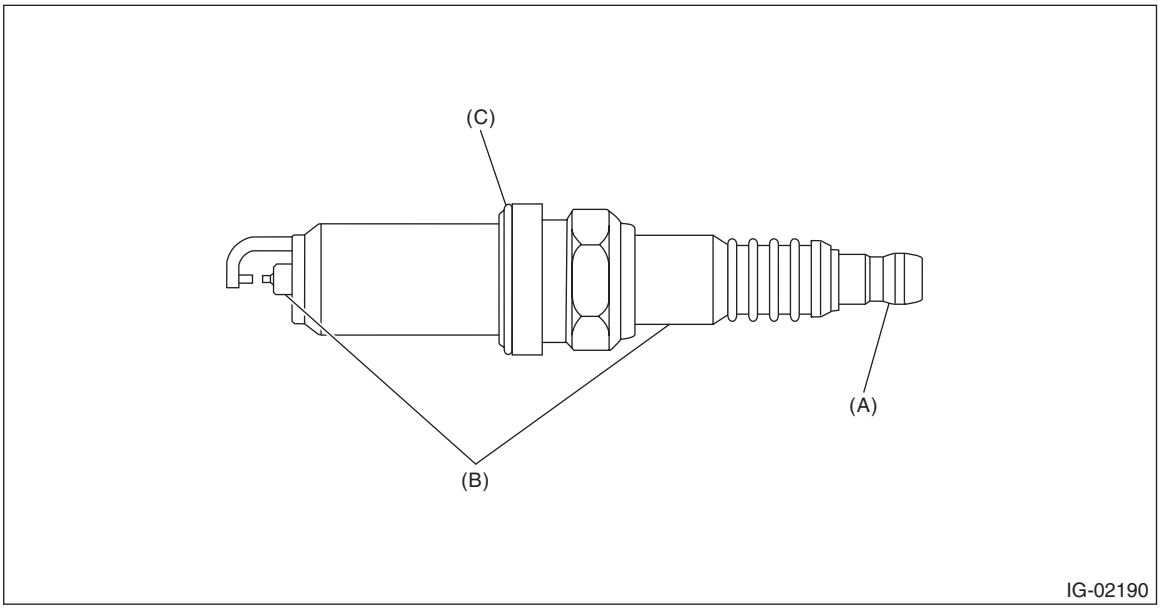
C: INSPECTION

1) Check the spark plug for abnormalities. If defective, replace the spark plug.
- Gasoline engine model



(A) Terminal damage (B) Crack or damage in insulator (C) Damaged gasket

- HEV model

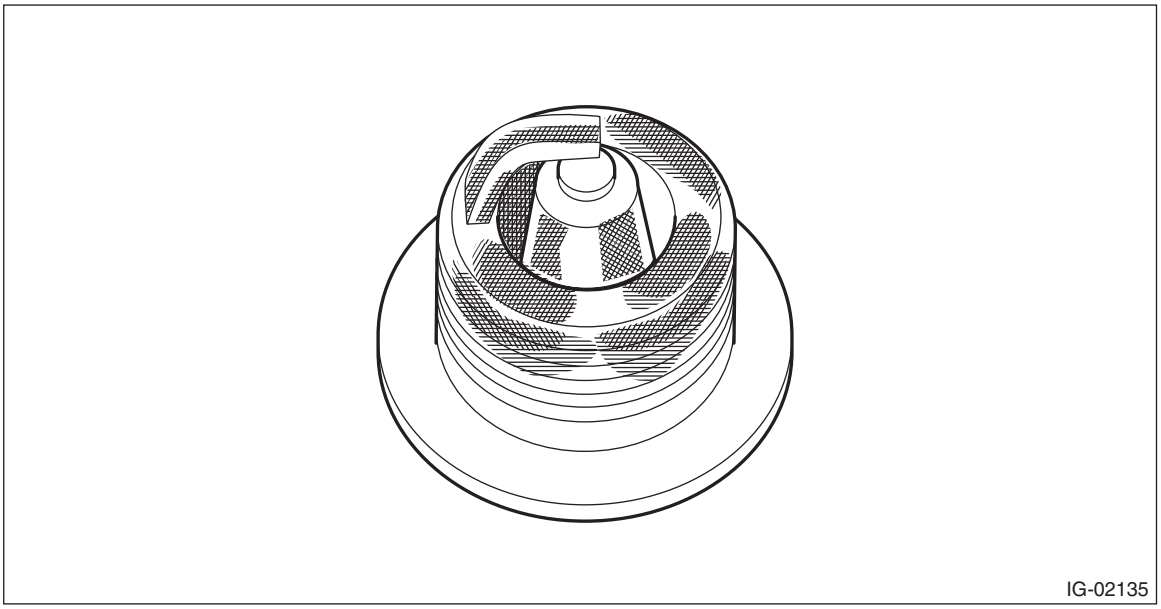


(A) Terminal damage (B) Crack or damage in insulator (C) Damaged gasket

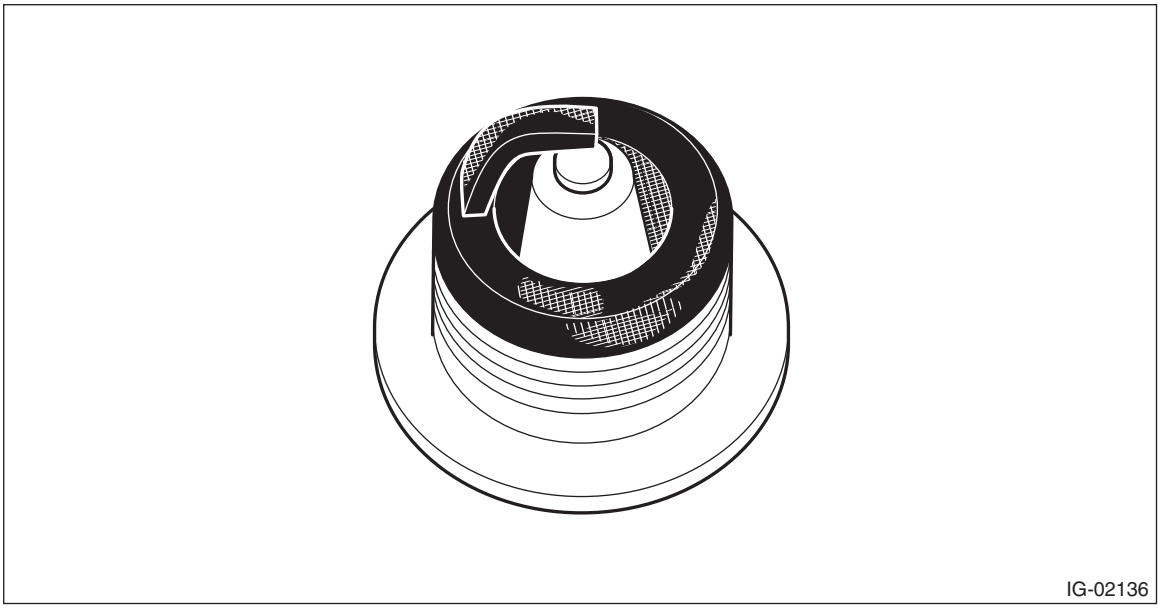
2) Check the spark plug electrode and condition of the insulator. If abnormal, check and repair the cause and replace the spark plug.

(1) Normal:

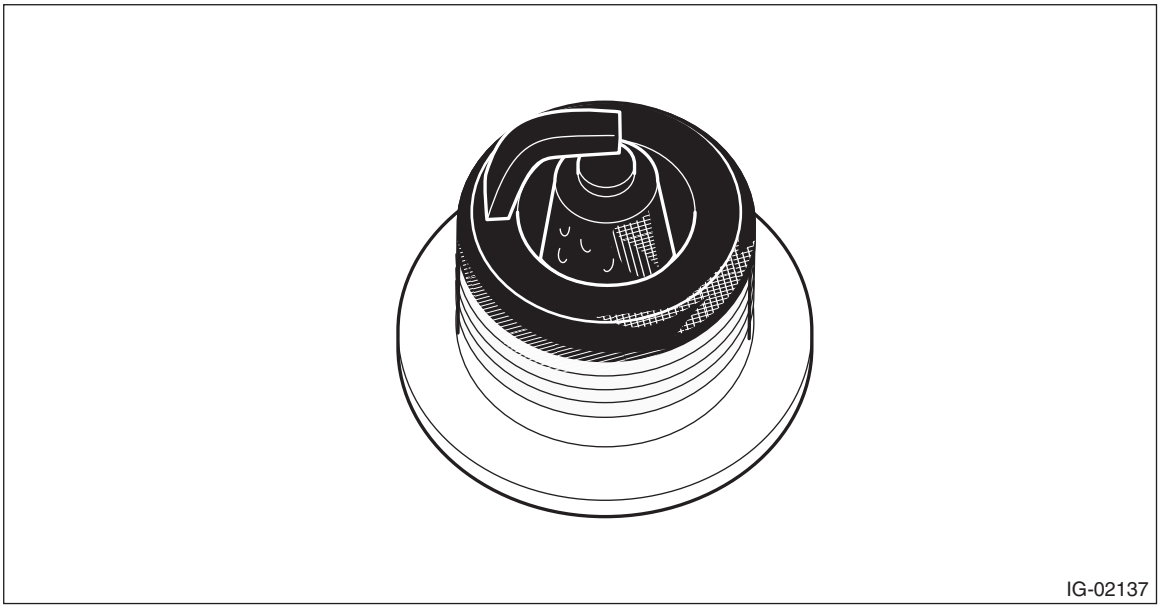
Brown to grayish-tan deposits and slight electrode wear indicate correct spark plug heat range.



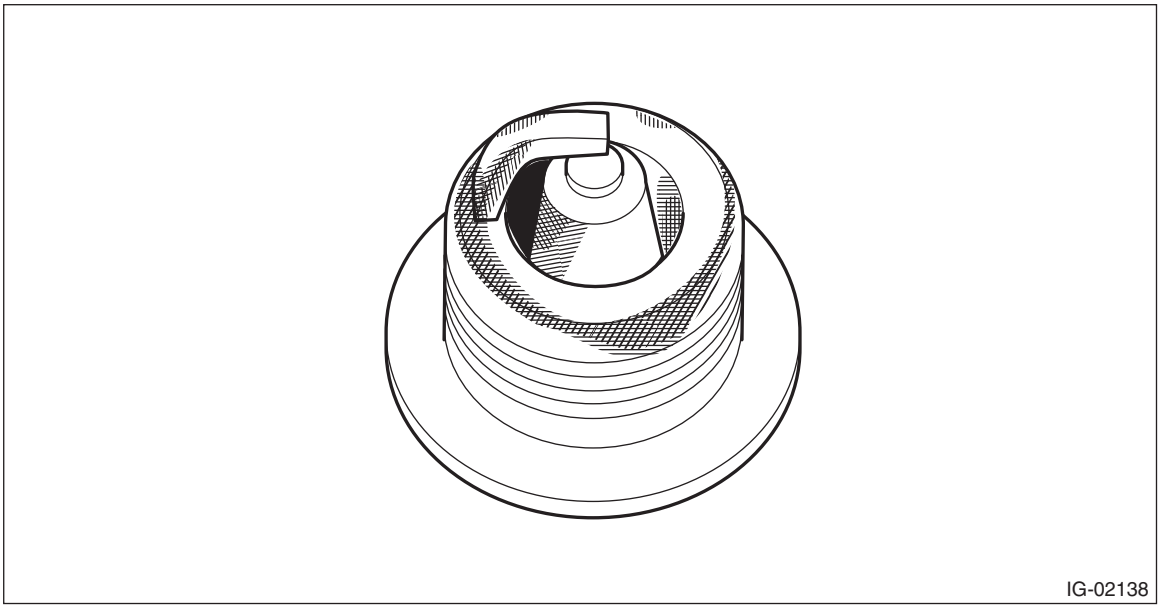
(2) Carbon fouled:
Dry fluffy carbon deposits on the insulator and electrode are mostly caused by slow-speed driving in town, weak ignition, too rich fuel mixture, etc.


IG-02136

(3) Oil fouled:
Wet black deposits show oil entrance into combustion chamber through worn piston rings or increased clearance between valve guides and valve stems.


IG-02137

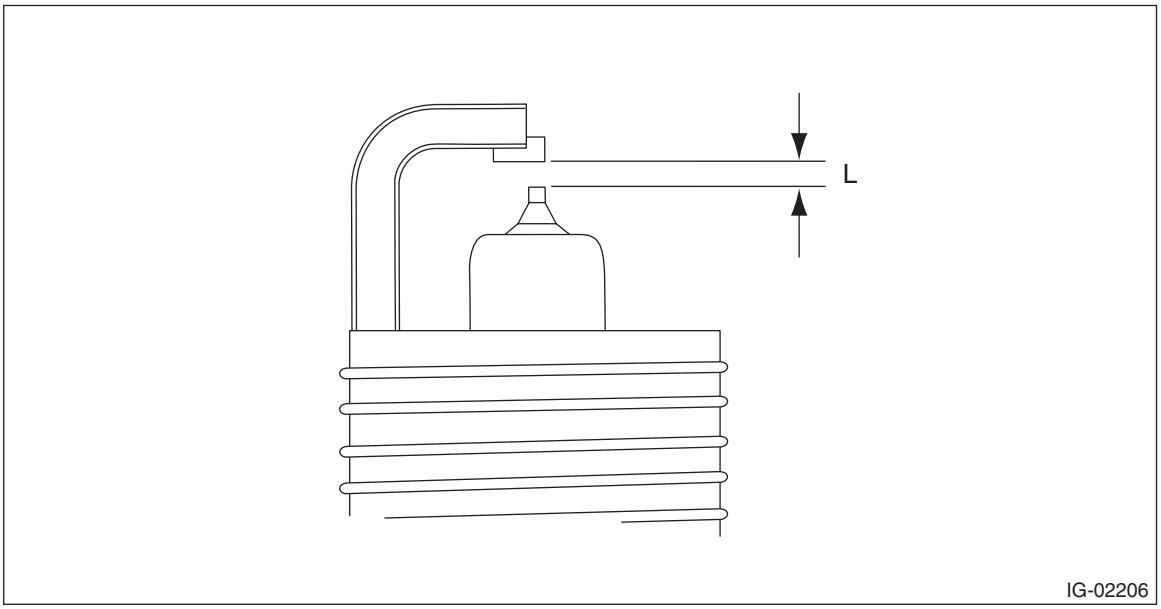
(4) Overheating:
A white or light gray insulator with black or brown spots and bluish burnt electrodes indicate engine overheating, wrong selection of fuel, or loose spark plugs.


IG-02138

3) Using a nylon brush, etc., clean and remove the carbon or oxide deposits from the spark plug. If deposits are too stubborn, replace the spark plugs. After cleaning the spark plugs, check the spark plug gap “L” using a gap gauge. If it is not within the standard, replace the spark plug.

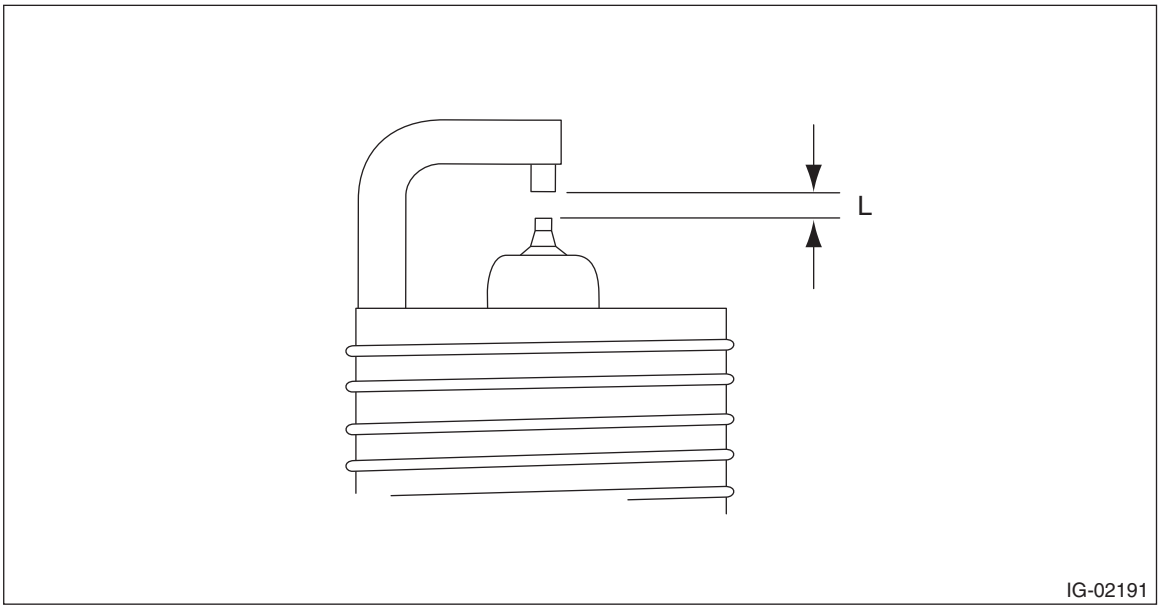
NOTE:
- Never use a plug cleaner.
- Do not use a metal brush as it may damage the electrode area.

Spark plug gap L:
Standard
1.0 — 1.1 mm (0.039 — 0.043 in)
- Gasoline engine model



IG-02206

- HEV model



3. Ignition Coil

A: REMOVAL

Direct ignition type is adopted. Refer to “Spark Plug” for removal procedure. <Ref. to IG(H4DO(w/o HEV))-4, REMOVAL, Spark Plug.>

B: INSTALLATION

Direct ignition type is adopted. Refer to “Spark Plug” for the installation procedure. <Ref. to IG(H4DO(w/o HEV))-7, INSTALLATION, Spark Plug.>

C: INSPECTION

For inspection procedure, refer to “Diagnostics for Engine Starting Failure”. <Ref. to EN(H4DO w/o HEV)(diag)-87, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.> <Ref. to EN(H4DO HEV)(diag)-85, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>

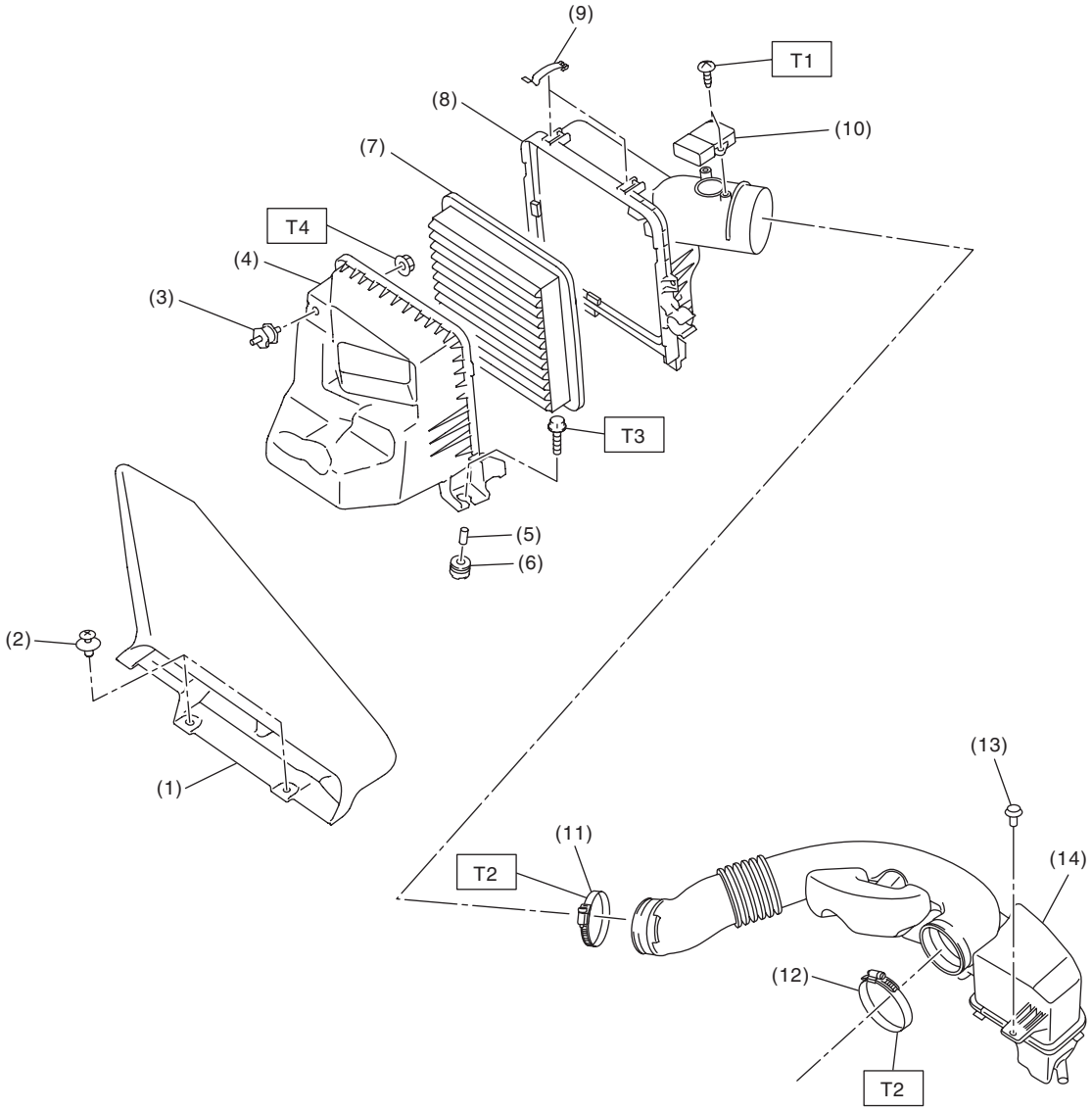
STARTING/CHARGING SYSTEMS

SC(H4DO(w/o HEV))

		Page
1.	General Description	2
2.	Starter	8
3.	Generator	32
4.	Battery	52
5.	Battery Current & Temperature Sensor	61

1. General Description

A: COMPONENT



IN-03526

(1)	Air intake duct	(8)	Air cleaner case (rear)	***Tightening torque: N·m (kgf-m, ft-lb)***
(2)	Clip	(9)	Clip	***T1: 1 (0.1, 0.7)***
(3)	Cushion	(10)	Mass air flow and intake air temperature sensor	***T2: 3 (0.3, 2.2)***
(4)	Air cleaner case (front)	(11)	Clamp	***T3: 6 (0.6, 4.4)***
(5)	Spacer	(12)	Clamp	***T4: 7.5 (0.8, 5.5)***
(6)	Cushion	(13)	Clip	
(7)	Air cleaner element	(14)	Air intake boot	

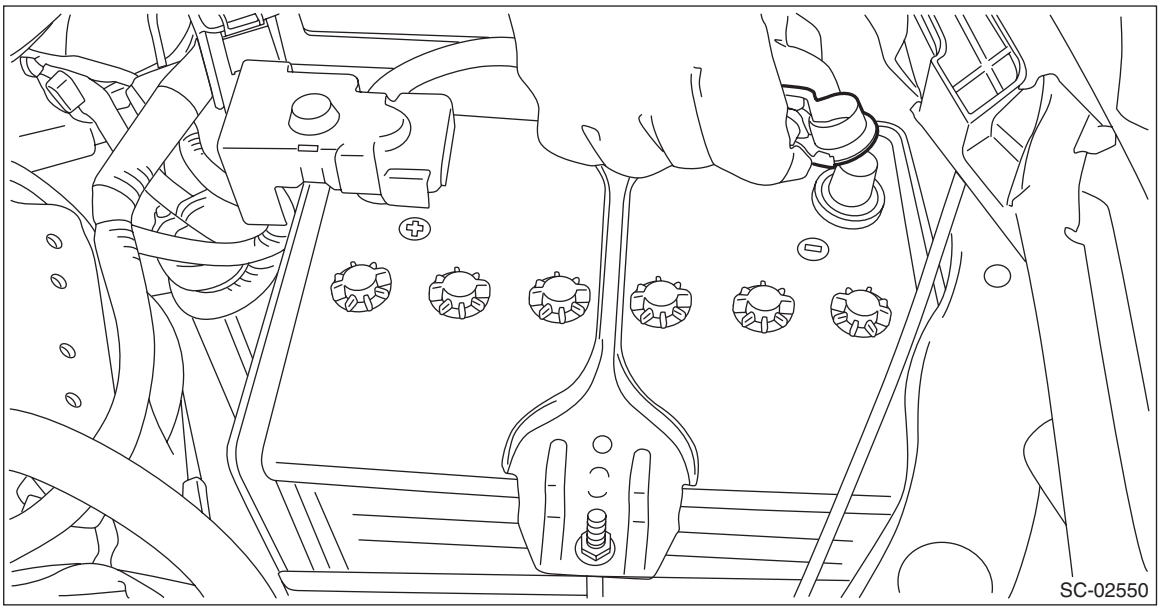
B: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a work cap, and protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.

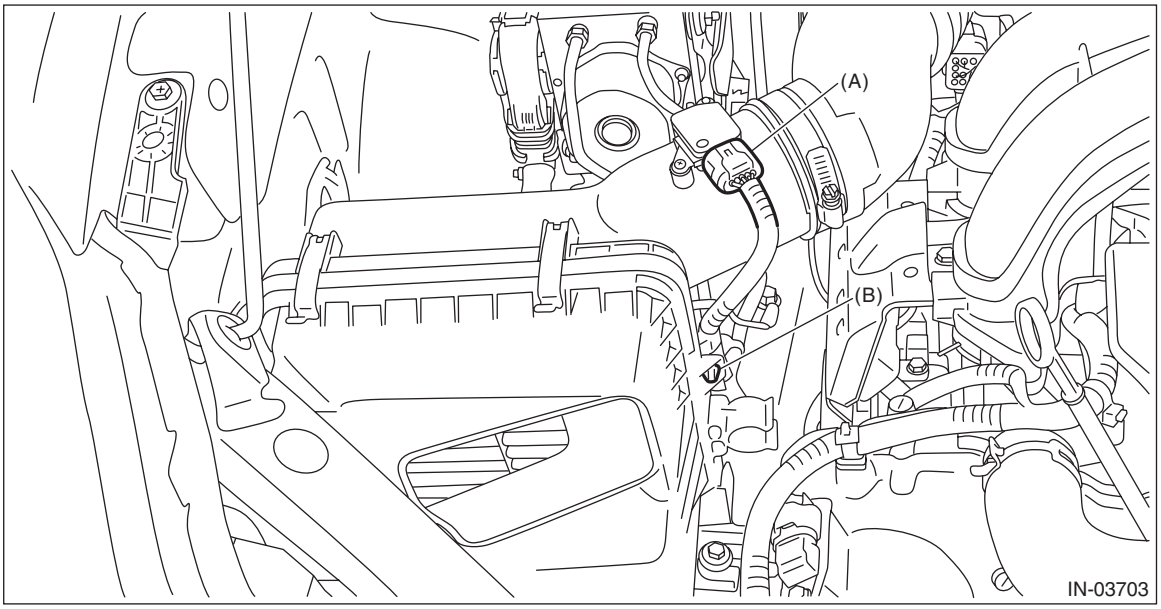
2. Air Cleaner Element

A: REMOVAL

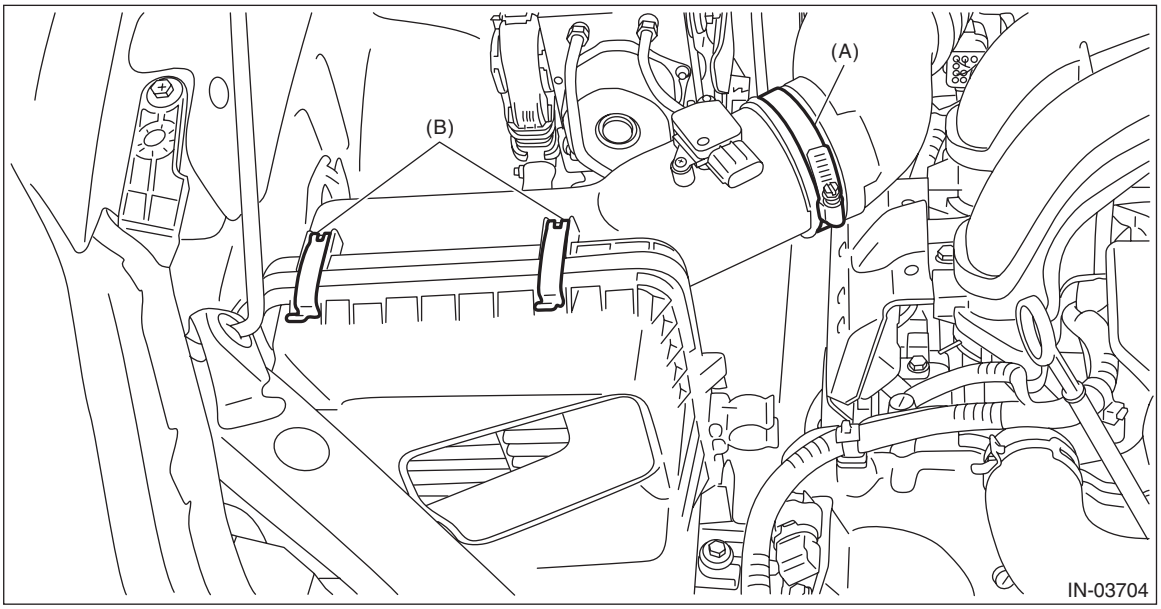
1) Disconnect the ground cable from battery.



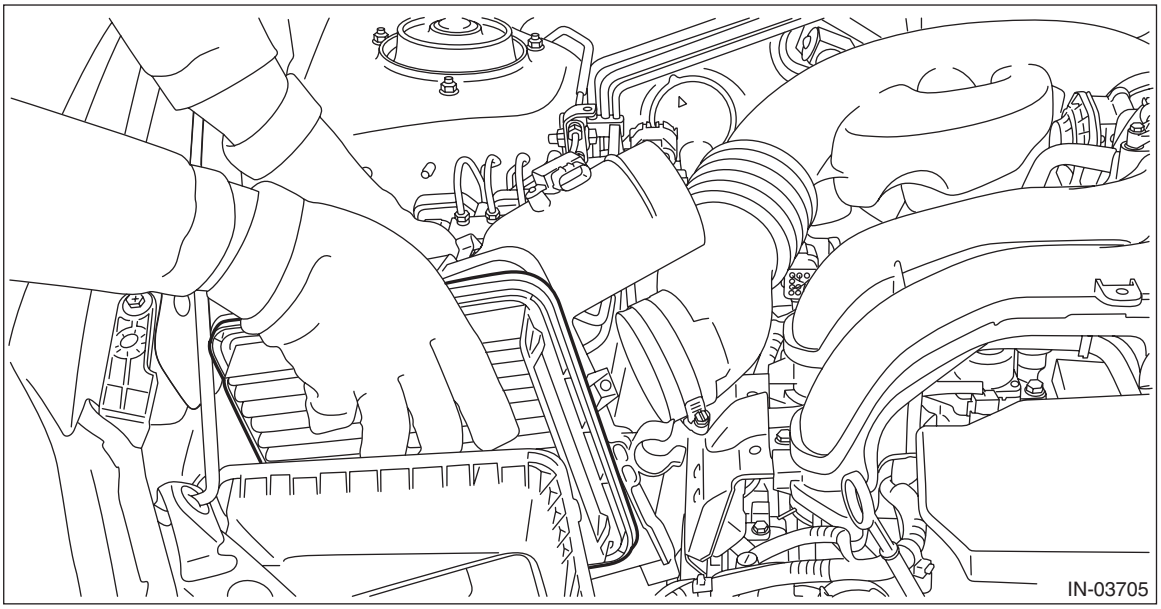
2) Remove the air intake duct. <Ref. to IN(H4DO(w/o HEV))-13, REMOVAL, Air Intake Duct.>
3) Disconnect the connector (A) from the mass air flow and intake air temperature sensor, and remove the clip (B).



4) Loosen the clamp (A) which secures the air intake boot to the air cleaner case (rear), and then remove the clip (B) from the air cleaner case (front).



5) Remove the air cleaner case (rear) and air cleaner element.

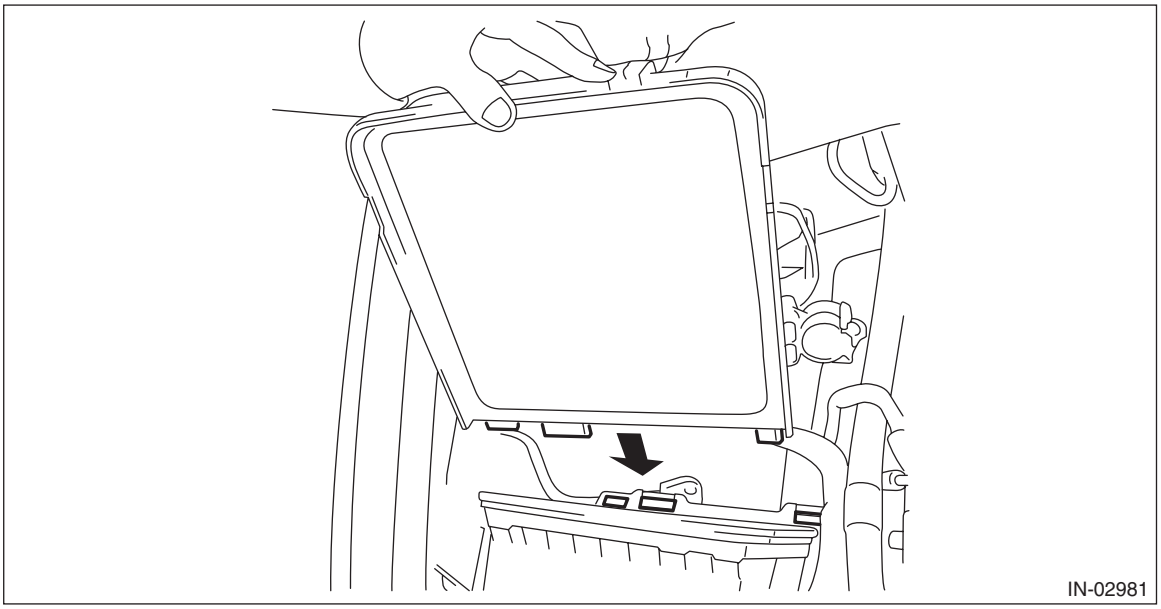


B: INSTALLATION

Install in the reverse order of removal.

CAUTION:
Be sure to use SUBARU genuine air cleaner element depending on the engine type when replacing the air cleaner elements. Using other air cleaner element may affect the engine performance.

NOTE:
- Check that there are no foreign objects in the air cleaner case.
- When installing the air cleaner case (rear), align the protrusion of the air cleaner case (rear) to the hole on the air cleaner case (front) to install.



Tightening torque:
3 N·m (0.3 kgf-m, 2.2 ft-lb)

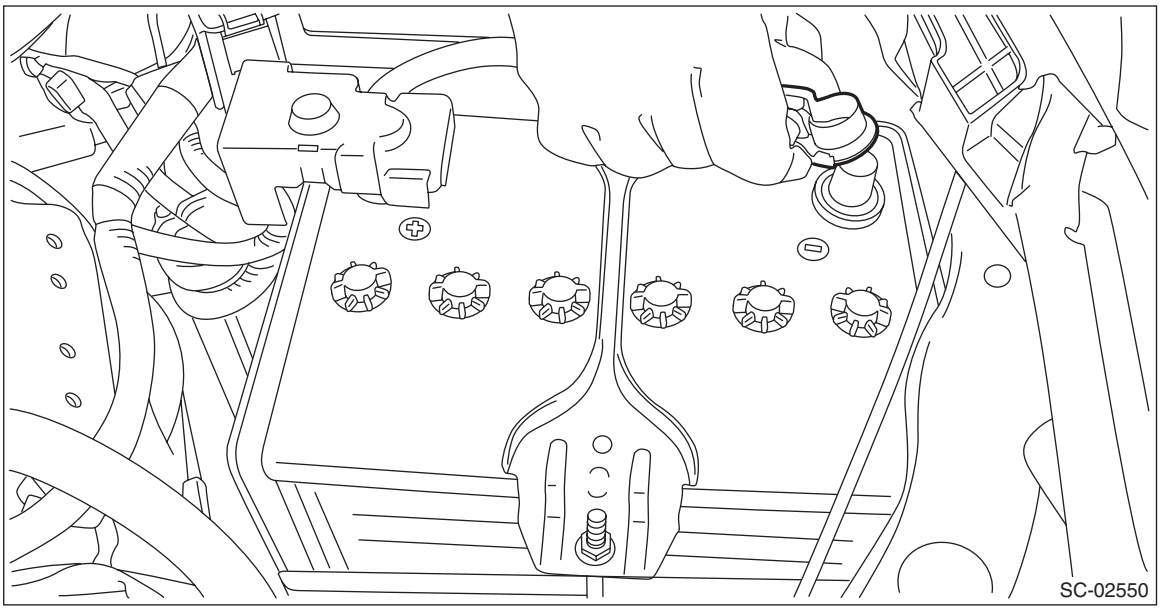
C: INSPECTION

1) Check that the air cleaner element has no deformation, cracks or other damages.
2) Check the air cleaner element for excessive dirt.
3) Replace the air cleaner case (rear) if the HC absorption filter is damaged.

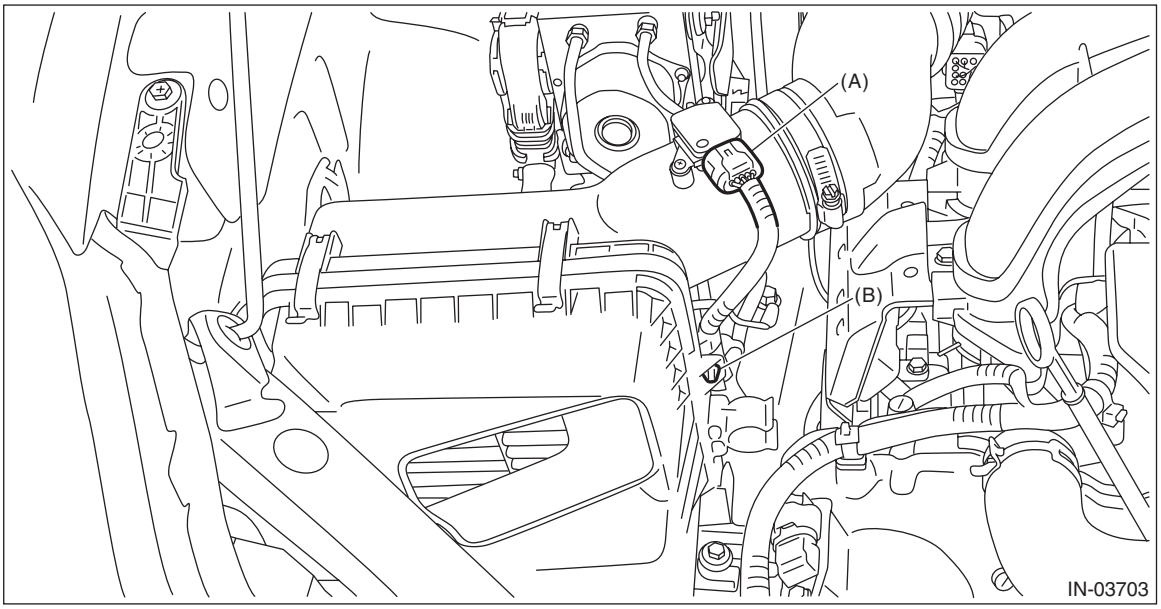
3. Air Cleaner Case

A: REMOVAL

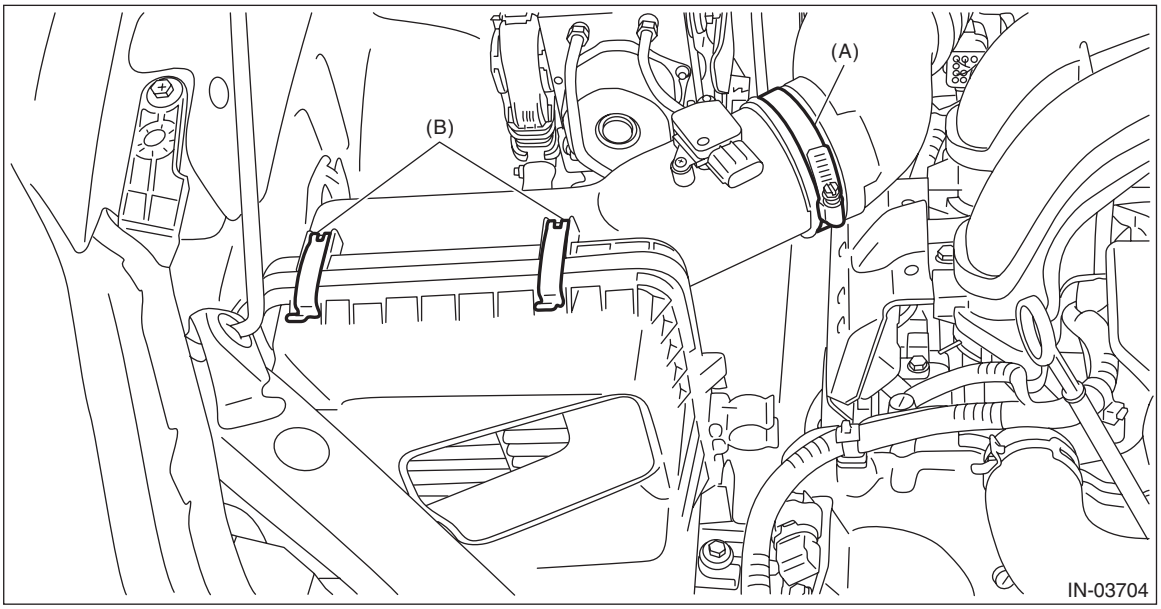
1) Disconnect the ground cable from battery.



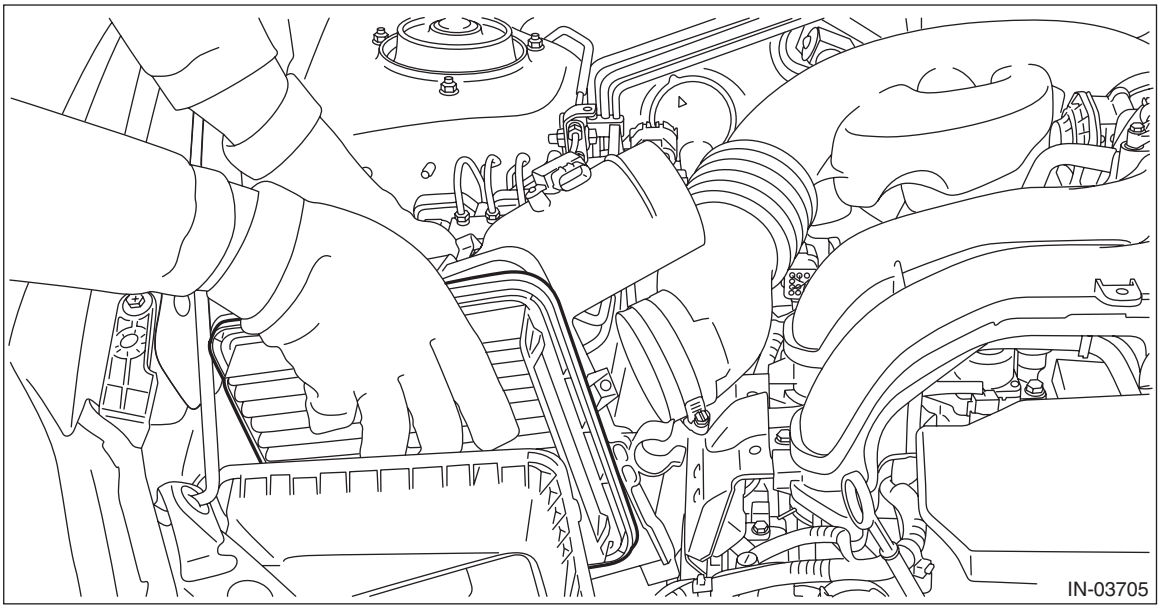
2) Remove the air intake duct. <Ref. to IN(H4DO(w/o HEV))-13, REMOVAL, Air Intake Duct.>
3) Disconnect the connector (A) from the mass air flow and intake air temperature sensor, and remove the clip (B).



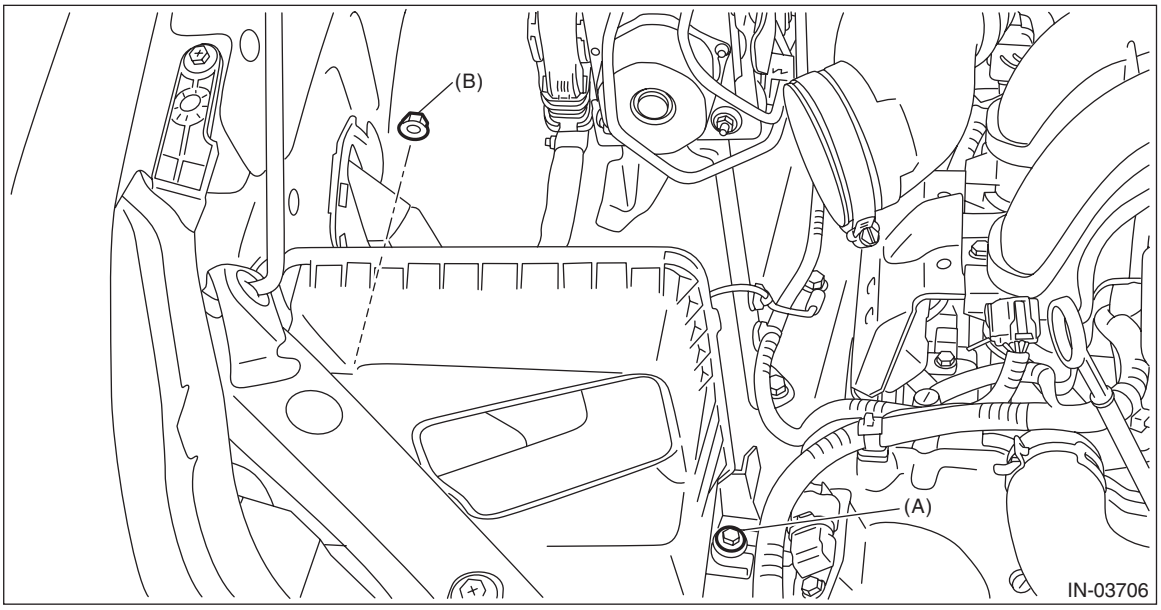
4) Loosen the clamp (A) which secures the air intake boot to the air cleaner case (rear), and then remove the clip (B) from the air cleaner case (front).



5) Remove the air cleaner case (rear) and air cleaner element.



6) Remove the bolt (A) and nut (B) which secure the air cleaner case (front) to the body.

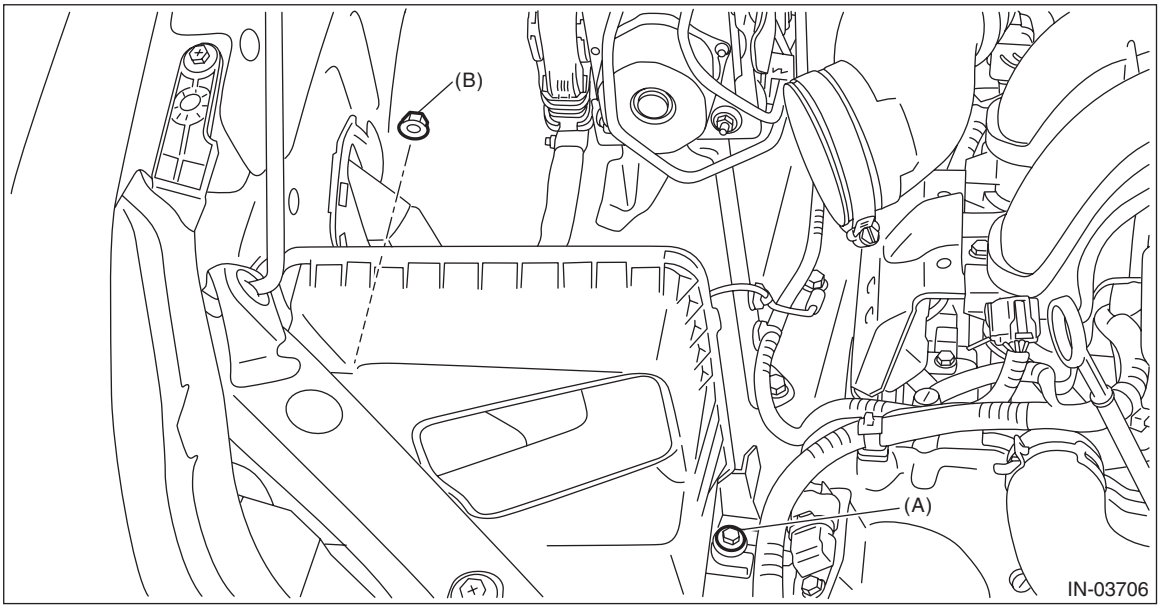


7) Remove the air cleaner case (front).

B: INSTALLATION

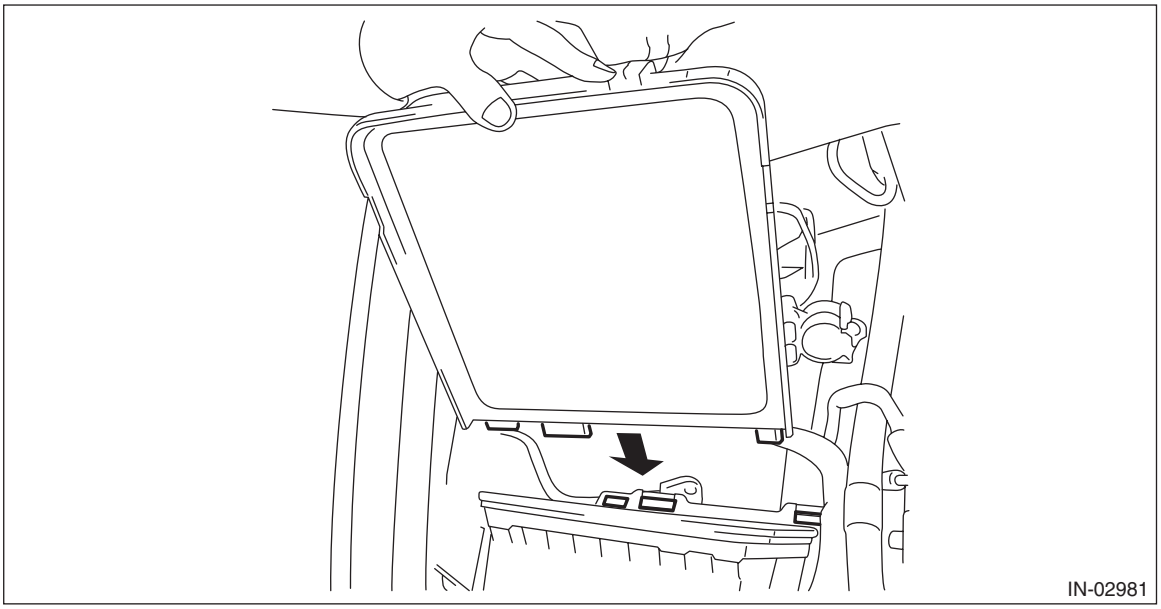
1) Install the bolt (A) and nut (B) which secure the air cleaner case (front) to the body.

Tightening torque:
Bolt (A)
6 N·m (0.6 kgf-m, 4.4 ft-lb)
Nut (B)
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



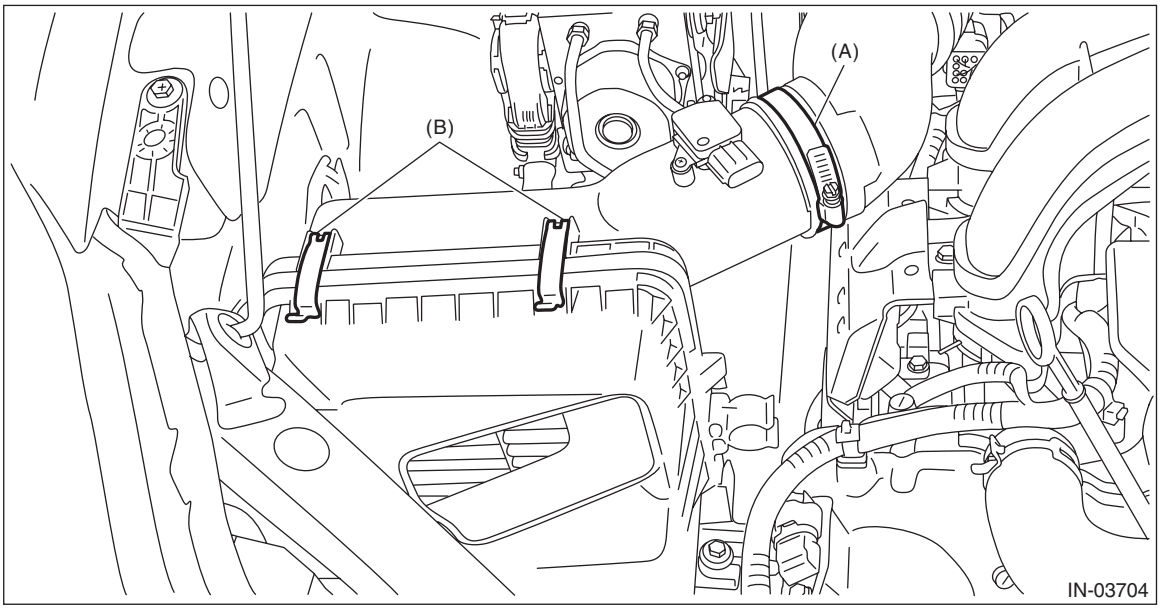
2) Install the air cleaner case (rear) and air cleaner element.

NOTE:
When installing the air cleaner case (rear), align the protrusion of the air cleaner case (rear) to the hole on the air cleaner case (front) to install.

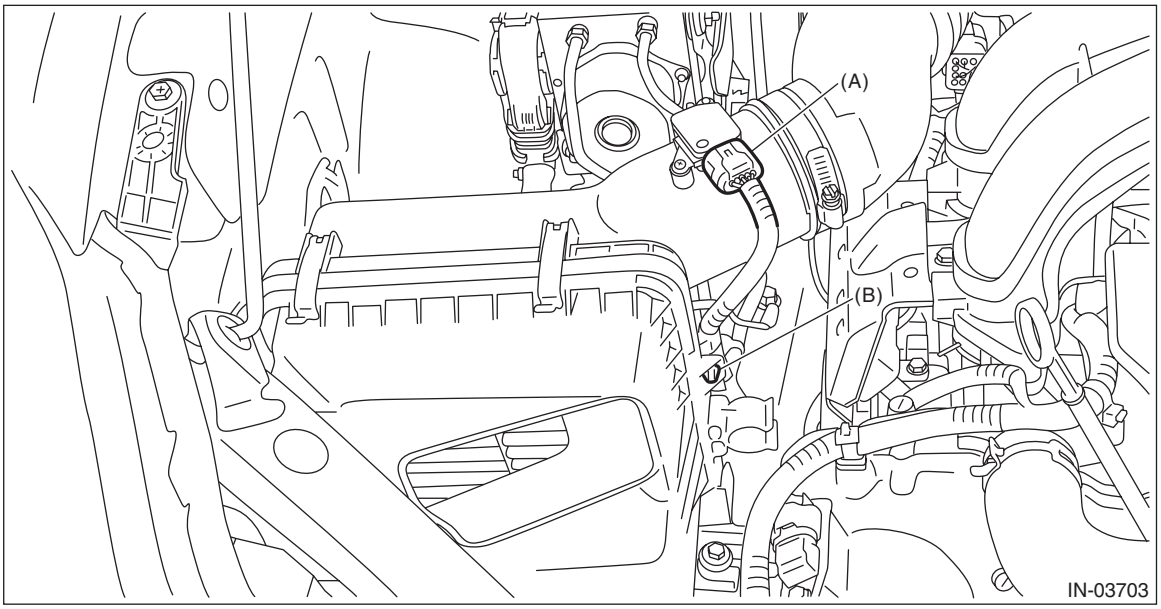


3) Install the clips (B) to the air cleaner case (front), then tighten the clamp (A) that secures the air intake boot to the air cleaner case (rear).

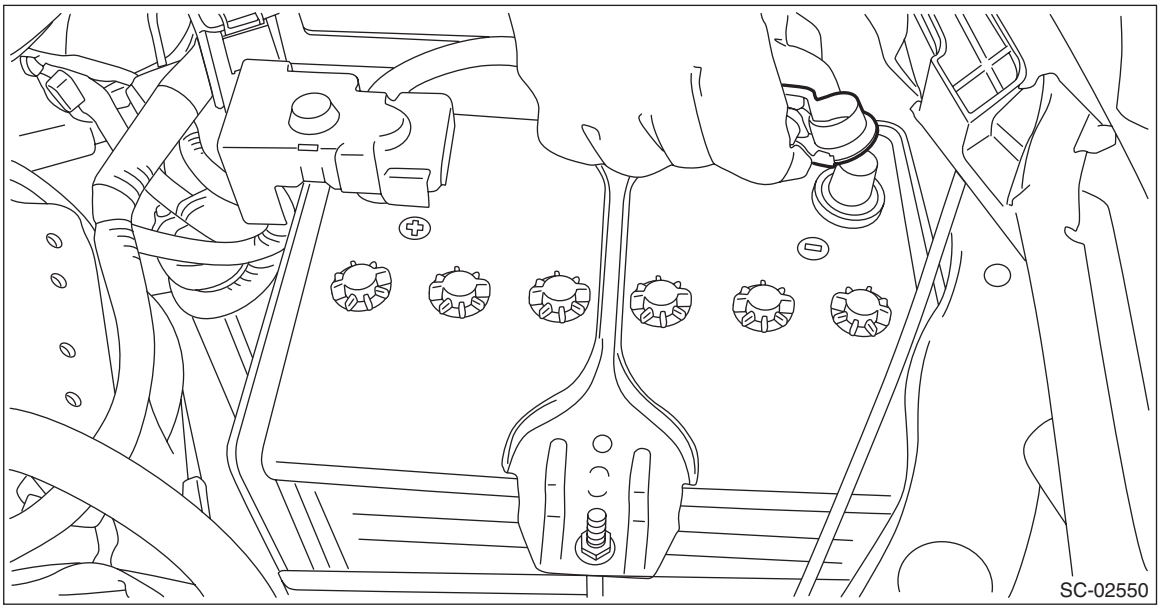
Tightening torque:
Clamp (A)
3 N·m (0.3 kgf-m, 2.2 ft-lb)



4) Connect the connector (A) to the mass air flow and intake air temperature sensor and secure the harness with clip (B).



5) Install the air intake duct. <Ref. to IN(H4DO(w/o HEV))-13, INSTALLATION, Air Intake Duct.>
6) Connect the battery ground terminal.



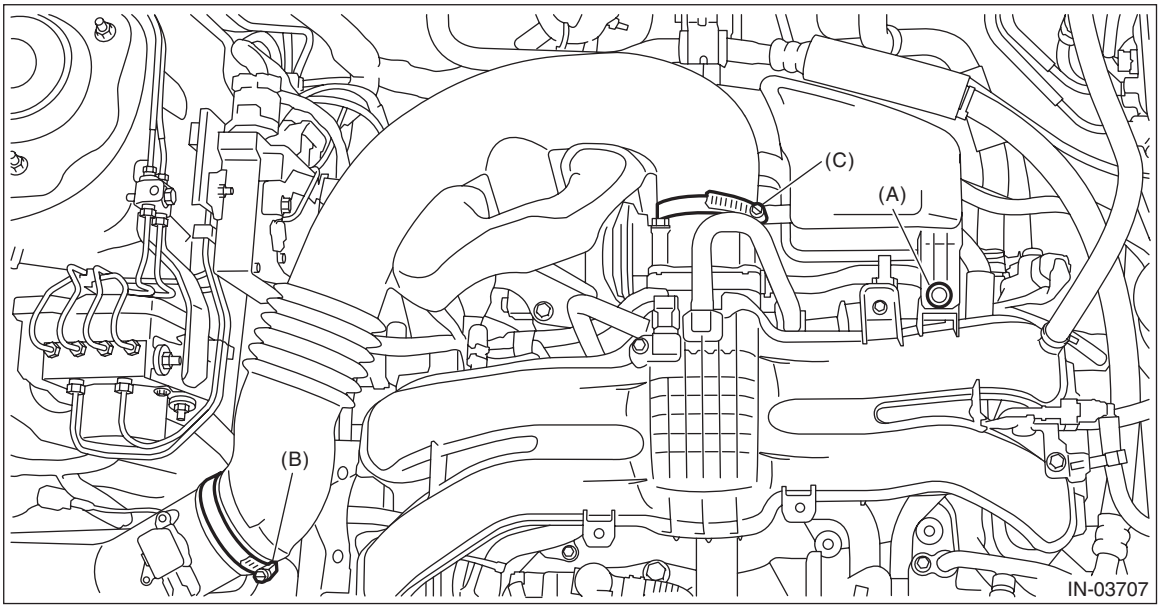
C: INSPECTION

1) Check that the air cleaner case has no deformation, cracks or other damages.
2) Check that the air intake boot has no cracks, damage or loose part.

4. Air Intake Boot

A: REMOVAL

1) Remove the clip (A) from the air intake boot.
2) Loosen the clamp (B) securing the air cleaner case (rear) to the air intake boot.
3) Loosen the clamp (C) which secures the throttle body to the air intake boot.



4) Disconnect the PCV hose and remove the air intake boot.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
3 N·m (0.3 kgf-m, 2.2 ft-lb)

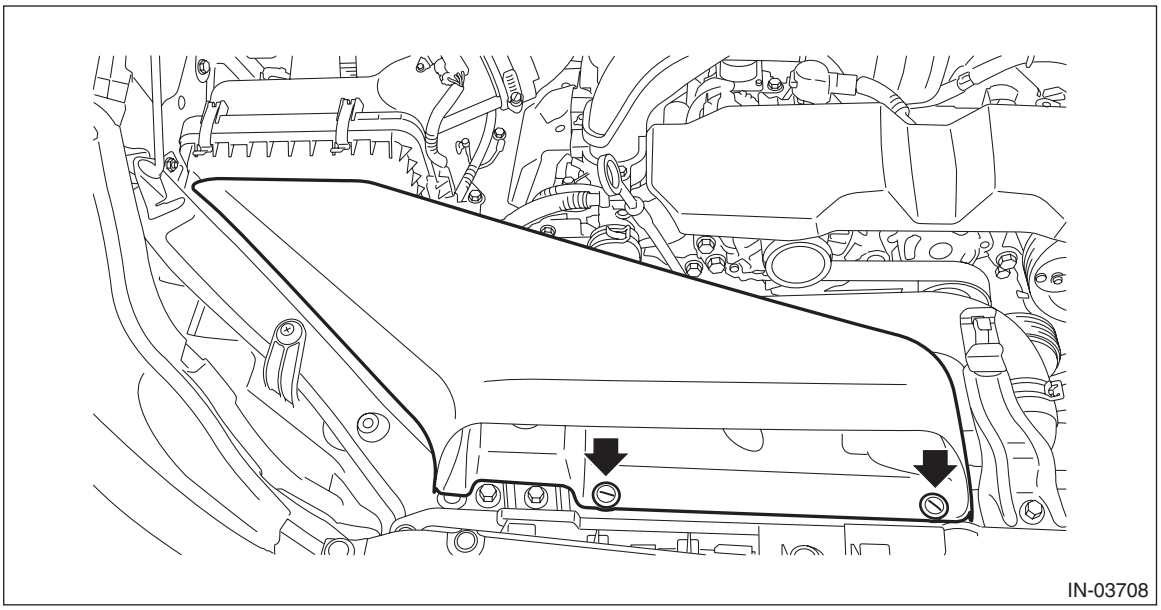
C: INSPECTION

1) Check that the air intake boot has no deformation, cracks or other damages.
2) Inspect that no foreign objects are mixed in the air intake boot.

5. Air Intake Duct

A: REMOVAL

1) Remove the clip which secures the air intake duct, and remove the air intake duct.



B: INSTALLATION

Install in the reverse order of removal.

C: INSPECTION

1) Check that the air intake duct has no deformation, cracks or other damages.
2) Inspect that no foreign objects are mixed in the air intake duct.

MECHANICAL

ME(H4DO(w/o HEV))

		Page
1.	General Description	2
2.	Compression	26
3.	Idle Speed	28
4.	Ignition Timing	29
5.	Intake Manifold Vacuum	30
6.	Engine Oil Pressure	33
7.	Fuel Pressure	35
8.	Cam Clearance	44
9.	Engine Assembly	55
10.	Engine Mounting	120
11.	Preparation for Overhaul	121
12.	V-belt	122
13.	Crank Pulley	140
14.	Chain Cover	149
15.	Timing Chain Assembly	169
16.	Cam Sprocket	191
17.	Crank Sprocket	201
18.	Rocker Cover	202
19.	Camshaft	219
20.	Cam Carrier	220
21.	Cylinder Head	263
22.	Cylinder Block	304
23.	Intake and Exhaust Valve	417
24.	Piston	418
25.	Connecting Rod	419
26.	Crankshaft	420
27.	Engine Trouble in General	421
28.	Engine Noise	428

1. General Description

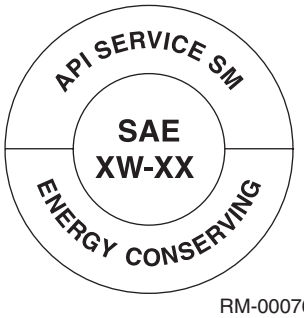
A: SPECIFICATION

Lubrication method					Forced lubrication
Oil pump	Pump type				Trochoid type
	Number of teeth	Inner rotor			11
		Outer rotor			12
	Outer rotor diameter × Thickness			mm (in)	77 × 12 (3.03 × 0.47)
	Performance (Oil temperature 120°C (248°F))	600 r/min	Discharge pressure	kPa (kg/cm^2, psi)	40 (0.4, 5.8)
			Discharge rate	L (US qt, Imp qt)/min	5.8 (6.1, 5.1) or more
		6,000 r/min	Discharge pressure	kPa (kg/cm^2, psi)	323 (3.3, 46.8)
			Discharge rate	L (US qt, Imp qt)/min	55 (58.1, 48.4) or more
	Relief valve working pressure (2-step relief)	1st opening pressure		kPa (kg/cm^2, psi)	150 (1.5, 21.7)
		Main opening pressure		kPa (kg/cm^2, psi)	570 (5.8, 82.6)
Oil filter	Filter type				Full-flow filter type
	Filtration area			cm^2 (sq in)	1,100 (171) (Outer diameter: 68 mm (2.68 in) (black))
					867 (134.3) (Outer diameter: 67.4 mm (2.65 in) (blue))
	By-pass valve opening pressure			kPa (kg/cm^2, psi)	160 (1.6, 23.2)
	Outer diameter × Width			mm (in)	68 × 85 (2.68 × 3.35) (Outer diameter: 68 mm (2.68 in) (black))
					67.4 × 87.1 (2.65 × 3.43) (Outer diameter: 67.4 mm (2.65 in) (blue))
	Installation screw specifications				M 20 × 1.5
Oil pressure switch	Type				Immersed contact point type
	Operating voltage				12 V
	Warning light operating pressure			kPa (kg/cm^2, psi)	14.7 (0.1, 2.1)
	Proof pressure			kPa (kg/cm^2, psi)	981 (10, 142.2)
Engine oil	Total capacity (at overhaul)			L (US qt, Imp qt)	5.7 (6.0, 5.0)
	When replacing engine oil and oil filter			L (US qt, Imp qt)	4.8 (5.1, 4.2)
	When replacing engine oil only			L (US qt, Imp qt)	4.6 (4.9, 4.0)

Specified oil:

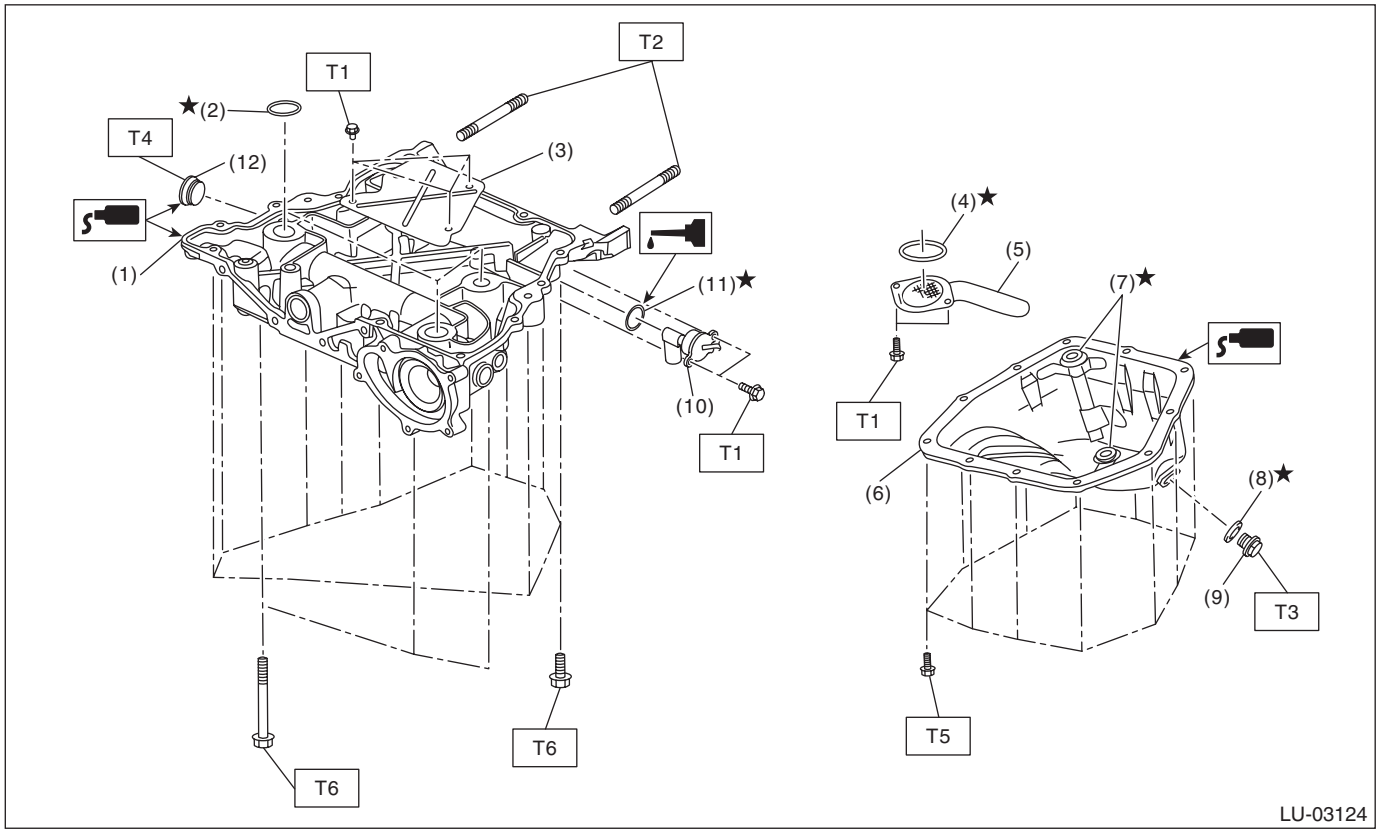
CAUTION:
- **Use 0W-20 (synthetic oil).**
- **It is acceptable to fill an engine with oil of another brand when replacing the oil, but make sure to use the following engine oil specified by Subaru.**

NOTE:
The proper viscosity oil helps the engine maintain its ideal temperature, and cranking speed increased by reducing viscosity friction in hot condition.

Engine oil standard		SAE viscosity No.
 RM-00076 Those with the API standard SM "Energy Conserving" or SN "Resource Conserving" logo.	or	 RM-00002 Those with the ILSAC standard GF-4 or GF-5 "starburst mark" displayed on top of the container.	0W-20 (synthetic oil)

B: COMPONENT

1. OIL PAN AND STRAINER



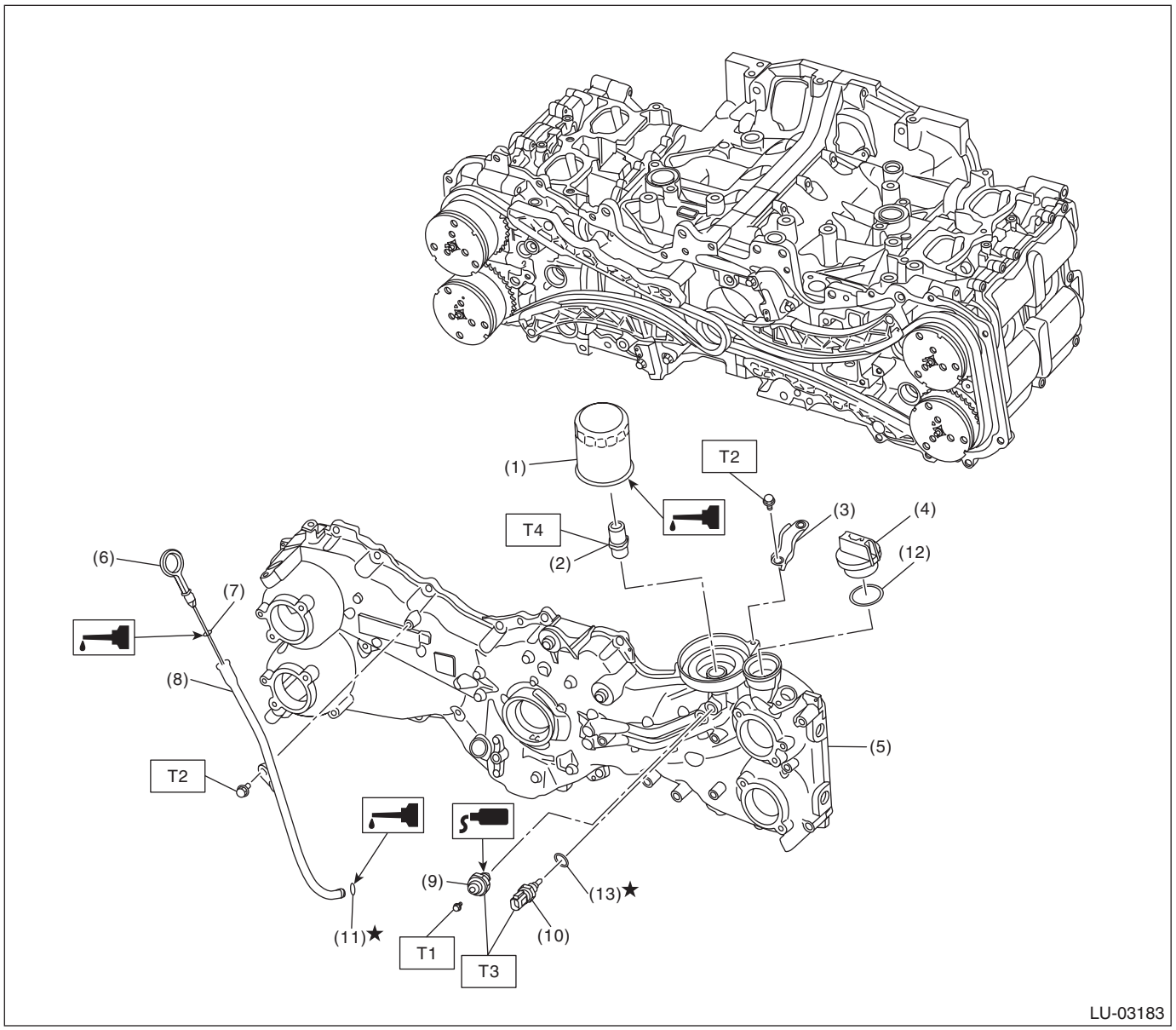
(1) Oil pan upper
(2) O-ring
(3) Baffle plate
(4) O-ring
(5) Oil strainer
(6) Oil pan
(7) Oil pan seal ring
(8) Drain plug gasket
(9) Drain plug
(10) Oil level switch
(11) O-ring
(12) Plug

Tightening torque: N·m (kgf-m, ft-lb)

T1: 6.4 (0.7, 4.7)
T2: 10 (1.0, 7.4)
T3: 41.7 (4.3, 30.8)
T4: 90 (9.2, 66.4)
T5: <Ref. to LU(H4DO(w/o HEV))-19, OIL PAN, INSTALLATION, Oil Pan and Strainer.>
T6: <Ref. to LU(H4DO(w/o HEV))-21, OIL PAN UPPER, INSTALLATION, Oil Pan and Strainer.>

2. OIL FILTER AND OIL LEVEL GAUGE

- Gasoline engine model

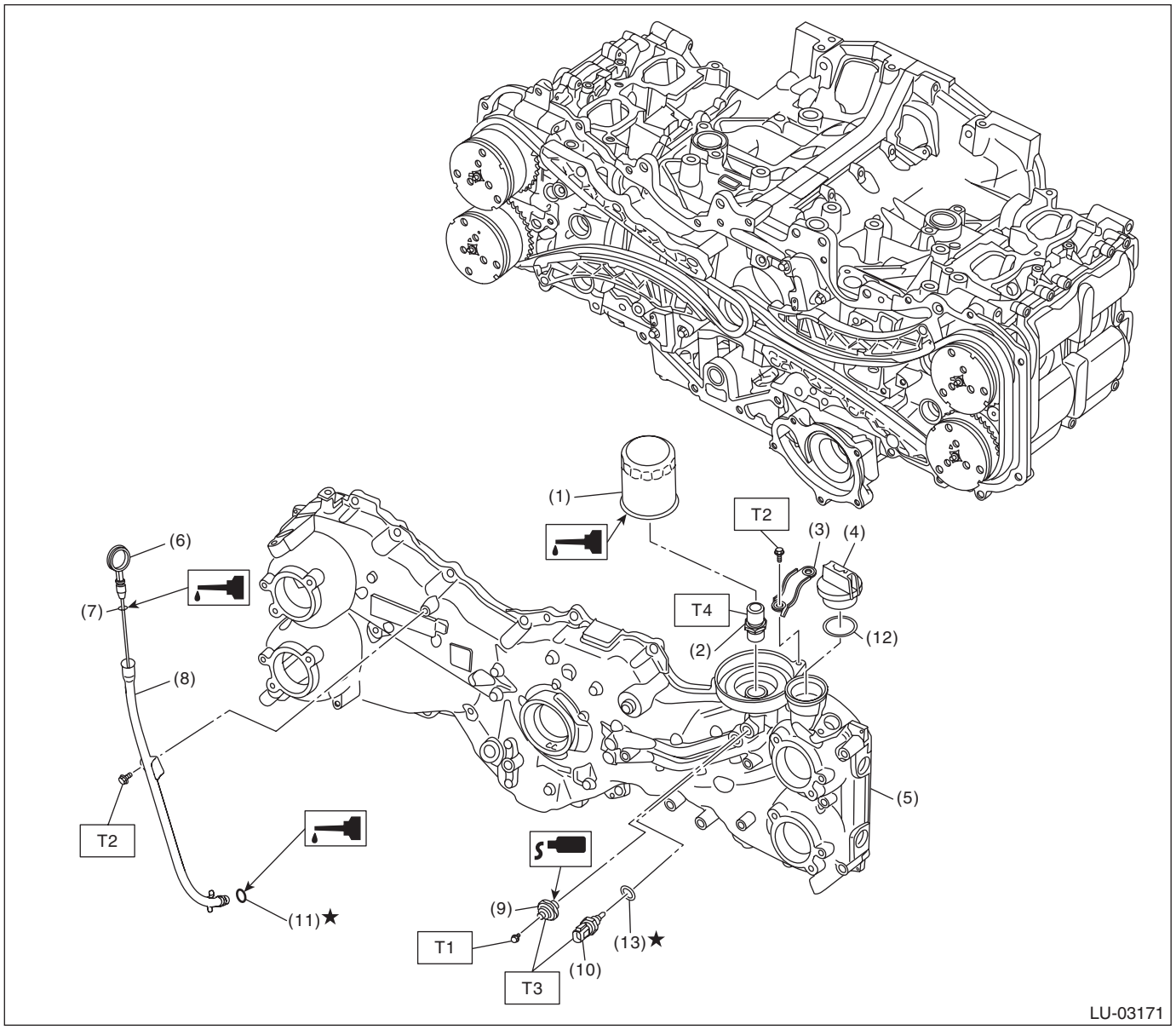


(1)	Oil filter	(8)	Oil level gauge guide
(2)	Oil pump union	(9)	Oil pressure switch
(3)	Generator cord stay	(10)	Engine oil temperature sensor
(4)	Oil filler cap	(11)	O-ring
(5)	Chain cover	(12)	O-ring
(6)	Oil level gauge	(13)	Gasket
(7)	O-ring		

Tightening torque: N·m (kgf-m, ft-lb)

T1: 1.5 (0.2, 1.1)
T2: 6.4 (0.7, 4.7)
T3: 18 (1.8, 13.3)
T4: 45 (4.6, 33.2)

- HEV model



(1)	Oil filter	(8)	Oil level gauge guide	
(2)	Oil pump union	(9)	Oil pressure switch	
(3)	Battery cable stay	(10)	Engine oil temperature sensor	
(4)	Oil filler cap	(11)	O-ring	
(5)	Chain cover	(12)	O-ring	
(6)	Oil level gauge	(13)	Gasket	
(7)	O-ring			

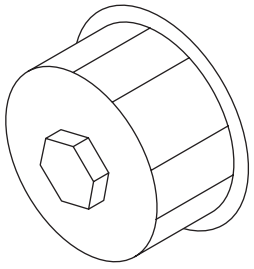
Tightening torque: N·m (kgf-m, ft-lb)
T1: 1.5 (0.2, 1.1)
T2: 6.4 (0.7, 4.7)
T3: 18 (1.8, 13.3)
T4: 45 (4.6, 33.2)

C: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a work cap, and protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Prepare a container and cloth when performing work which oil possibly spills. If oil spills, wipe it off immediately to prevent from penetrating into floor or flowing out for environmental protection.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.
- If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.
- Follow all government and local regulations concerning disposal of refuse when disposing of oil.

D: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18332AA000	18332AA000	OIL FILTER WRENCH	Used for removing and installing oil filter (black). (Outer diameter: 68 mm (2.68 in)).

2. GENERAL TOOL

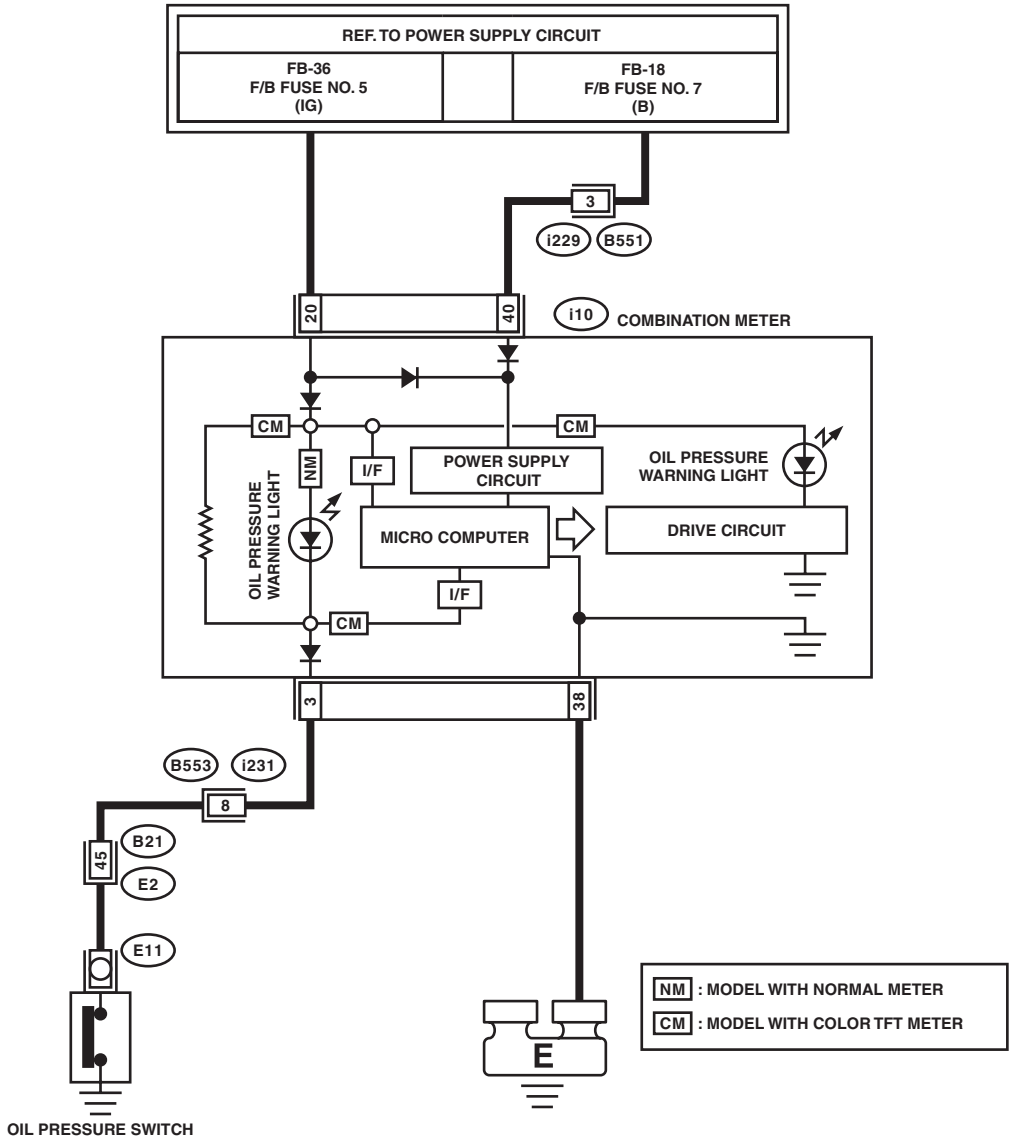
TOOL NAME	REMARKS
Oil filter wrench (65/67 mm 14 Flutes)	Used for removing and installing oil filter (Blue). (Outer diameter: 67.4 mm (2.65 in))
Circuit tester	Used for measuring resistance and voltage.

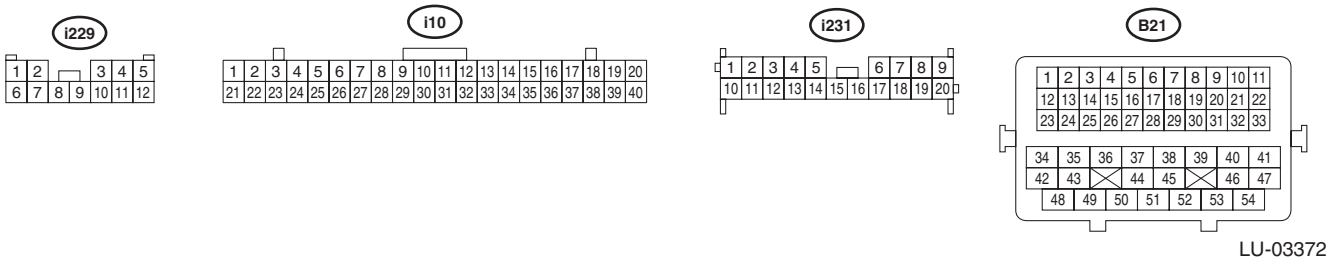
2. Oil Pressure System

A: WIRING DIAGRAM

Oil pressure warning system <Ref. to WI(w/o HEV)-173, WIRING DIAGRAM, Oil Pressure Warning Light System.> <Ref. to WI(HEV)-175, WIRING DIAGRAM, Oil Pressure Warning Light System.>

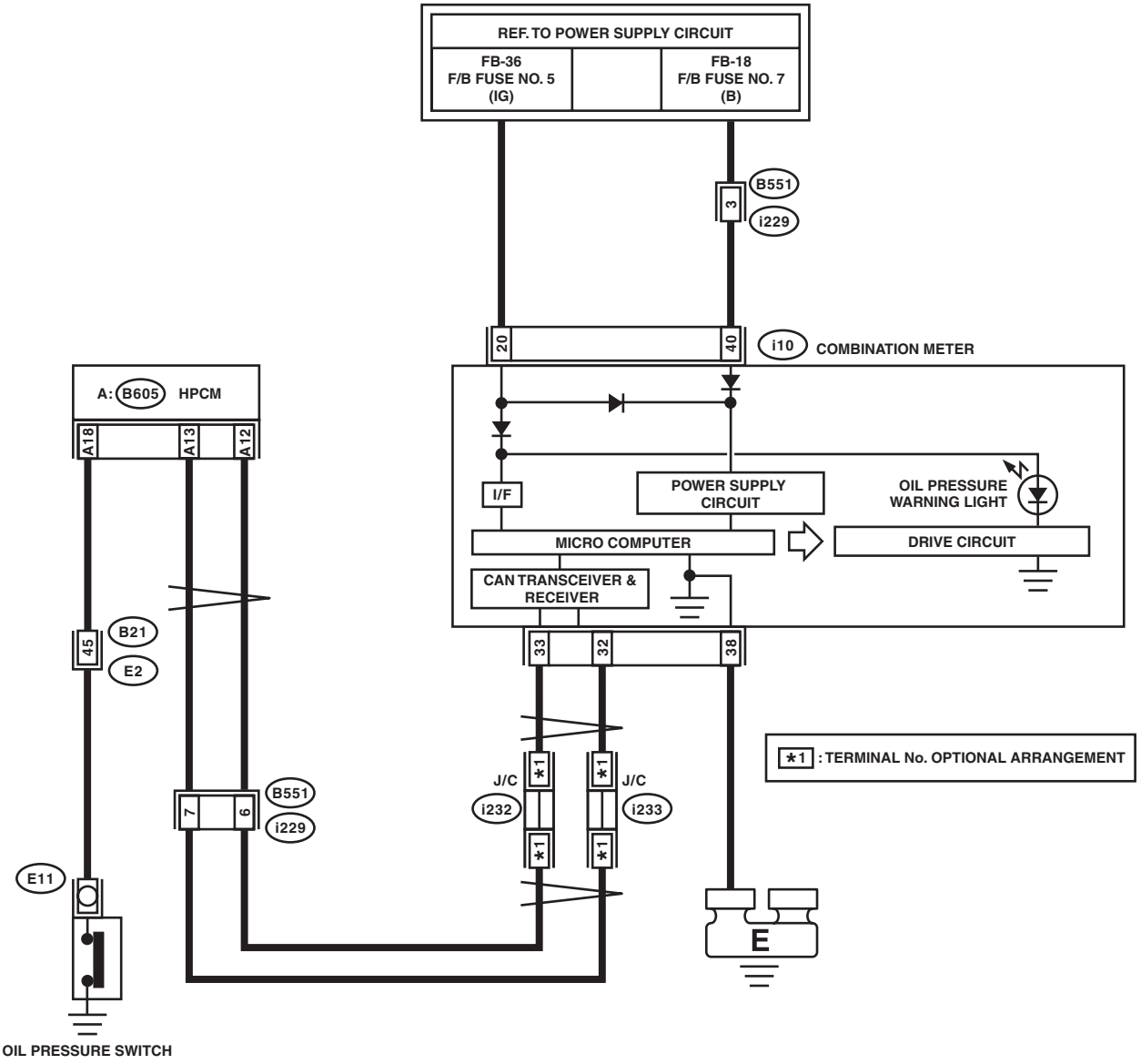
- Gasoline engine model

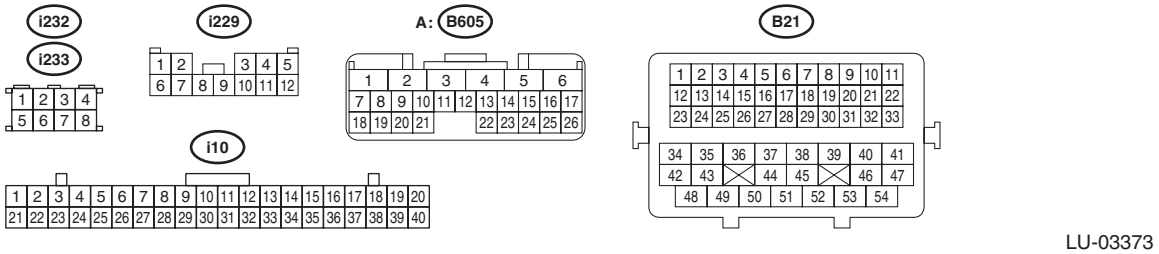




LU-03372

- HEV model





LU-03373

B: INSPECTION

1. GASOLINE ENGINE MODEL

	Step	Check	Yes	No
1	**CHECK COMBINATION METER.** 1) Turn the ignition switch to ON. (engine OFF) 2) Check the warning light in the combination meter.	Does the warning light illuminate?	Go to step **2**.	Repair or replace the combination meter. <Ref. to IDI-12, INSPECTION, Combination Meter System.>
2	**CHECK POWER SUPPLY TO OIL PRESSURE SWITCH.** 1) Turn the ignition switch to OFF. 2) Disconnect the terminal from oil pressure switch. 3) Turn the ignition switch to ON. 4) Measure the voltage between oil pressure switch harness terminal and chassis ground. ***Terminals*** ***(E11) No. 1 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Replace the oil pressure switch. <Ref. to LU(H4DO(w/o HEV))-25, Oil Pressure Switch.>	Go to step **3**.
3	**CHECK COMBINATION METER.** 1) Turn the ignition switch to OFF. 2) Remove the combination meter. 3) Measure the resistance of combination meter. ***Terminals*** ***No. 20 — No. 3:***	Is the resistance less than 10 Ω?	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between combination meter and oil pressure switch • Poor contact of combination meter connector • Poor contact of oil pressure switch terminal • Poor contact of coupling connector	Repair or replace the combination meter. <Ref. to IDI-12, INSPECTION, Combination Meter System.>

2. HEV MODEL

	Step	Check	Yes	No
1	**CHECK DTC.**	Is DTC of engine, HEV and CAN communication line displayed? <Ref. to HEV(diag)-24, Read Diagnostic Trouble Code (DTC).> <Ref. to IDI(diag)-15, Read Diagnostic Trouble Code (DTC).> <Ref. to LAN(w/o HEV)(diag)-25, Read Diagnostic Trouble Code (DTC).>	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to HEV(diag)-74, List of Diagnostic Trouble Code (DTC).> <Ref. to IDI(diag)-27, List of Diagnostic Trouble Code (DTC).> <Ref. to LAN(w/o HEV)(diag)-64, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK COMBINATION METER.** 1) Turn the ignition switch to ON. (engine OFF) 2) Check the warning light in the combination meter.	Does the warning light illuminate?	Go to step **3**.	Repair or replace the combination meter. <Ref. to IDI-12, INSPECTION, Combination Meter System.>
3	**CHECK POWER SUPPLY TO OIL PRESSURE SWITCH.** 1) Turn the ignition switch to OFF. 2) Disconnect the terminal from oil pressure switch. 3) Turn the ignition switch to ON. 4) Measure the voltage between oil pressure switch harness terminal and chassis ground. ***Terminals*** ***(E11) No. 1 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Replace the oil pressure switch. <Ref. to LU(H4DO(w/o HEV))-25, Oil Pressure Switch.>	Go to step **4**.
4	**CHECK COMBINATION METER.** Perform the self-diagnosis of combination meter to check if there are any faults in the combination meter. <Ref. to IDI-8, OPERATION, Combination Meter System.>	Is combination meter OK?	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between hybrid powertrain control module and oil pressure switch • Poor contact of oil pressure switch terminal • Poor contact of coupling connector	Replace the combination meter. <Ref. to IDI-20, REMOVAL, Combination Meter.>

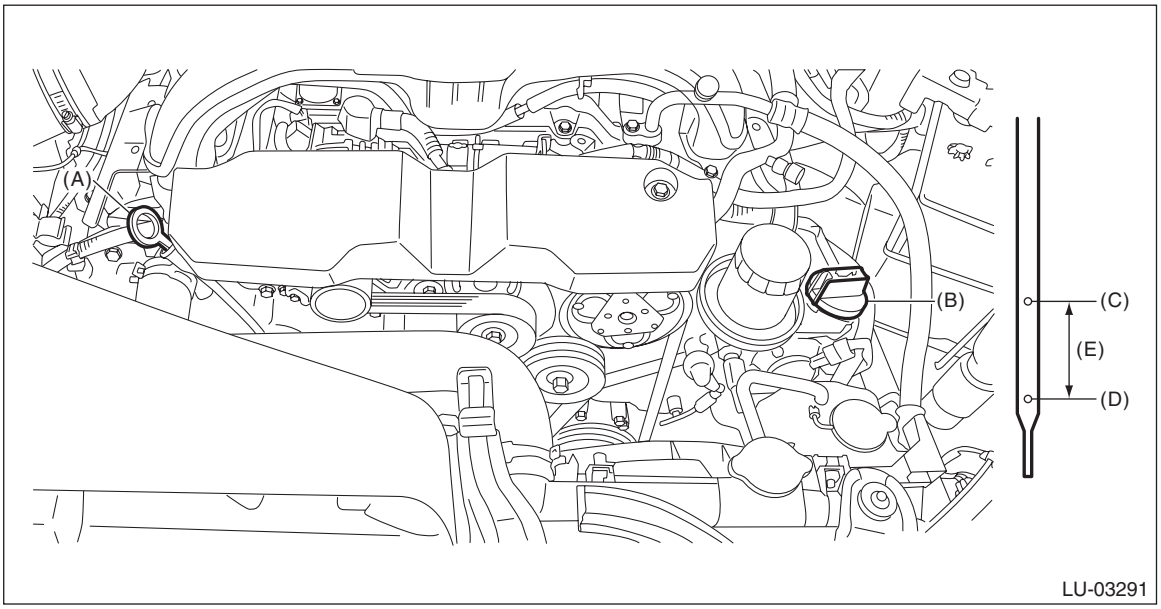
3. Engine Oil

A: INSPECTION

CAUTION:
If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.

1) Park the vehicle on a level surface.
2) Turn the ignition switch to OFF.
3) Remove the oil level gauge and wipe away the oil.
4) Reinsert the oil level gauge all the way. Be sure that the oil level gauge is correctly inserted and properly orientated.
5) Pull out the oil level gauge again, and check both sides of the oil level gauge. Use a lower side to determine the engine oil level. If the engine oil level is below “L” line, check for oil leakage from engine and add oil to bring the level up to “F” line.
6) Start the engine to circulate the oil in engine.
7) After turning off the engine (ignition OFF), wait a few minutes for the oil to return to the oil pan before checking the level.

NOTE:
- To prevent overfilling of engine oil, do not add oil above “F” line when the engine is cold.
- As the oil level gauge is used for daily maintenance, “F” line and “L” line is set assuming that the engine is cold.



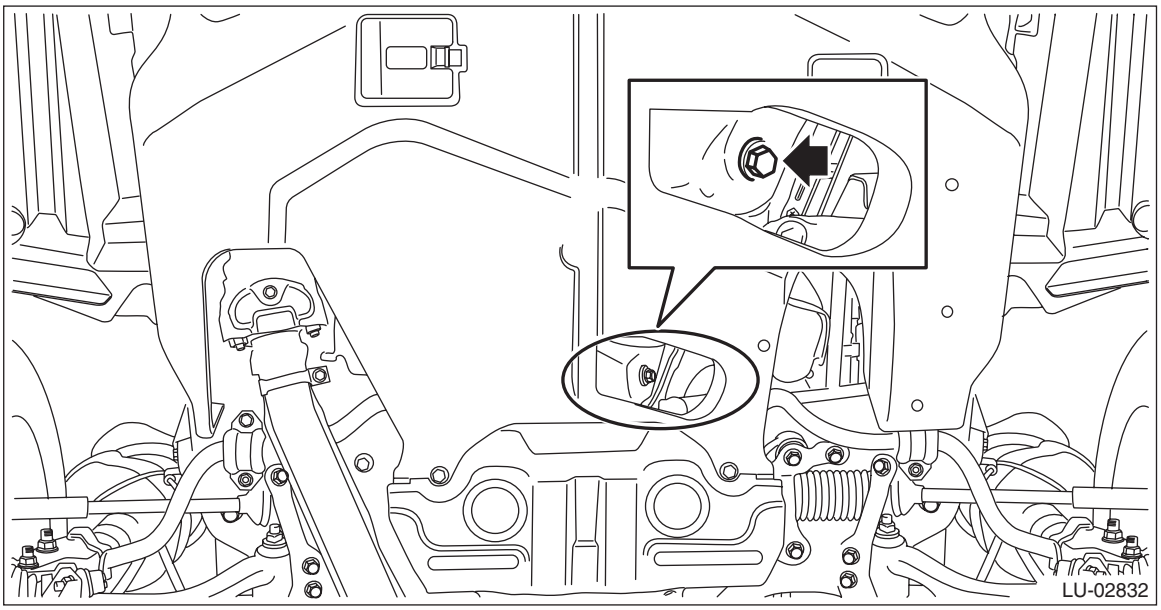
(A) Oil level gauge
(B) Oil filler cap
(C) “F” line
(D) “L” line
(E) Approx. 1.0 L (1.1 US qt, 0.9 Imp qt)

B: REPLACEMENT

CAUTION:
If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.

1) Turn the ignition switch to OFF.
2) Open the oil filler cap for quick draining of engine oil.
3) Lift up the vehicle.
4) Drain engine oil by loosening the drain plug.

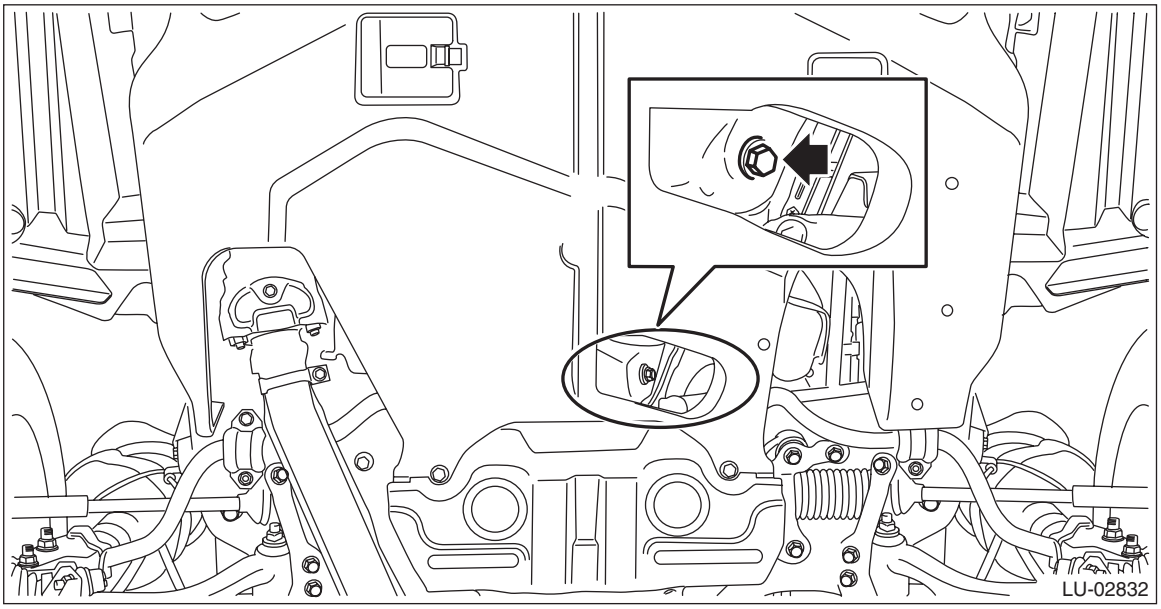
NOTE:
Prepare the container for draining of engine oil.



5) After draining the engine oil, tighten the engine oil drain plug.

NOTE:
Use a new drain plug gasket.

Tightening torque:
41.7 N·m (4.3 kgf-m, 30.8 ft-lb)



6) Lower the vehicle.

7) Select engine oil of adequate quality and viscosity and fill it through the chain cover to the “F” line on the oil level gauge. Make sure that the vehicle is parked on a level surface when checking oil level.

Recommended oil:

Refer to “SPECIFICATION” for recommended oil. <Ref. to LU(H4DO(w/o HEV))-2, SPECIFICATION, General Description.>

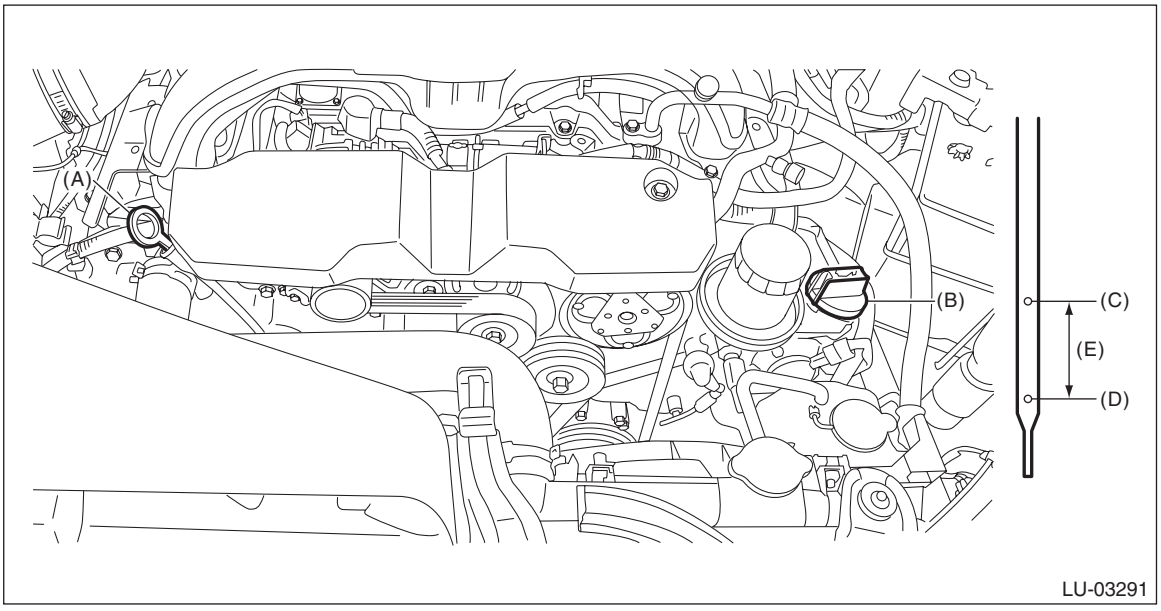
Engine oil capacity:

Refer to “SPECIFICATION” for engine oil capacity. <Ref. to LU(H4DO(w/o HEV))-2, SPECIFICATION, General Description.>

8) Close the oil filler cap.

9) Start the engine to circulate the oil in engine.

10) Stop the engine (ignition OFF) and pull out the oil level gauge again, and check both sides of the oil level gauge. Use a lower side to check the engine oil level. If necessary, add engine oil up to the “F” line on oil level gauge.



(A) Oil level gauge
(B) Oil filler cap
(C) “F” line
(D) “L” line
(E) Approx. 1.0 L (1.1 US qt, 0.9 Imp qt)

4. Oil Pump

A: SPECIFICATION

The oil pump cannot be disassembled.
Refer to “Chain Cover” for removal and installation procedures. <Ref. to ME(H4DO(w/o HEV))-149, REMOVAL, Chain Cover.> <Ref. to ME(H4DO(w/o HEV))-156, INSTALLATION, Chain Cover.>

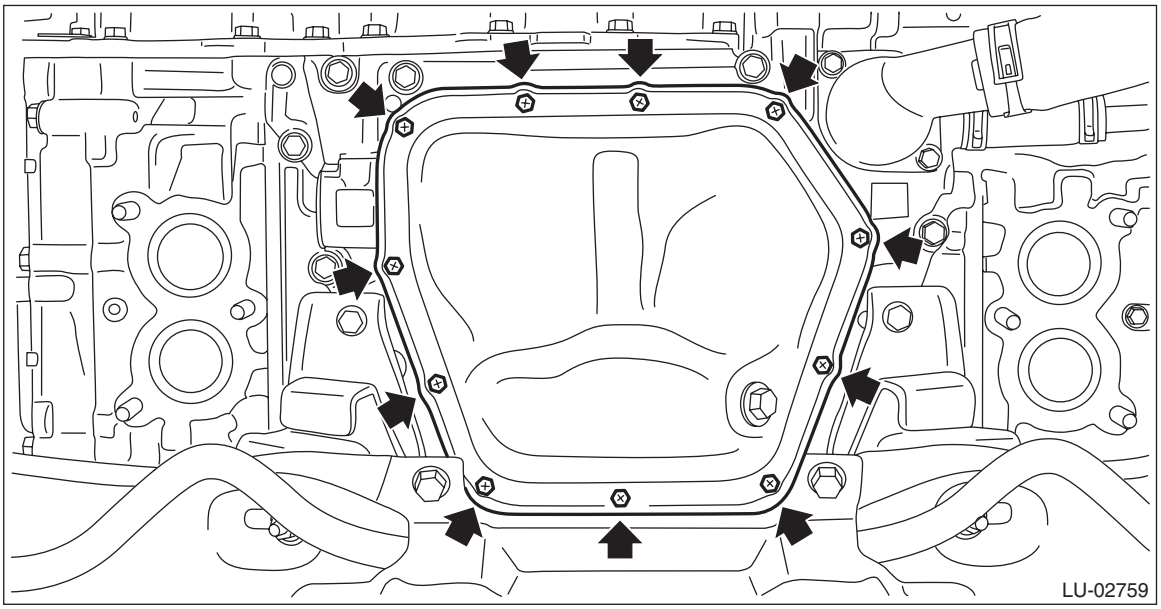
5. Oil Pan and Strainer

A: REMOVAL

1. OIL PAN

1) Disconnect the ground cable from battery. <Ref. to NT-5, BATTERY, NOTE, Note.>

NOTE:
For the 12 volt engine restart battery of HEV model, disconnect the ground terminal from 12V engine restart battery sensor.
2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-32, REMOVAL, Front Under Cover.>
4) Drain the engine oil. <Ref. to LU(H4DO(w/o HEV))-13, REPLACEMENT, Engine Oil.>
5) Remove the front exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-6, REMOVAL, Front Exhaust Pipe.>
6) Remove the bolts which secure oil pan to oil pan upper.



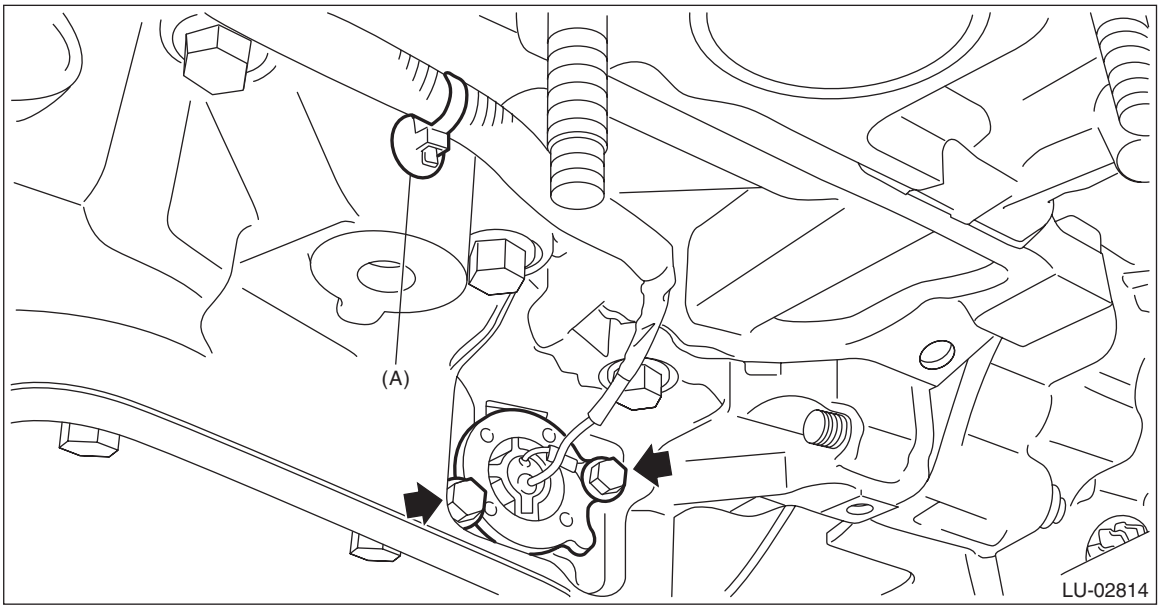
7) Insert an oil pan cutter blade into the gap between oil pan upper and oil pan, and remove the oil pan.

CAUTION:
Do not use a screwdriver or similar tool in place of oil pan cutter.

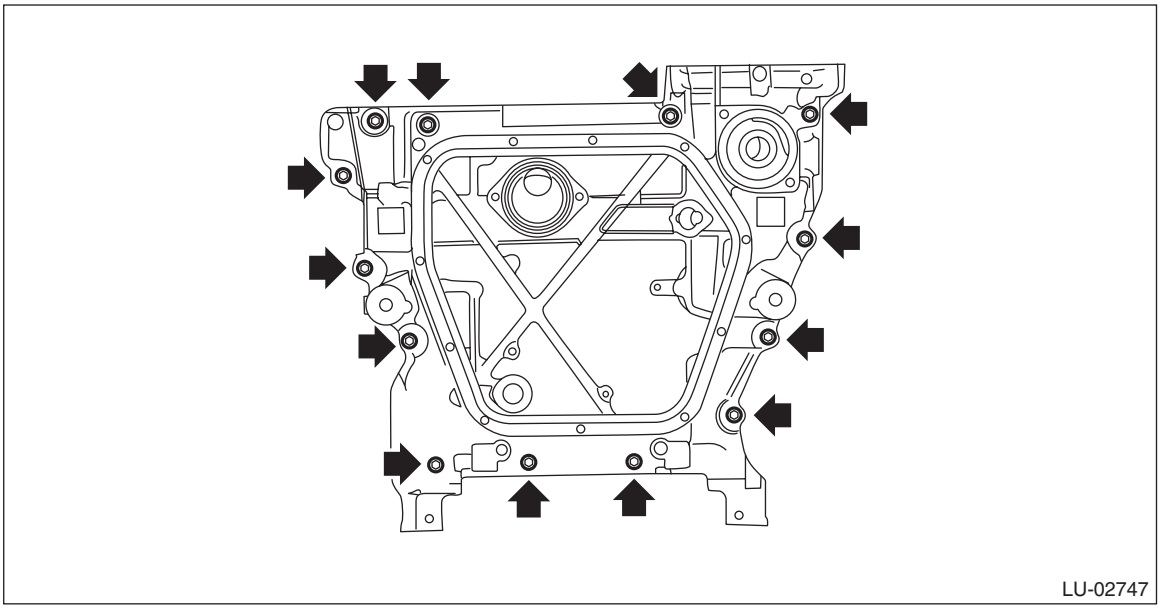
2. OIL PAN UPPER

1) Remove the engine from the vehicle. <Ref. to ME(H4DO(w/o HEV))-55, REMOVAL, Engine Assembly.>
2) Remove the water pump. <Ref. to CO(H4DO(w/o HEV))-19, REMOVAL, Water Pump.>
3) Remove the thermostat cover. <Ref. to CO(H4DO(w/o HEV))-64, REMOVAL, Thermostat.>
4) Remove the water pipe assembly. <Ref. to CO(H4DO(w/o HEV))-24, REMOVAL, Water Pipe Assembly.>
5) Remove the chain cover. <Ref. to ME(H4DO(w/o HEV))-149, REMOVAL, Chain Cover.>
6) Remove the oil pan. <Ref. to LU(H4DO(w/o HEV))-16, OIL PAN, REMOVAL, Oil Pan and Strainer.>

7) Remove clip (A) from the oil pan upper, and remove the oil level switch.

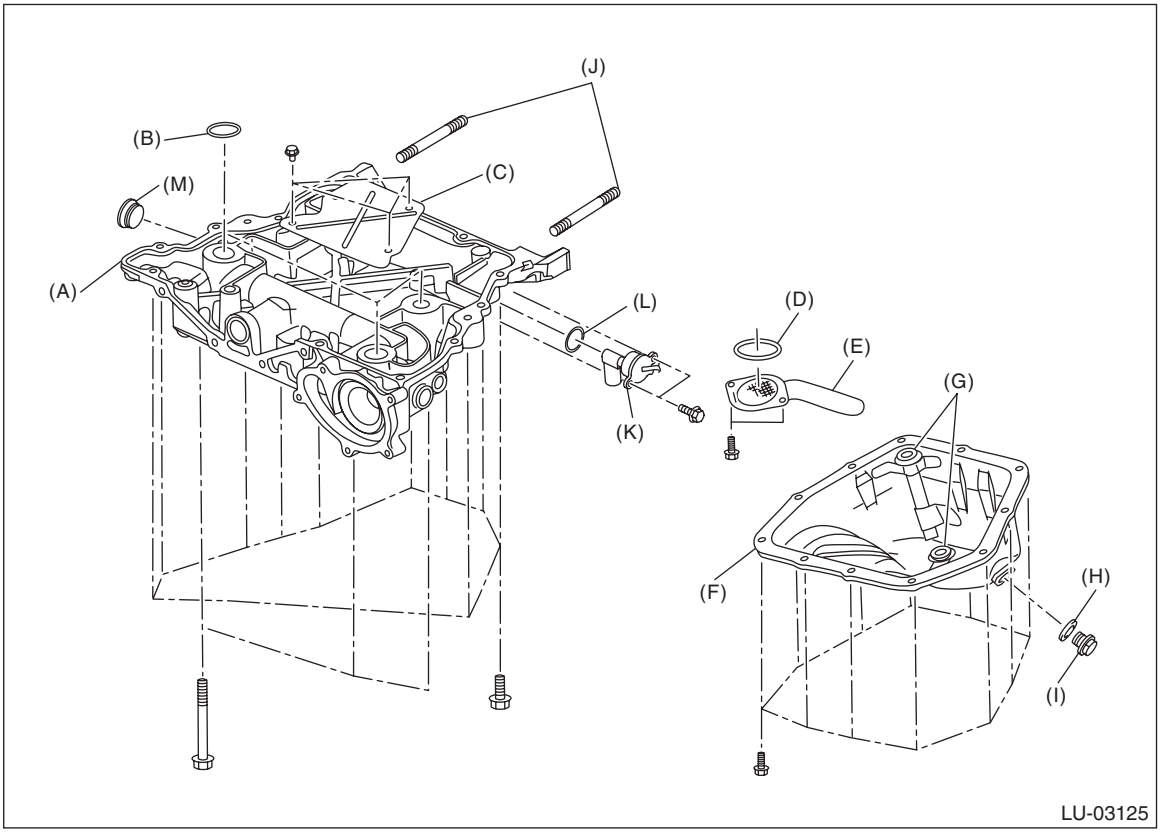


8) Remove the bolts which secure oil pan upper to cylinder block, and remove the oil pan upper.



9) Remove the baffle plate from the oil pan upper.
10) Remove the oil strainer from the oil pan upper.
11) Remove stud bolts from the oil pan upper.

12) Remove the plug from the oil pan upper.



(A) Oil pan upper
(B) O-ring
(C) Baffle plate
(D) O-ring
(E) Oil strainer
(F) Oil pan
(G) Oil pan seal ring
(H) Drain plug gasket
(I) Drain plug
(J) Stud bolt
(K) Oil level switch
(L) O-ring
(M) Plug

B: INSTALLATION

1. OIL PAN

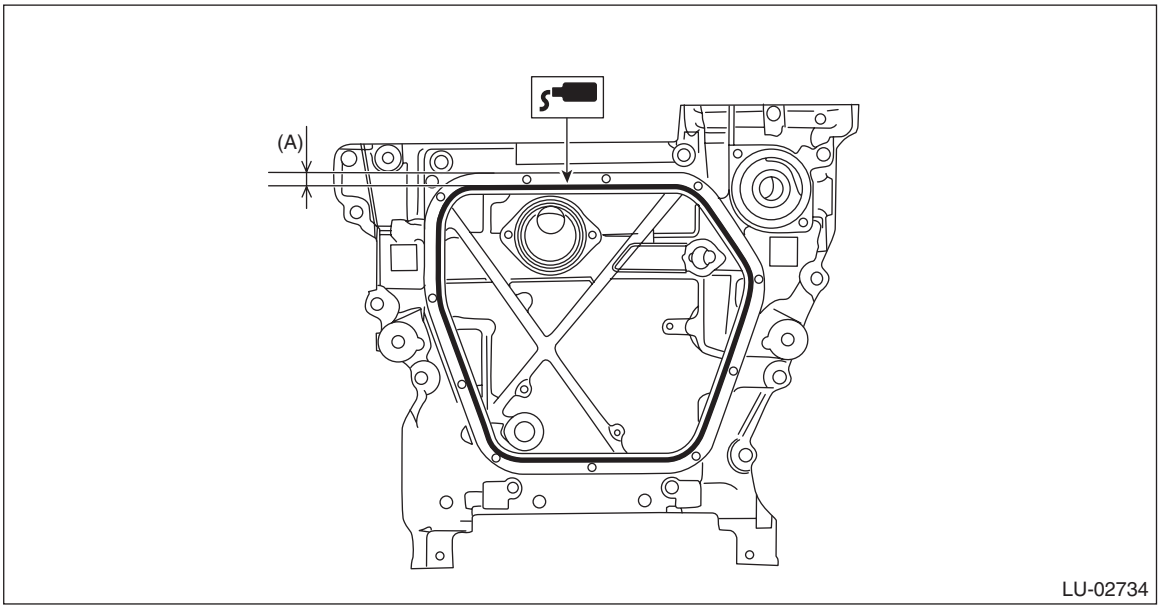
NOTE:
- Before installing the oil pan, wipe and clean the mating surface of oil pan and oil pan upper.
- Use a new oil pan seal ring.

1) Apply liquid gasket to the mating surfaces of oil pan upper, and install the oil pan.

NOTE:
Install within 5 min. after applying liquid gasket.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

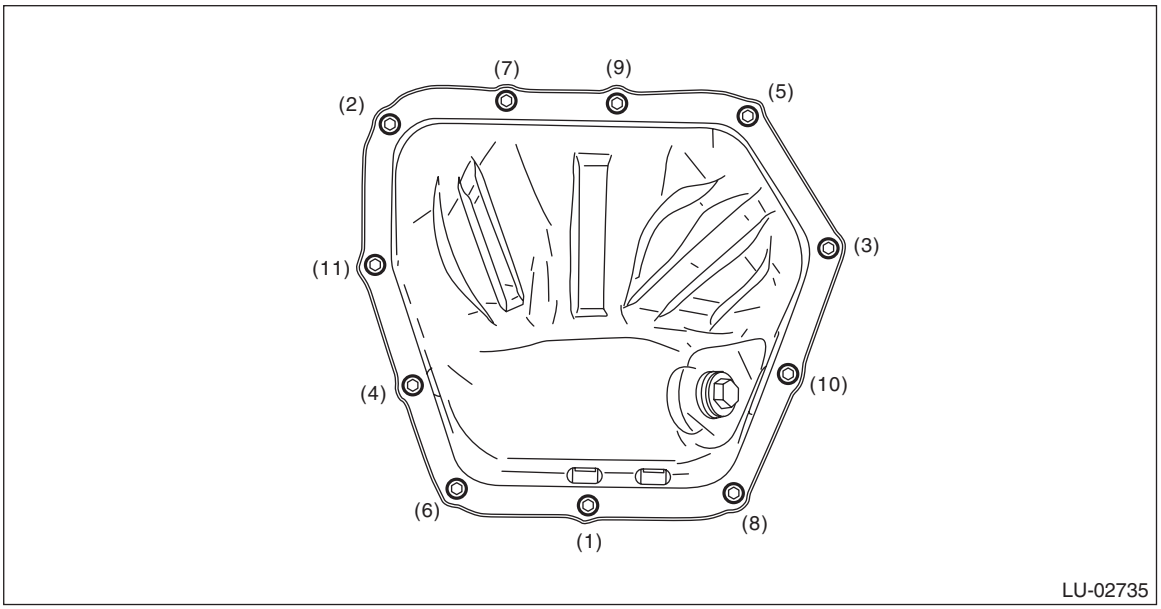
Liquid gasket applying diameter:
5±1 mm (0.1969±0.0394 in)



(A) 7.5 mm (0.295 in)

2) Tighten the bolts to install the oil pan to the oil pan upper in the numerical order.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



3) Install the front exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-8, INSTALLATION, Front Exhaust Pipe.>
4) Install the under cover. <Ref. to EI-32, INSTALLATION, Front Under Cover.>
5) Lower the vehicle.
6) Connect the battery ground terminal. <Ref. to NT-5, BATTERY, NOTE, Note.>
7) Refill the engine oil. <Ref. to LU(H4DO(w/o HEV))-13, REPLACEMENT, Engine Oil.>

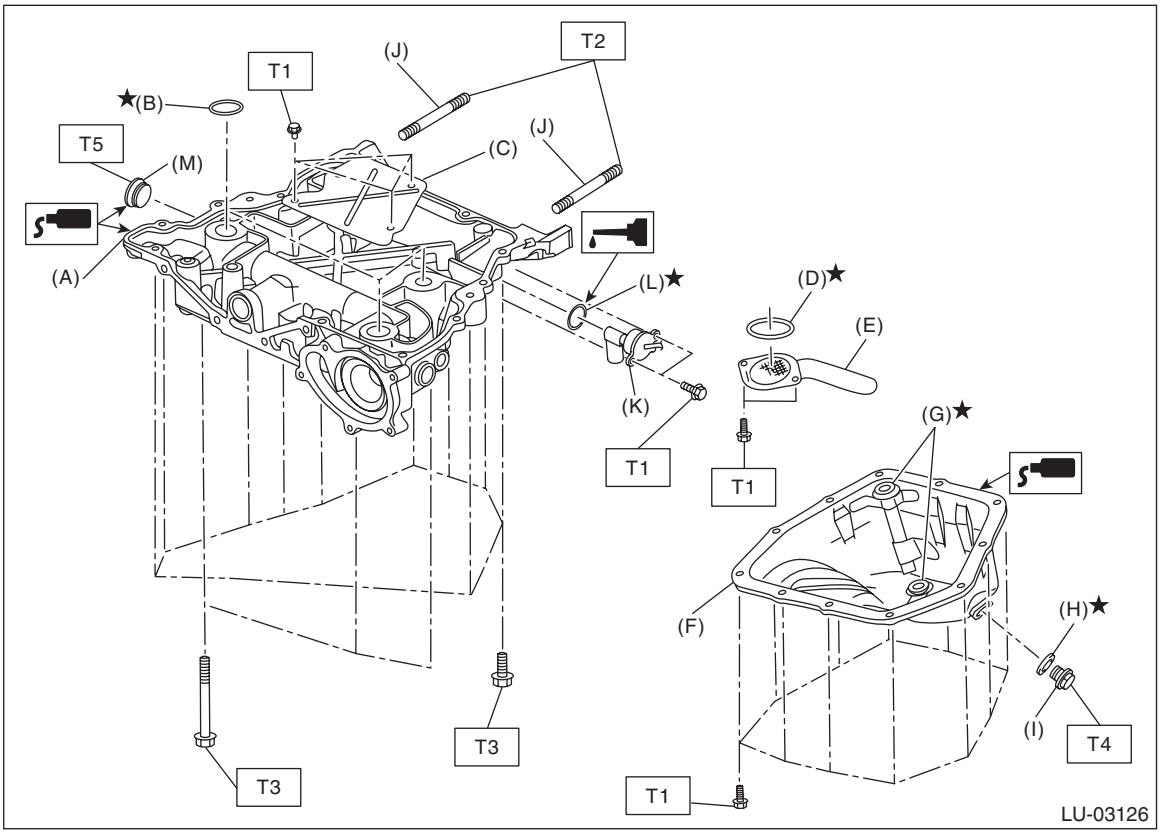
2. OIL PAN UPPER

NOTE:
Before installing the oil pan upper, clean the mating surface of oil pan upper and cylinder block.
1) Apply liquid gasket to the plug threads.

Liquid gasket:
THREE BOND 2411 or equivalent
2) Attach the plug to the oil pan upper.
3) Attach the stud bolts to the oil pan upper.
4) Attach the oil strainer to the oil pan upper.

NOTE:
Use new O-rings.
5) Attach the baffle plate to the oil pan upper.

Tightening torque:
T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
T2: 10 N·m (1.0 kgf-m, 7.4 ft-lb)
T3: 18 N·m (1.8 kgf-m, 13.3 ft-lb)
T4: 41.7 N·m (4.3 kgf-m, 30.8 ft-lb)
T5: 90 N·m (9.2 kgf-m, 66.4 ft-lb)



(A)	Oil pan upper	(B)	O-ring	(C)	Baffle plate
(D)	O-ring	(E)	Oil strainer	(F)	Oil pan
(G)	Oil pan seal ring	(H)	Drain plug gasket	(I)	Drain plug
(J)	Stud bolt	(K)	Oil level switch	(L)	O-ring
(M)	Plug				

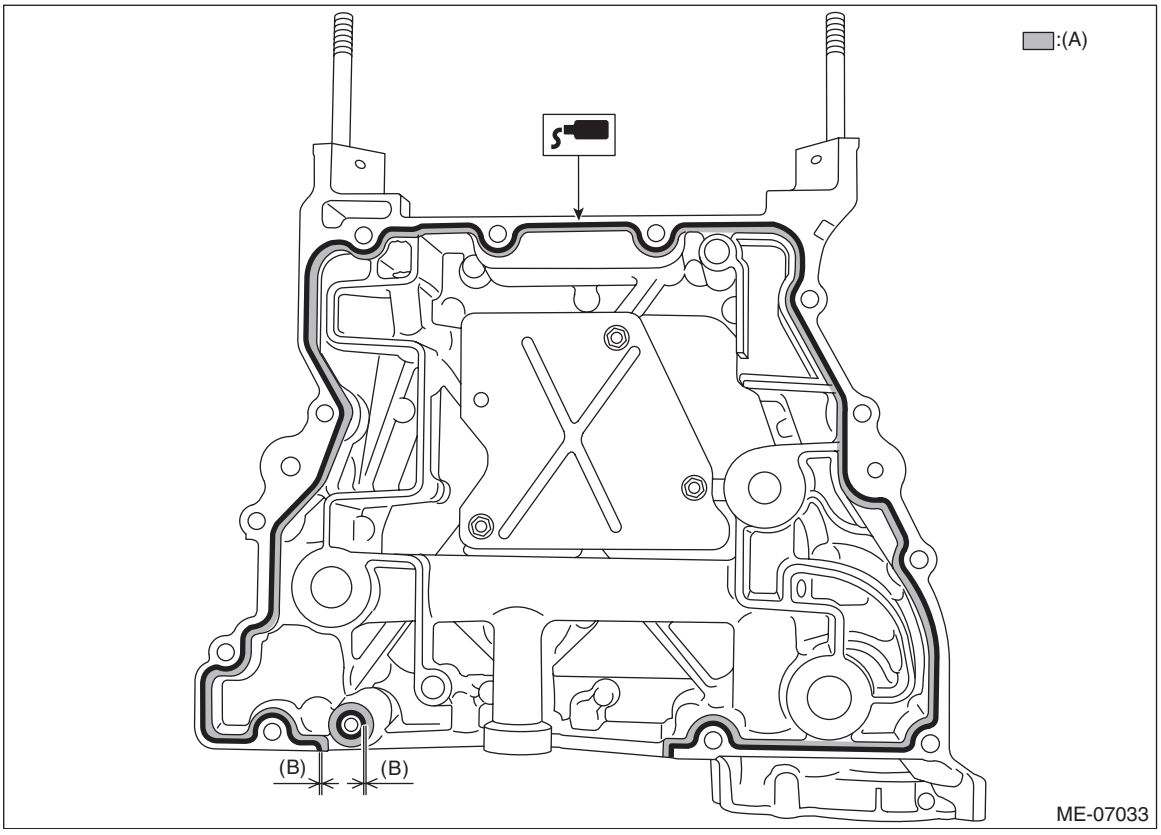
6) Apply liquid gasket to the mating surface of the oil pan upper as shown in the figure, and install the oil pan upper to the cylinder block.

CAUTION:
Be careful not to apply any liquid gasket to the O-ring.

NOTE:
- Use new O-rings.
- Install within 5 min. after applying liquid gasket.
- Apply liquid gasket 1.5 mm (0.0591 in) outside from the chamfer surface. However, application of liquid gasket on the chamfer surface around the bolt hole is allowed.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:
5±1 mm (0.1969±0.0394 in)

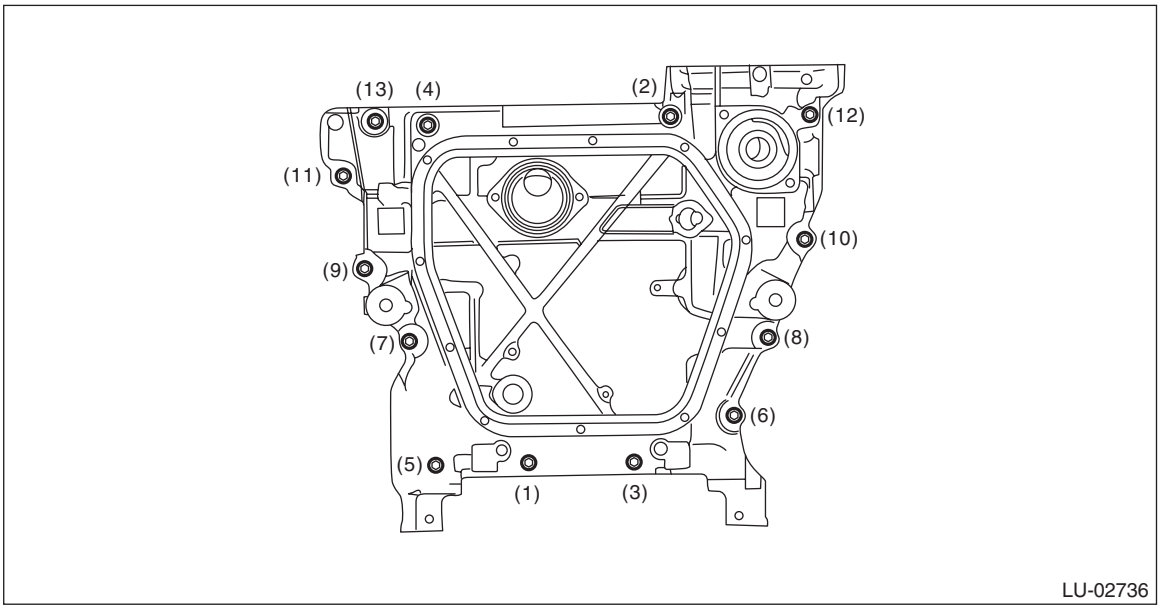


(A) Chamfer surface (B) 1.5 mm (0.0591 in)

7) Set the oil pan upper to the cylinder block, and tighten the bolts in numerical order as shown in the figure.

NOTE:
After tightening, if the liquid gasket is squeezed out onto the seal surface of the chain cover, completely remove any squeezed-out liquid gasket.

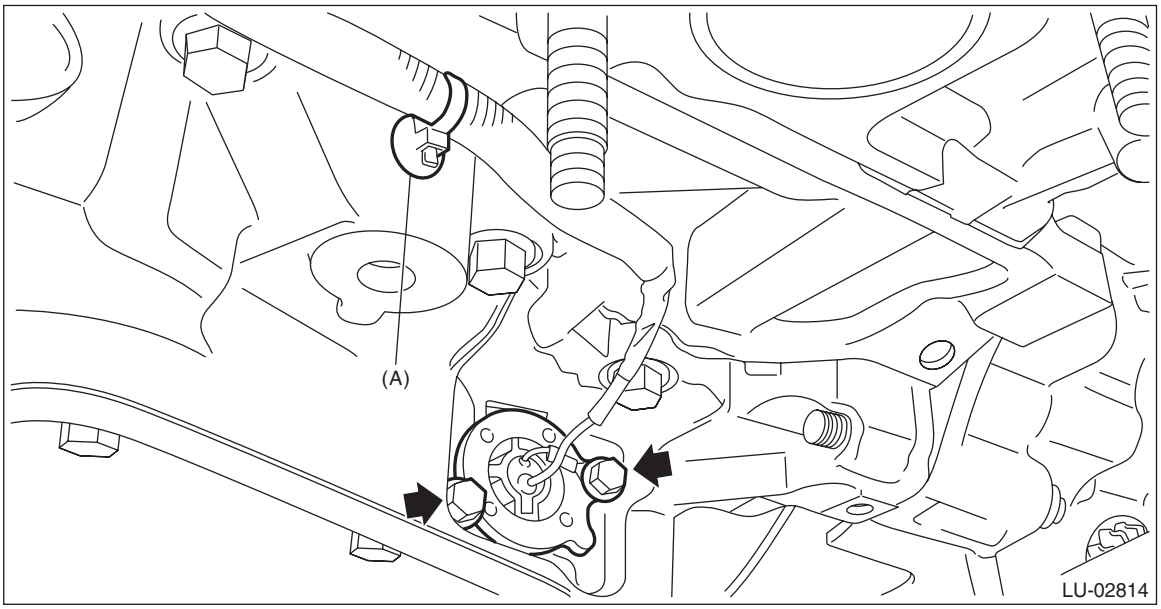
Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)



8) Install the oil level switch on the oil pan upper, and secure the harness with clips (A).

NOTE:
- Use new O-rings.
- Apply a coat of engine oil to the O-rings.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



9) Install the oil pan. <Ref. to LU(H4DO(w/o HEV))-19, OIL PAN, INSTALLATION, Oil Pan and Strainer.>
10) Install the chain cover. <Ref. to ME(H4DO(w/o HEV))-156, INSTALLATION, Chain Cover.>
11) Install the water pipe assembly. <Ref. to CO(H4DO(w/o HEV))-45, INSTALLATION, Water Pipe Assembly.>
12) Install the thermostat cover. <Ref. to CO(H4DO(w/o HEV))-70, INSTALLATION, Thermostat.>
13) Install the water pump. <Ref. to CO(H4DO(w/o HEV))-21, INSTALLATION, Water Pump.>
14) Lower the vehicle.
15) Install the engine to the vehicle. <Ref. to ME(H4DO(w/o HEV))-88, INSTALLATION, Engine Assembly.>
16) Refill the engine oil. <Ref. to LU(H4DO(w/o HEV))-13, REPLACEMENT, Engine Oil.>

C: INSPECTION

Check that the oil pan, oil pan upper, oil strainer and baffle plate do not have deformation, cracks or damage.

6. Oil Pressure Switch

A: REMOVAL

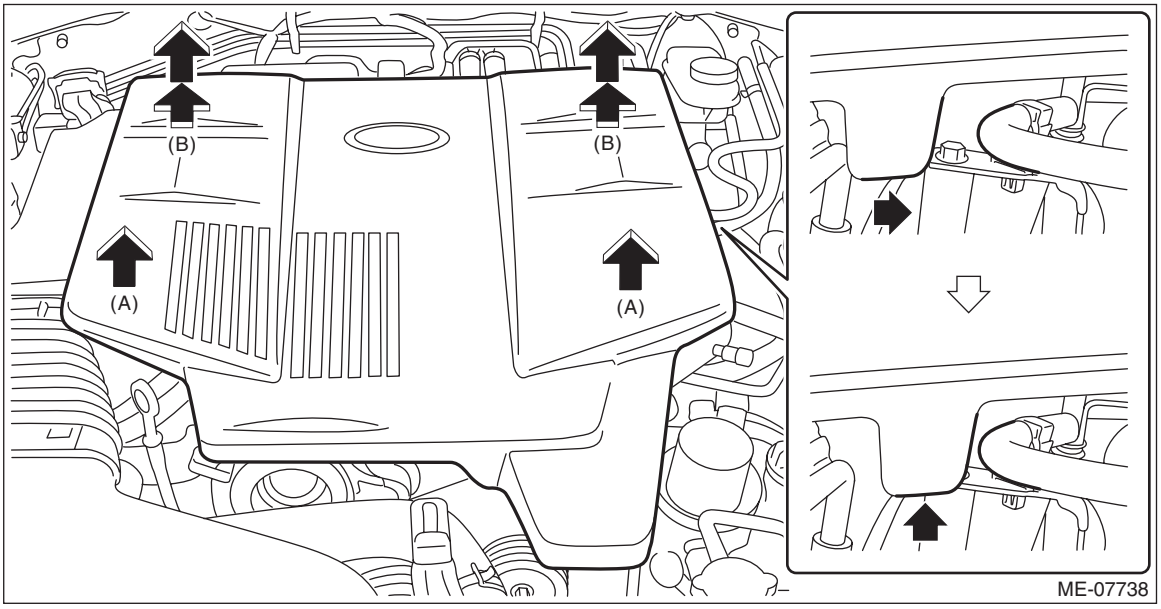
CAUTION:
If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.

1) Disconnect the ground cable from battery. <Ref. to NT-5, BATTERY, NOTE, Note.>

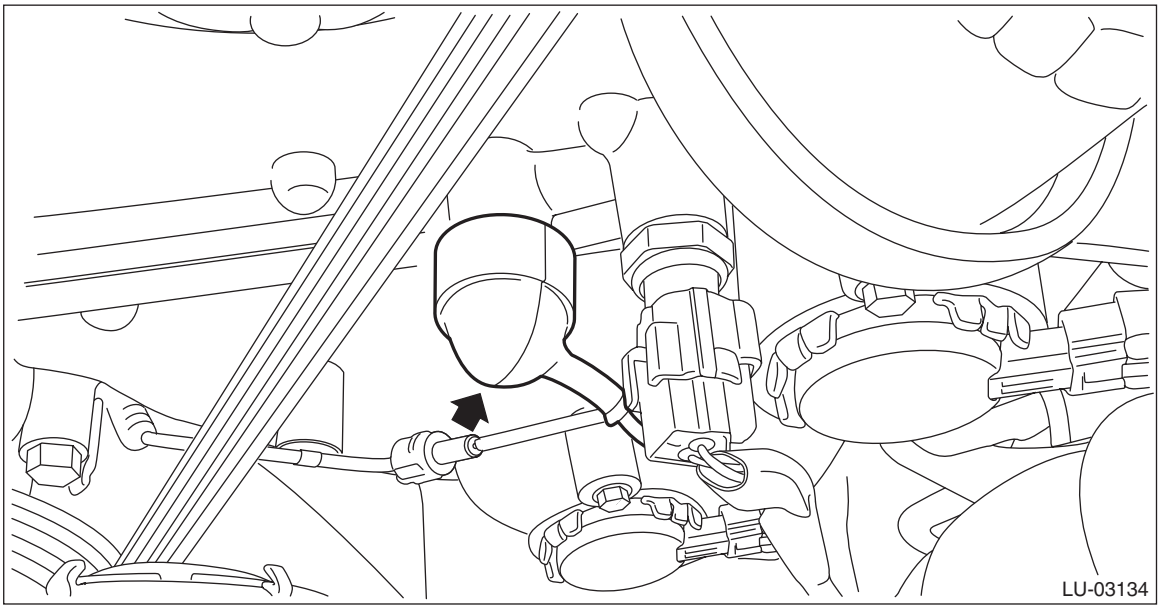
NOTE:
For the 12 volt engine restart battery of HEV model, disconnect the ground terminal from 12V engine restart battery sensor.

2) Remove the collector cover. (HEV model)
   (1) Carefully pull up the front of collector cover at two positions (A).
   (2) Carefully pull up the rear of collector cover at two positions (B) while moving it backward.

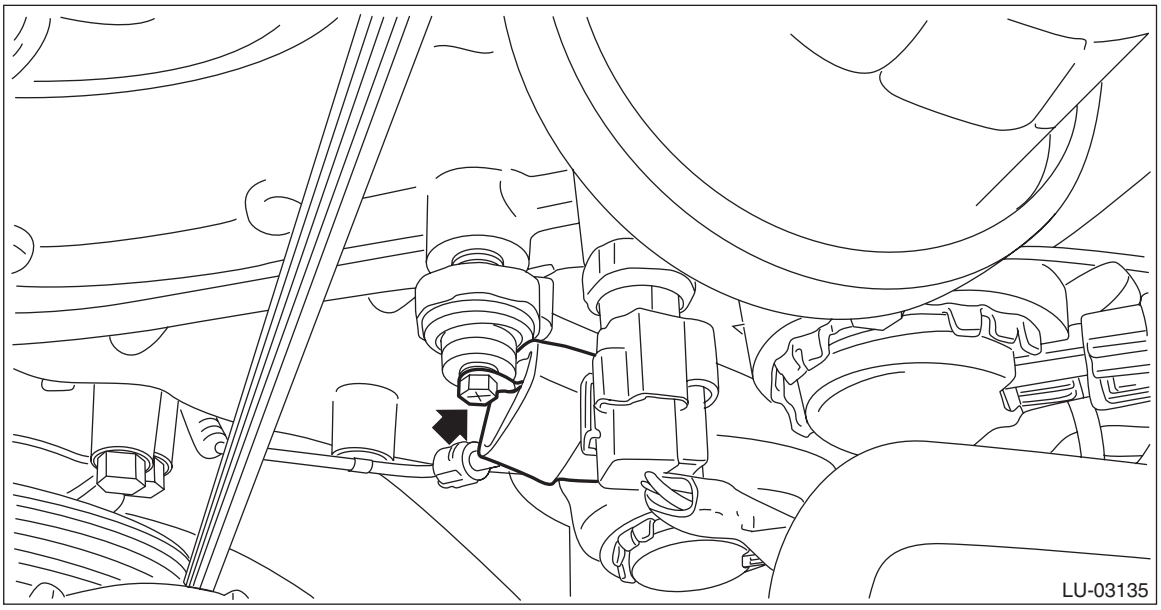
NOTE:
Be careful not to contact the fuel delivery tube when moving the collector cover rearward.



3) Remove the rubber cap.

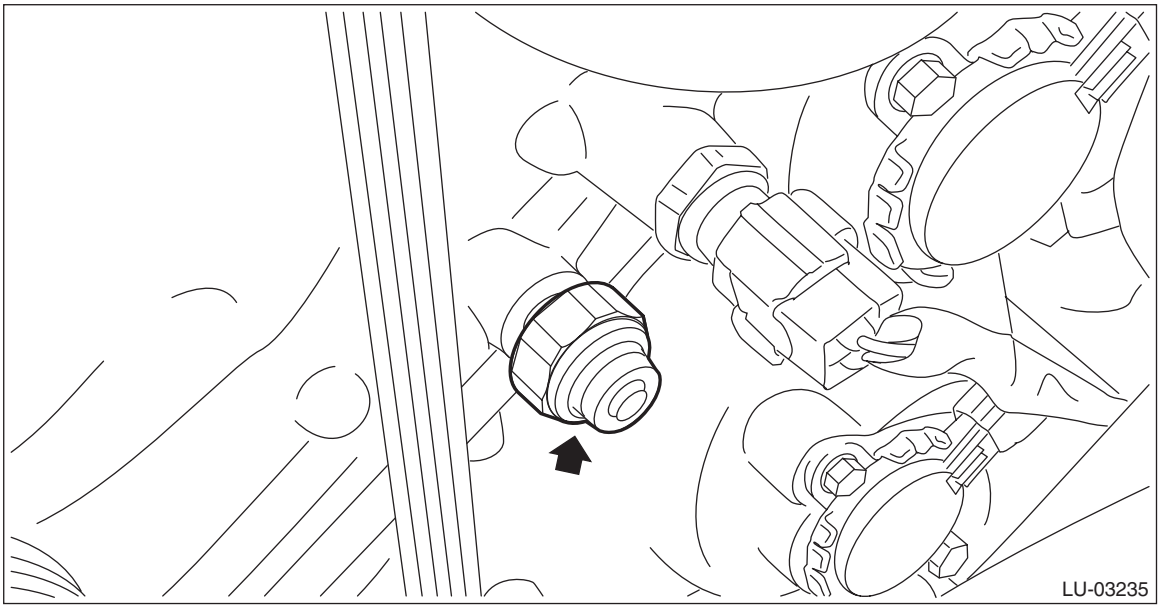


4) Disconnect the terminal from oil pressure switch.



5) Remove the oil pressure switch.

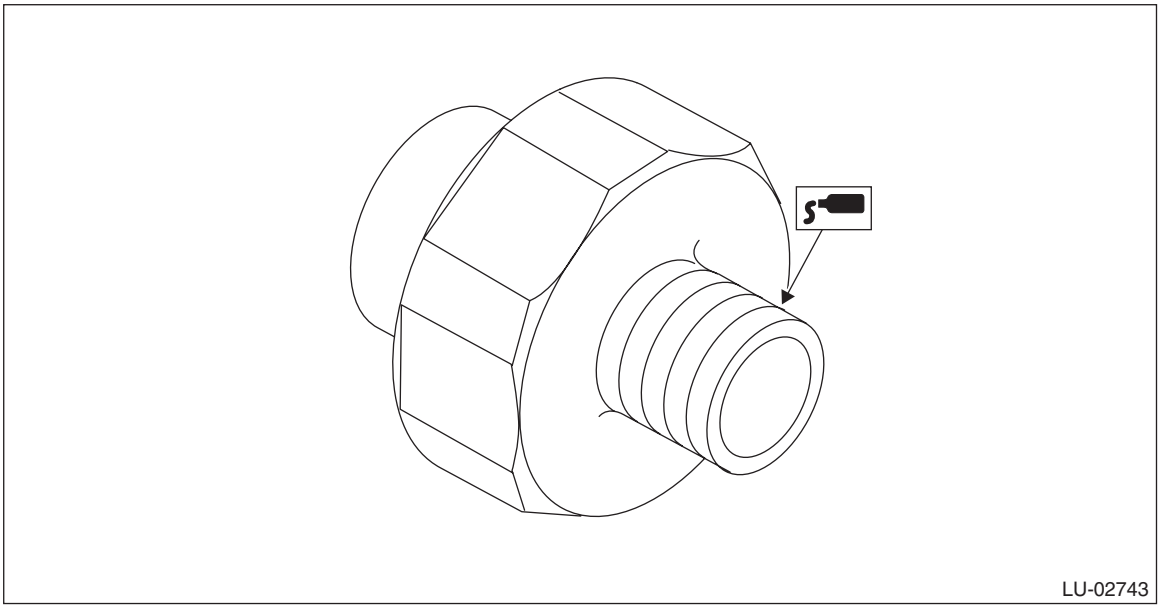
CAUTION:
Catch the engine oil using cloth to prevent it from splashing.



B: INSTALLATION

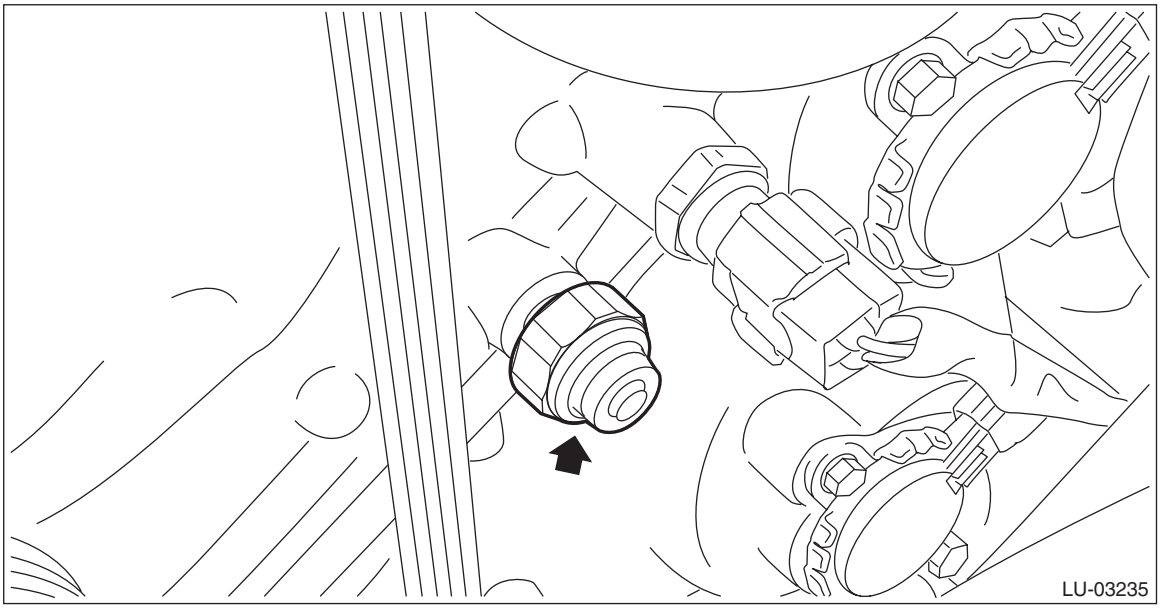
1) Apply liquid gasket to the oil pressure switch threads.

Liquid gasket:
THREE BOND 1324 (Part No. 004403042) or equivalent



2) Install the oil pressure switch to the chain cover.

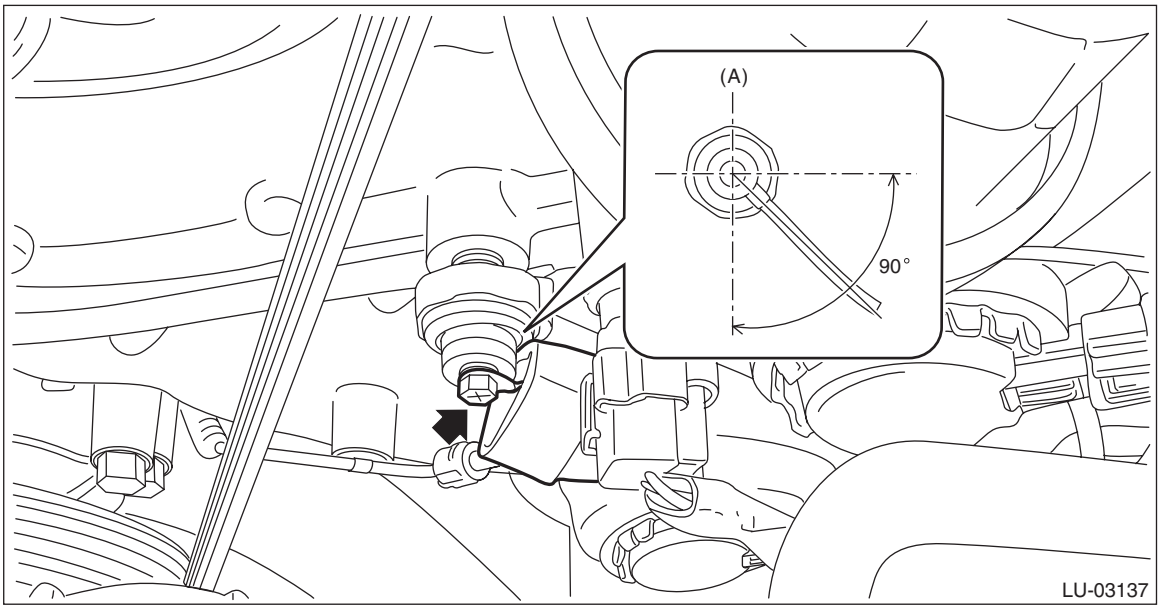
Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)



3) Connect the terminal to the oil pressure switch.

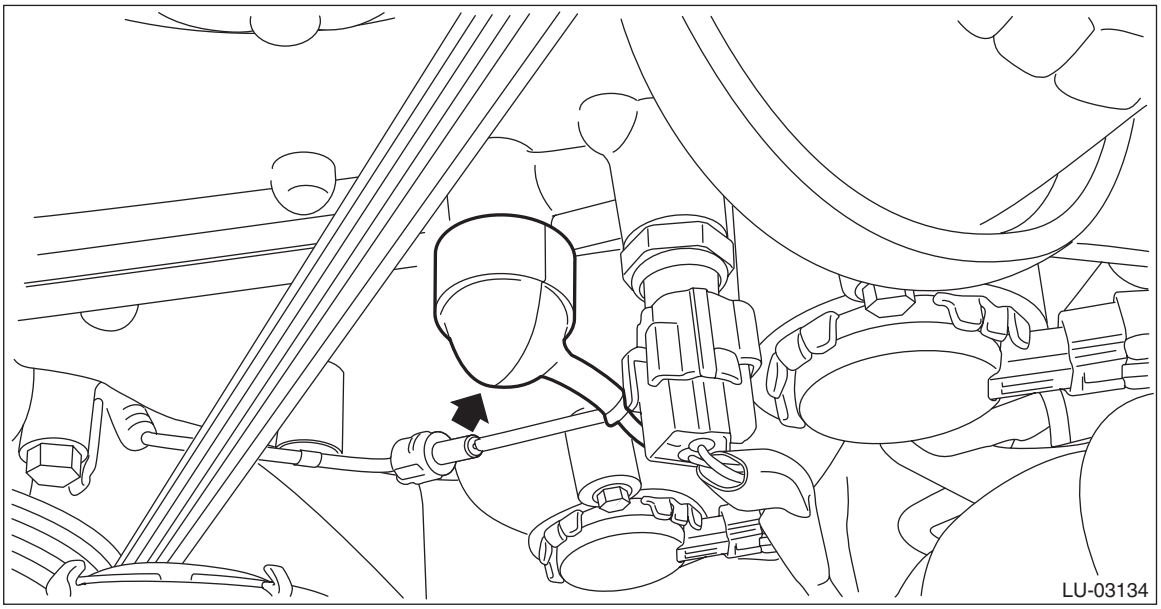
NOTE:
The oil pressure switch harness must be tightened within the range of a 90° angle as shown below.

Tightening torque:
1.5 N·m (0.2 kgf-m, 1.1 ft-lb)



(A) Upper side of the engine

4) Attach the rubber cap.



5) Install the collector cover. (HEV model)
6) Connect the battery ground terminal. <Ref. to NT-5, BATTERY, NOTE, Note.>

C: INSPECTION

1) Check that the oil pressure switch does not have deformation, cracks or damage.
2) Check that there are no oil leaks or oil oozing from the oil pressure switch installation portion.

7. Engine Oil Filter

A: REMOVAL

CAUTION:
If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.

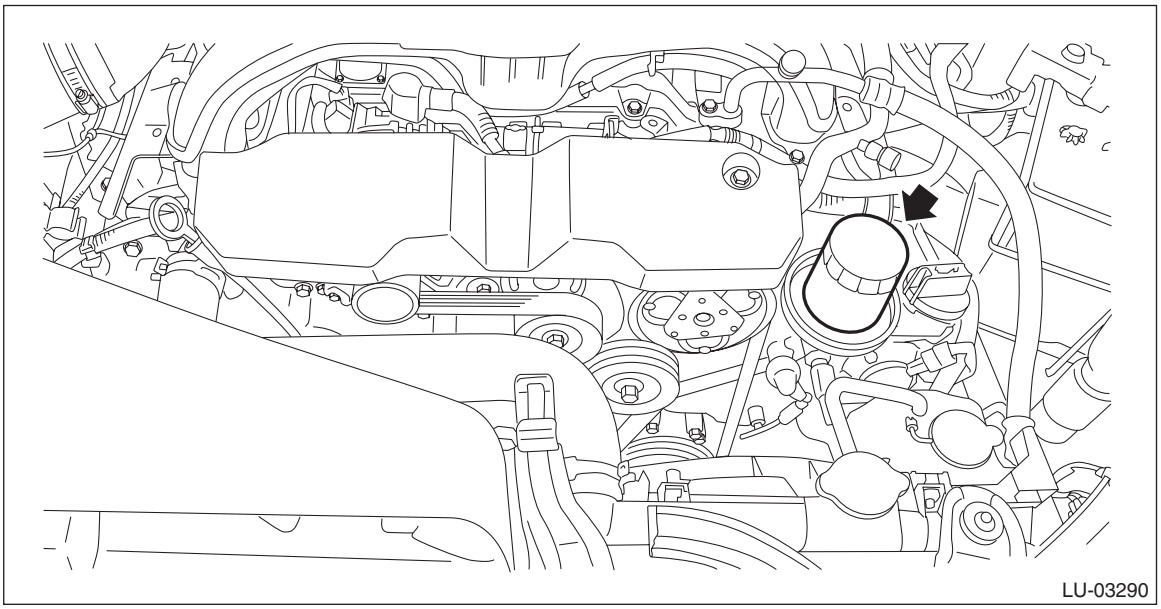
1. OIL FILTER

1) Turn the ignition switch to OFF.
2) Remove the oil filter.

NOTE:
Clean off water or dust from the oil element mating surface using air.
- Oil filter (black)

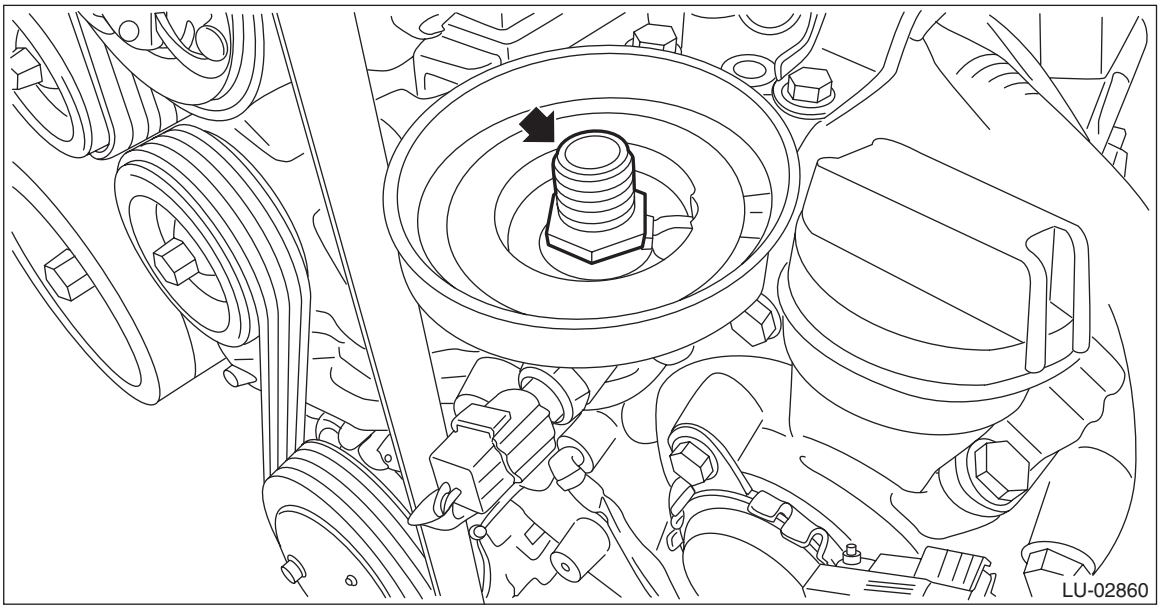
Remove the oil filter using ST.
ST 18332AA000 OIL FILTER WRENCH (outer diameter: 68 mm (2.68 in) for oil filter)
- Oil filter (blue)

Remove using a general tool (65/67 mm 14 Flutes).



2. OIL PUMP UNION

1) Remove the oil filter. <Ref. to LU(H4DO(w/o HEV))-29, OIL FILTER, REMOVAL, Engine Oil Filter.>
2) Remove the oil pump union from the chain cover.



B: INSTALLATION

1. OIL FILTER

CAUTION:
Do not tighten excessively, or oil may leak.
1) Clean the oil filter installing surface on the chain cover.
2) Obtain a new oil filter and apply a thin coat of engine oil to the seal rubber.
3) Install the oil filter by turning it by hand, being careful not to damage the seal rubber of the oil filter.
• Tighten the oil filter (Black) with an outer diameter of 68 mm (2.68 in) (approx. 1 rotation) after the seal rubber of the oil filter comes in contact with chain cover. When using a torque wrench, tighten to 14 N·m (1.4 kgf-m, 10.3 ft-lb).
• Tighten the oil filter (Blue) with an outer diameter of 67.4 mm (2.65 in) (approx. 7/8 rotation) after the seal rubber of the oil filter comes in contact with chain cover. When using a torque wrench, tighten to 12 N·m (1.2 kgf-m, 8.9 ft-lb).
4) After installing, check the engine oil level and replenish it if necessary. <Ref. to LU(H4DO(w/o HEV))-12, INSPECTION, Engine Oil.>

2. OIL PUMP UNION

Install in the reverse order of removal.

Tightening torque:
45 N·m (4.6 kgf-m, 33.2 ft-lb)

C: INSPECTION

1) After installing the oil filter, run the engine and check for oil leakage.

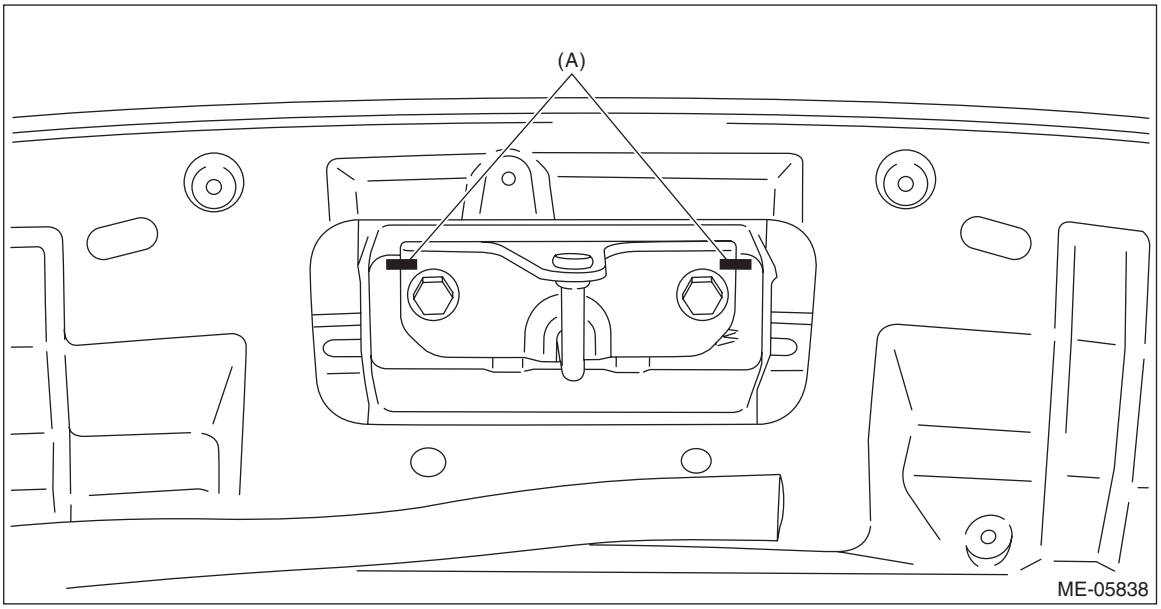
NOTE:
The filter element and filter case are permanently jointed; therefore, interior cleaning is not necessary.
2) Check the engine oil level. <Ref. to LU(H4DO(w/o HEV))-12, INSPECTION, Engine Oil.>

8. Oil Level Switch

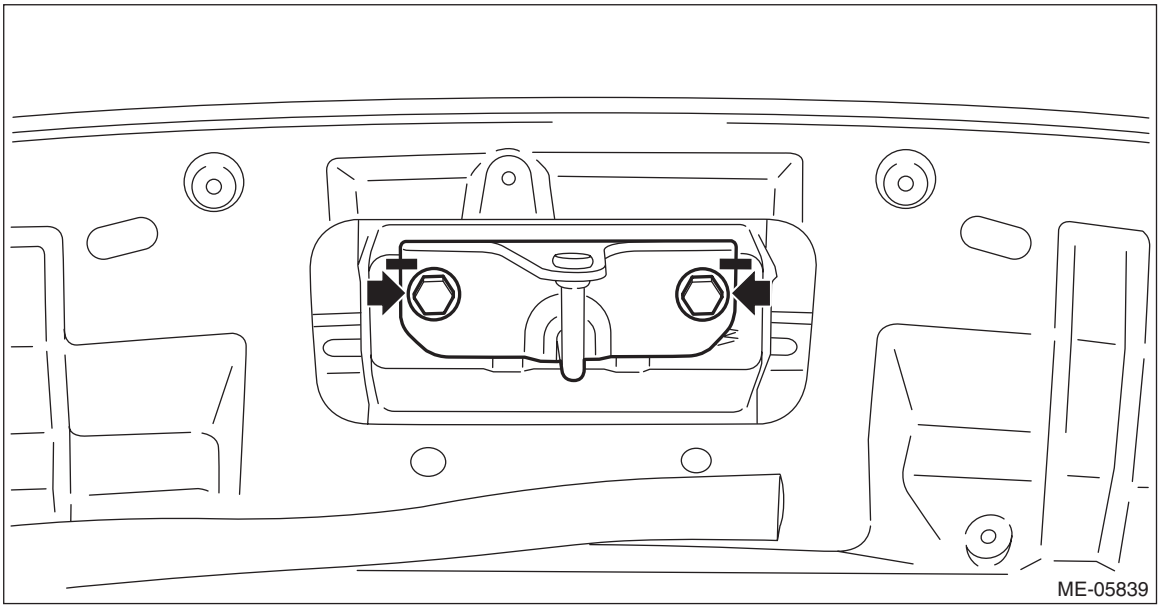
A: REMOVAL

1. GASOLINE ENGINE MODEL

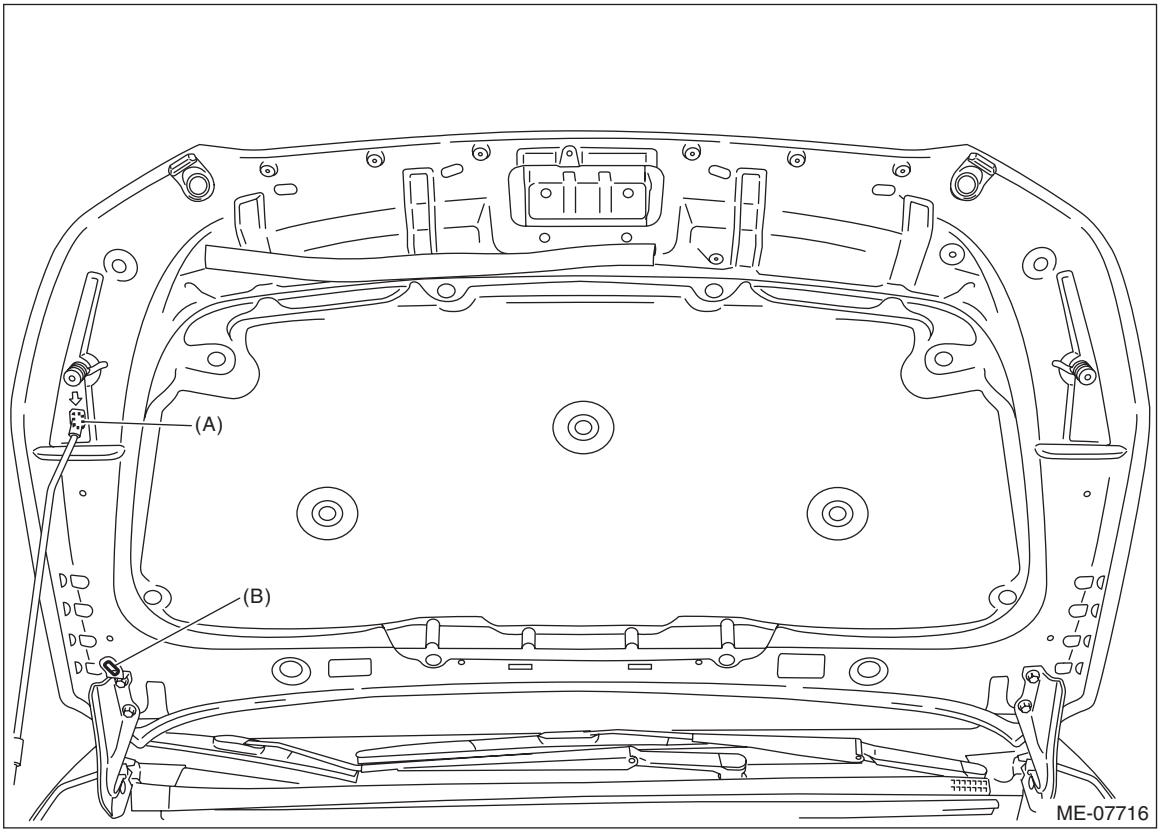
1) Open the front hood, and make alignment marks (A) on the front hood striker and the front hood using a marker pen.



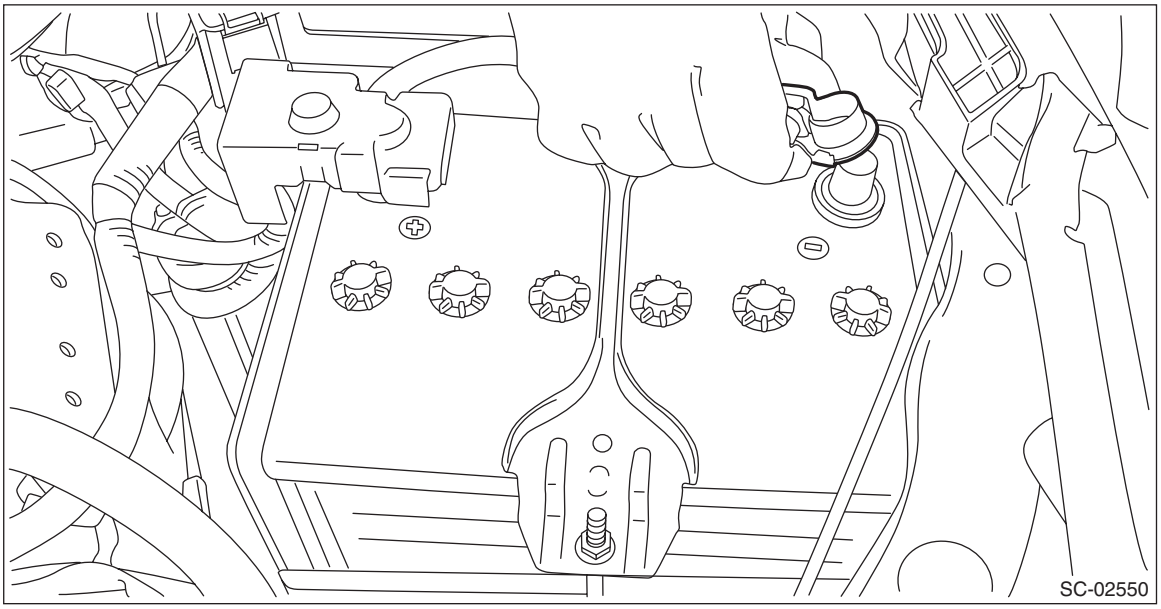
2) Remove the front hood striker from the front hood.



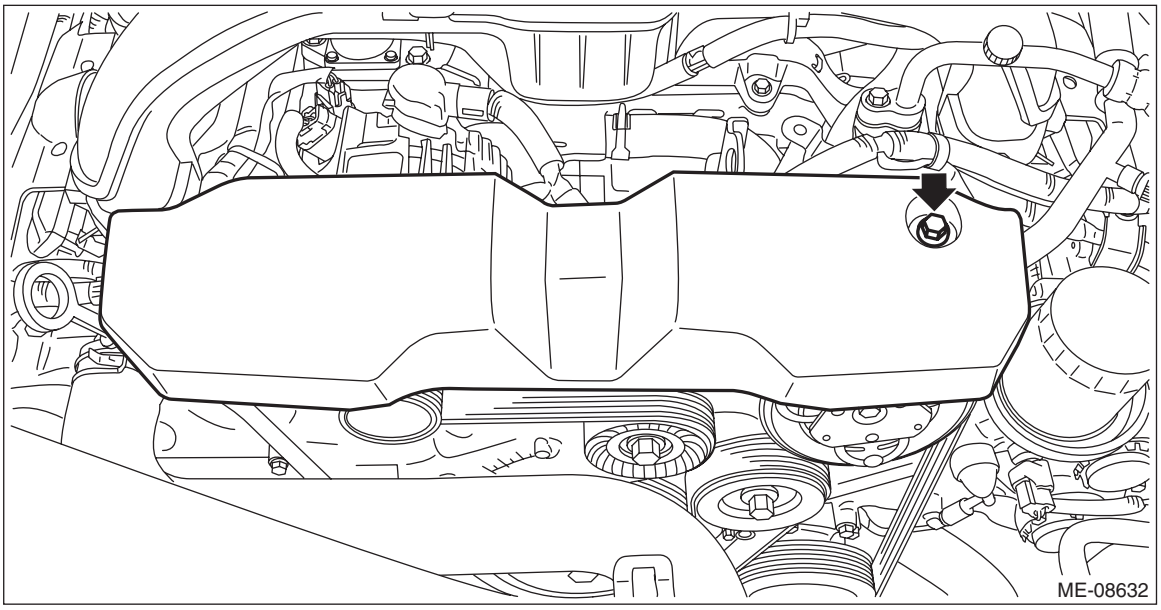
3) Change the front hood stay position from (A) to (B), and completely open the front hood.



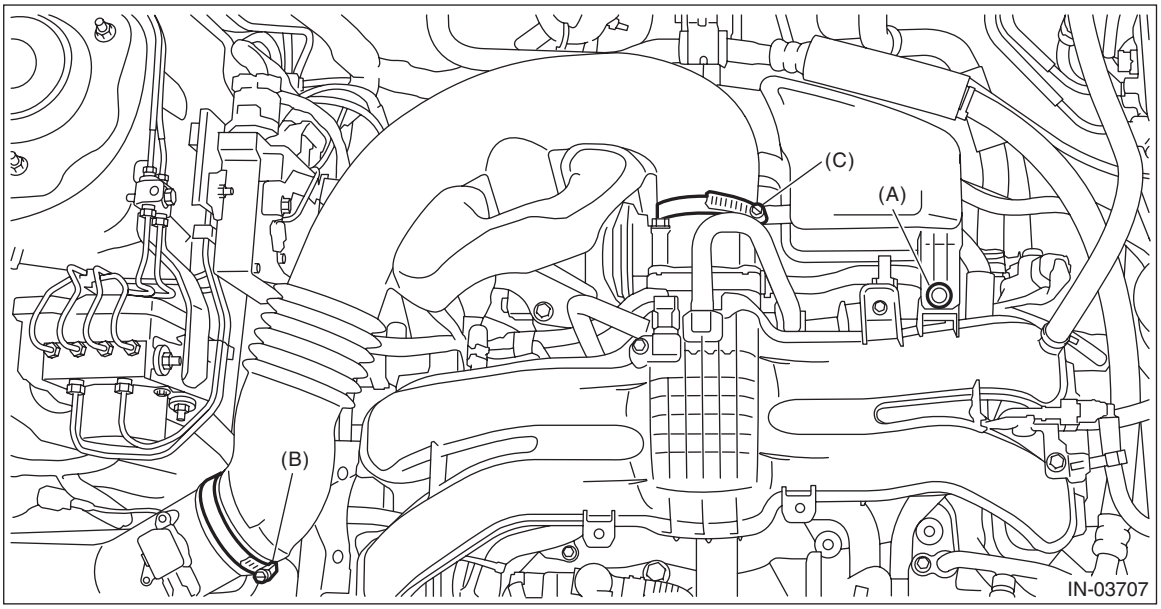
4) Disconnect the ground cable from battery.



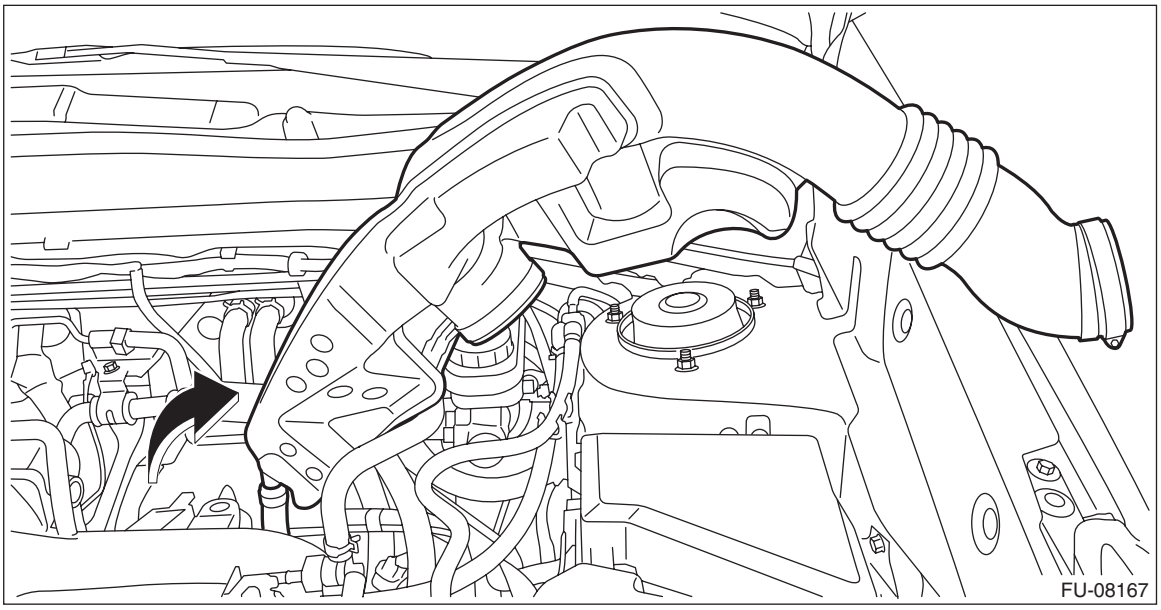
5) Remove the V-belt covers.



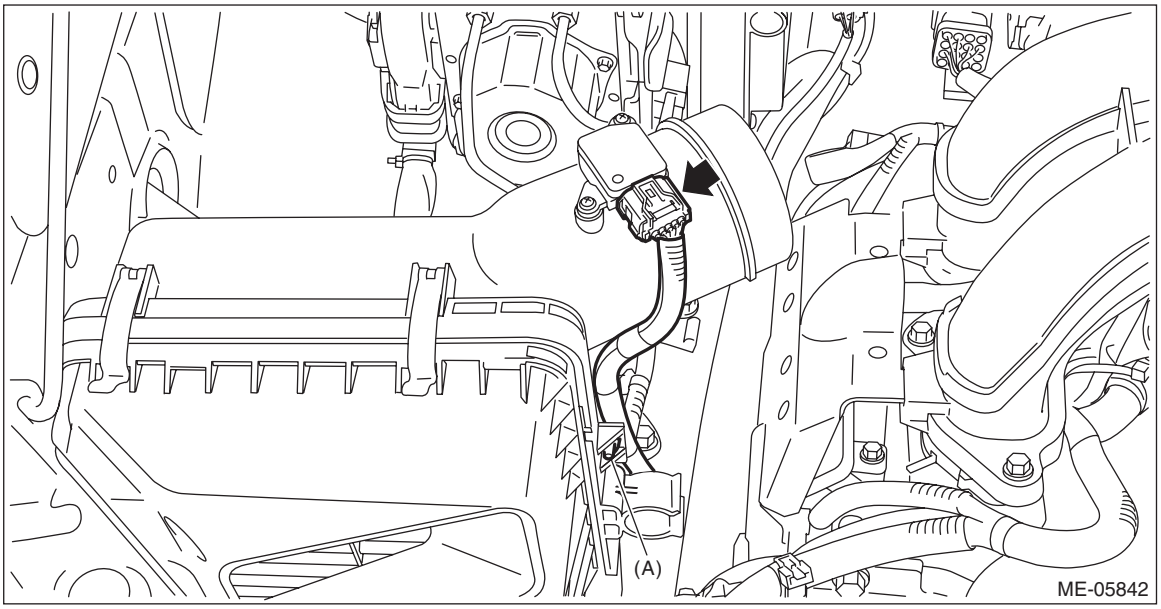
6) Remove the air intake duct. <Ref. to IN(H4DO(w/o HEV))-13, REMOVAL, Air Intake Duct.>
7) Remove the clip (A) from the air intake boot.
8) Loosen the clamp (B) securing the air cleaner case (rear) to the air intake boot.
9) Loosen the clamp (C) which secures the throttle body to the air intake boot.



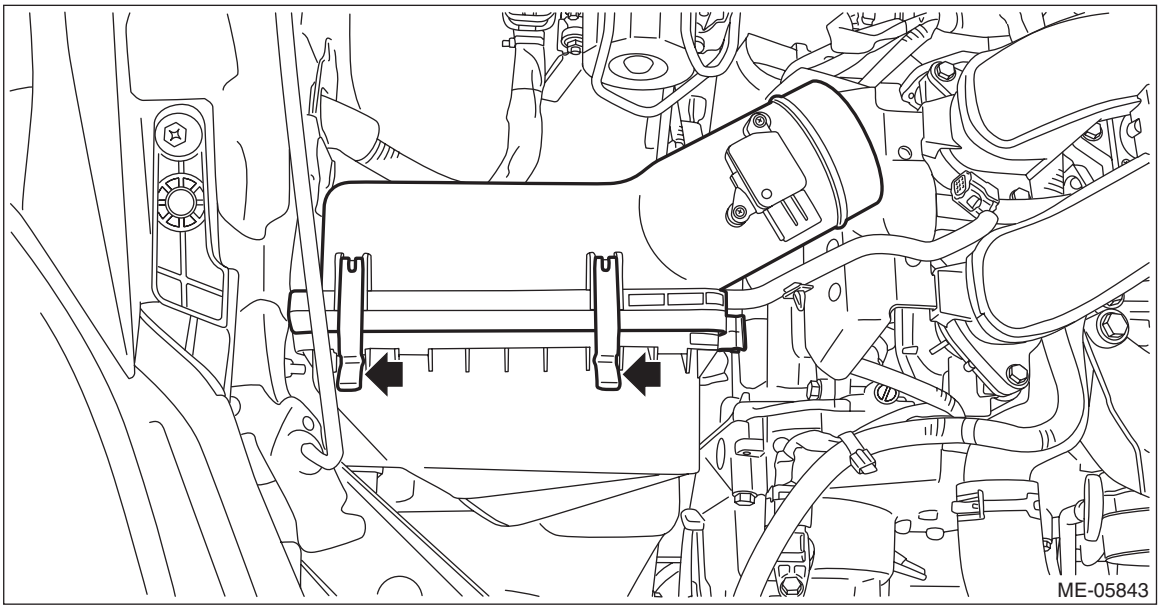
10) Remove the air intake boot from the throttle body, and move it to the left side wheel apron.



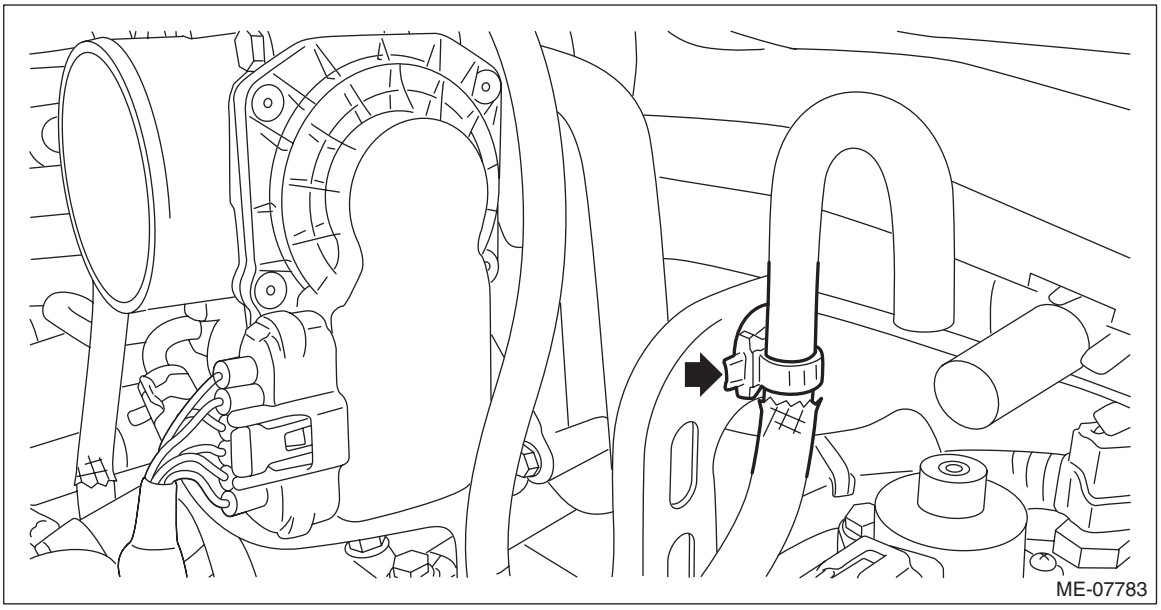
11) Disconnect the connector from the mass air flow and intake air temperature sensor, and remove the clip (A) which holds the mass air flow and intake air temperature sensor harness.



12) Remove the air cleaner case (rear).

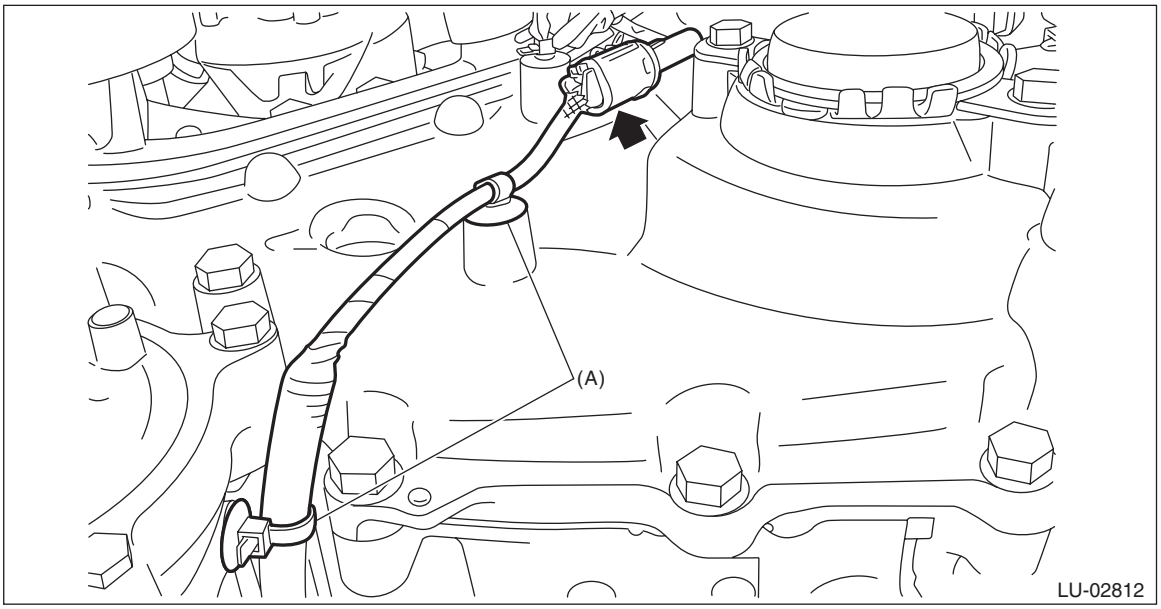


13) Remove the clip holding the air breather hose to the engine rear hanger. (MT model)

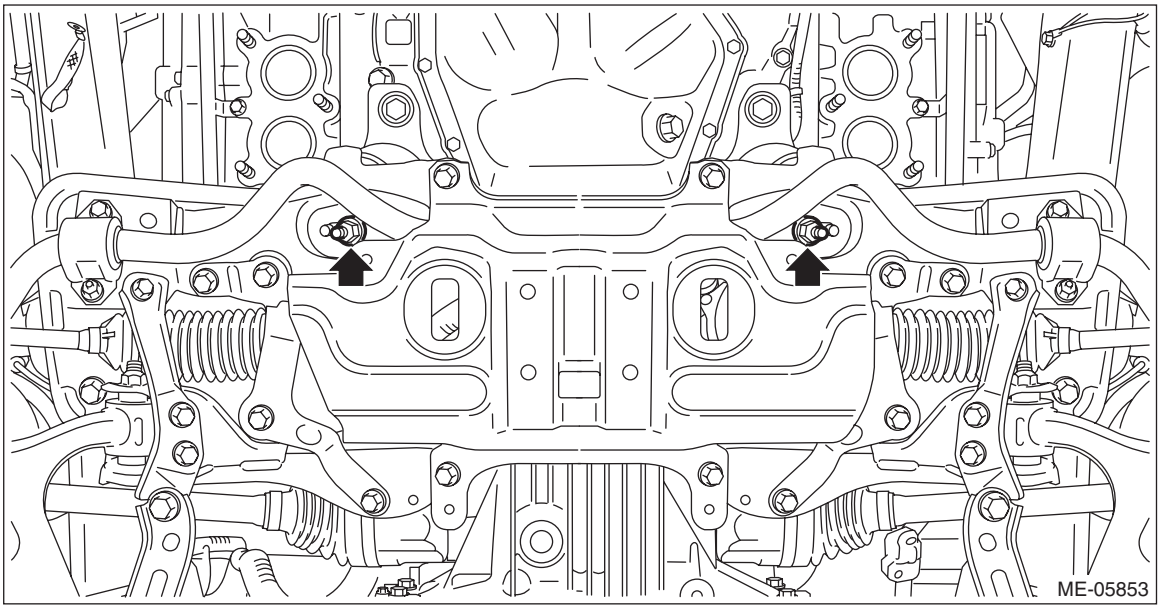


14) Lift up the vehicle.
15) Remove the under cover. <Ref. to EI-32, REMOVAL, Front Under Cover.>
16) Drain the engine oil. <Ref. to LU(H4DO(w/o HEV))-13, REPLACEMENT, Engine Oil.>
17) Remove the front exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-6, REMOVAL, Front Exhaust Pipe.>

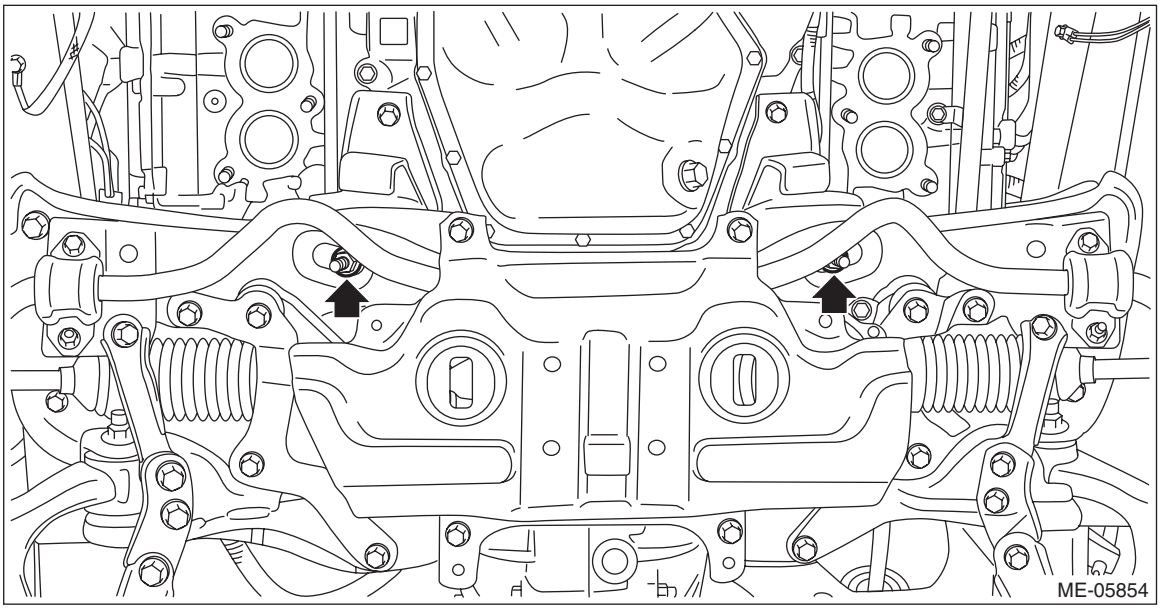
18) Disconnect the oil level switch connector from the engine harness, and remove the clip (A) securing the harness.



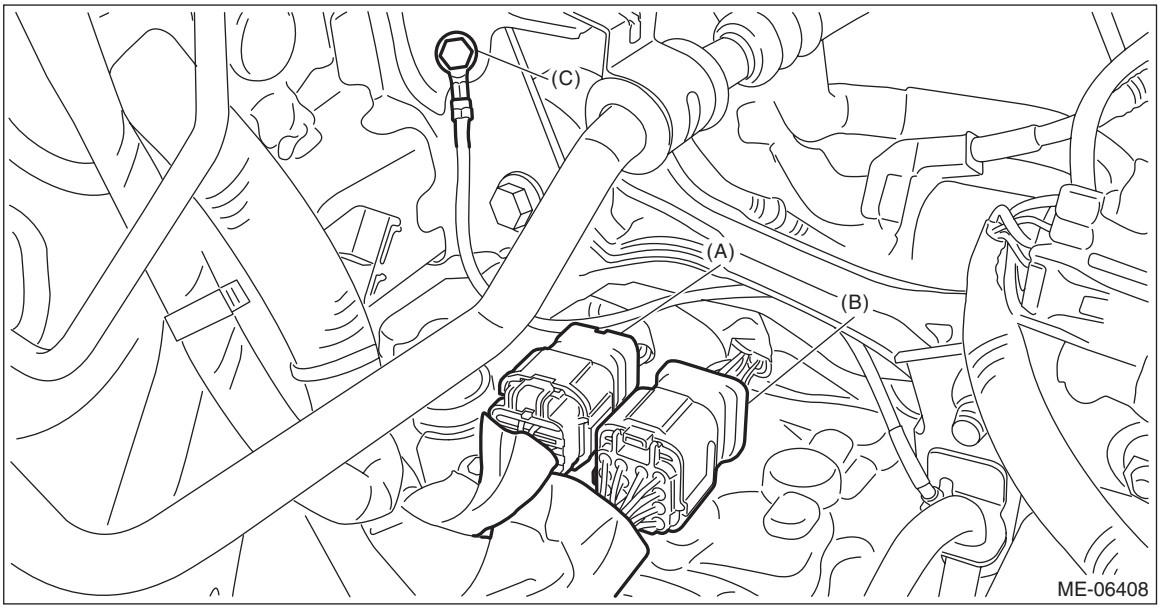
19) Remove the nuts which secure the engine mounting to the front crossmember. (CVT model)



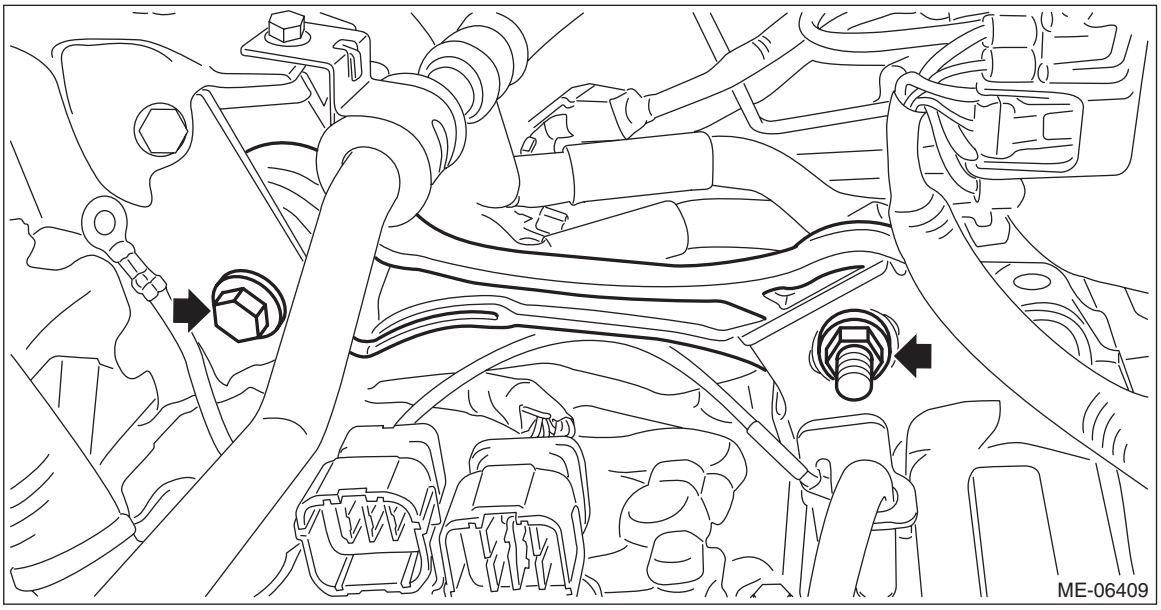
20) Remove the nuts which secure the engine mounting to the front crossmember. (MT model)



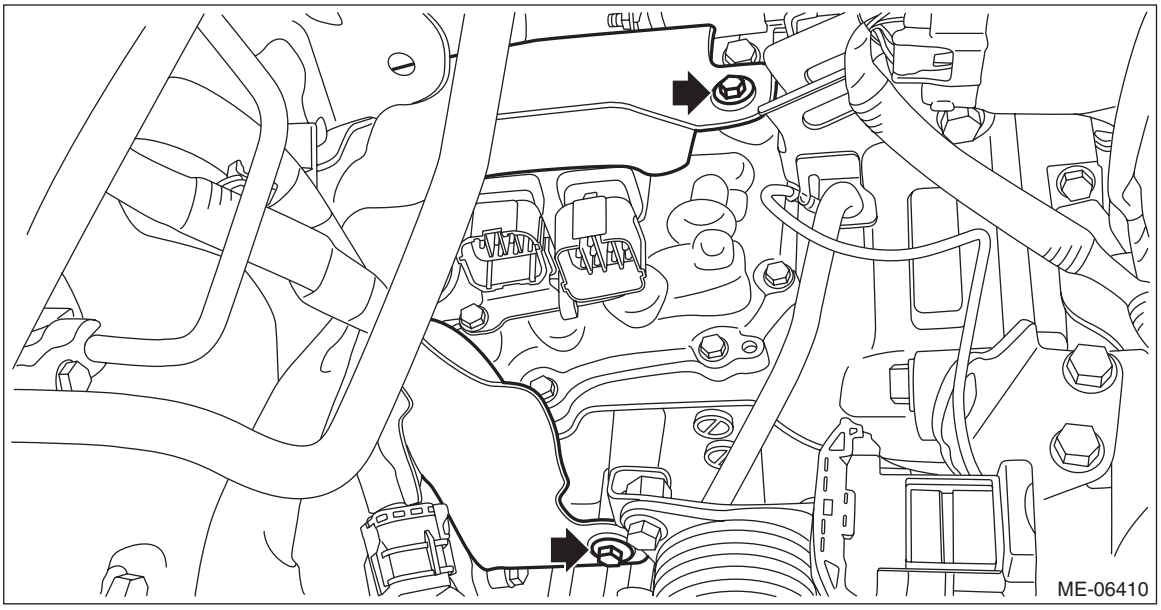
21) Remove the electric power steering gearbox. <Ref. to PS-28, REMOVAL, Electric Power Steering Gearbox.>
22) Remove the front drive shaft LH. <Ref. to DS-56, REMOVAL, Front Drive Shaft.>
23) Lower the vehicle.
24) Disconnect the bulkhead harness connector from the transmission harness connector (A) and the inhibitor harness connector (B), and disconnect the transmission radio ground terminal (C) from the vehicle body. (CVT model)



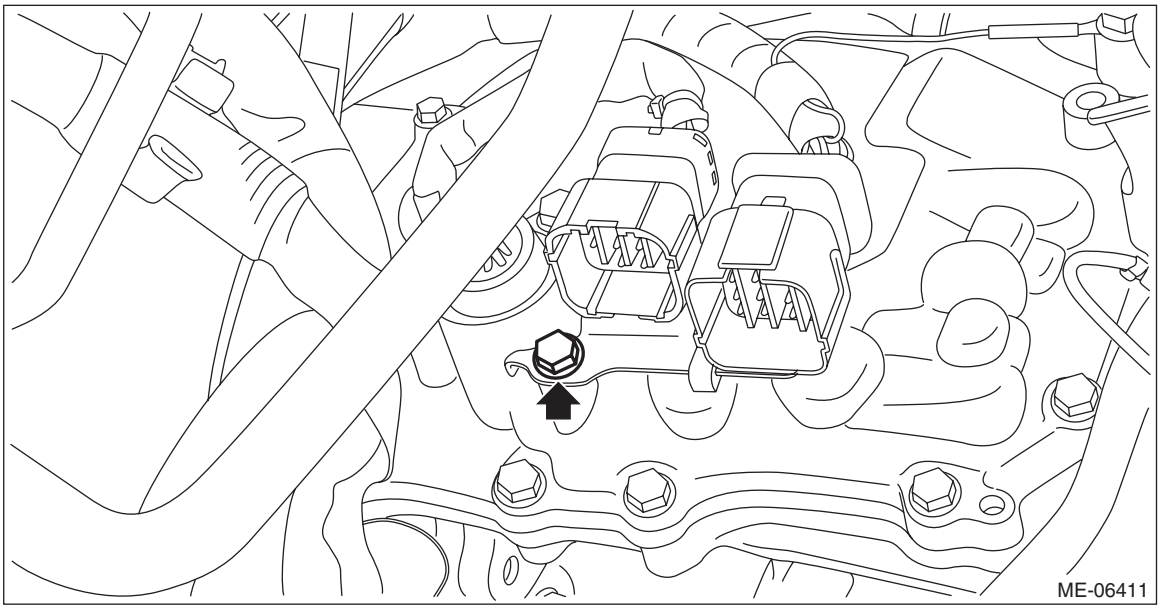
25) Remove the pitching stopper.



26) Remove the transmission cover. (CVT model)

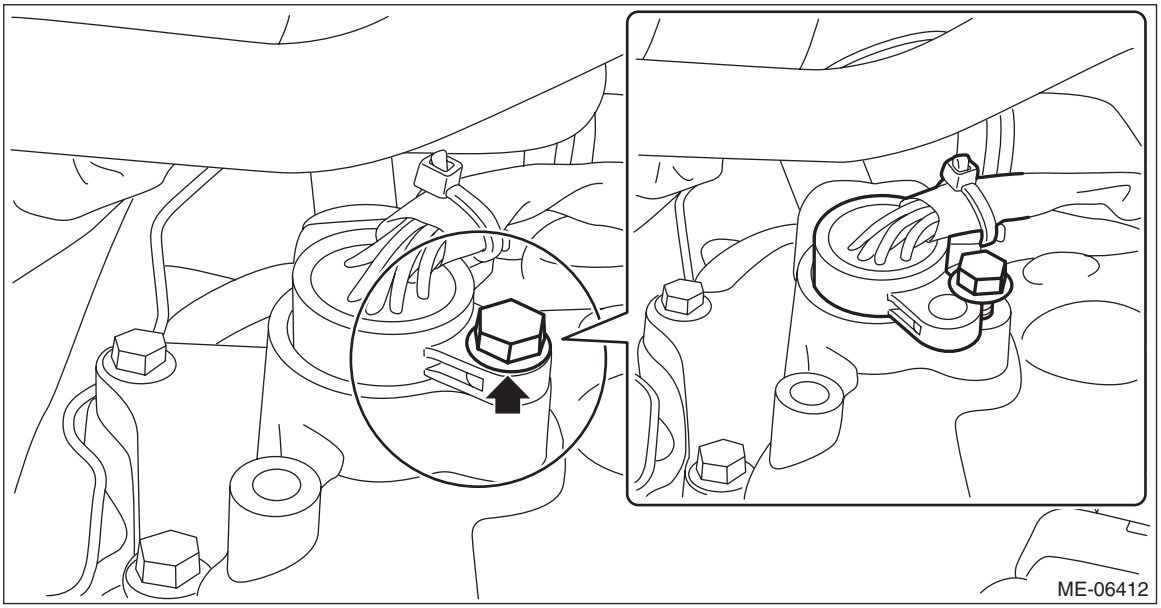


27) Remove the bolt which holds the transmission harness stay. (CVT model)



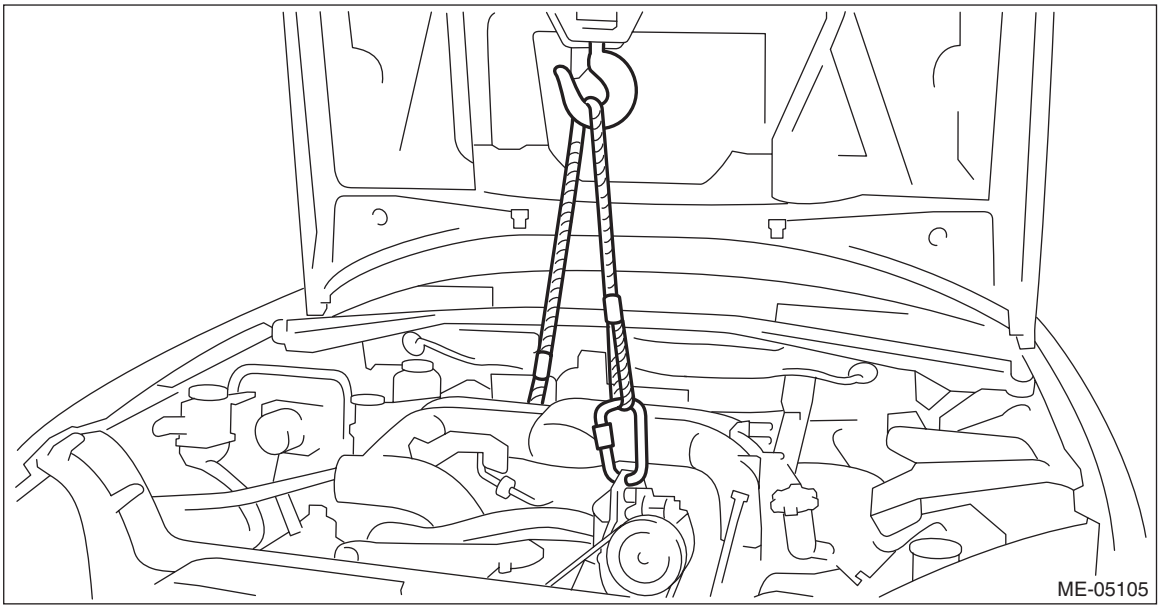
28) Remove the bolt which holds the transmission harness to the control valve body, and turn the transmission harness clockwise till the bolt hole can be seen as shown in the figure, and tighten the bolt to temporary lock the harness. (CVT model)

NOTE:
This procedure is required to prevent the transmission harness from touching the vehicle body during engine removal/installation.

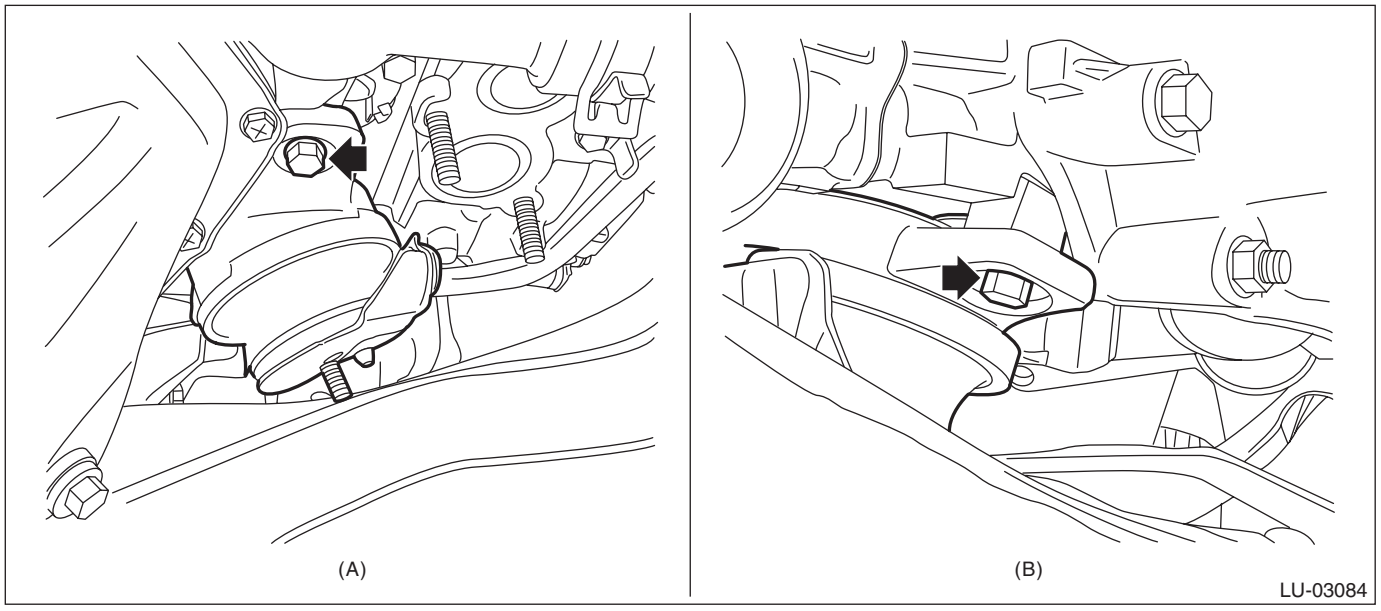


29) Lift up the engine with a lifting device and wire ropes.

CAUTION:
When lifting up the engine, pay attention to the clearance of each part and be careful not to lift the engine too much, in order to prevent damaging the vehicle.

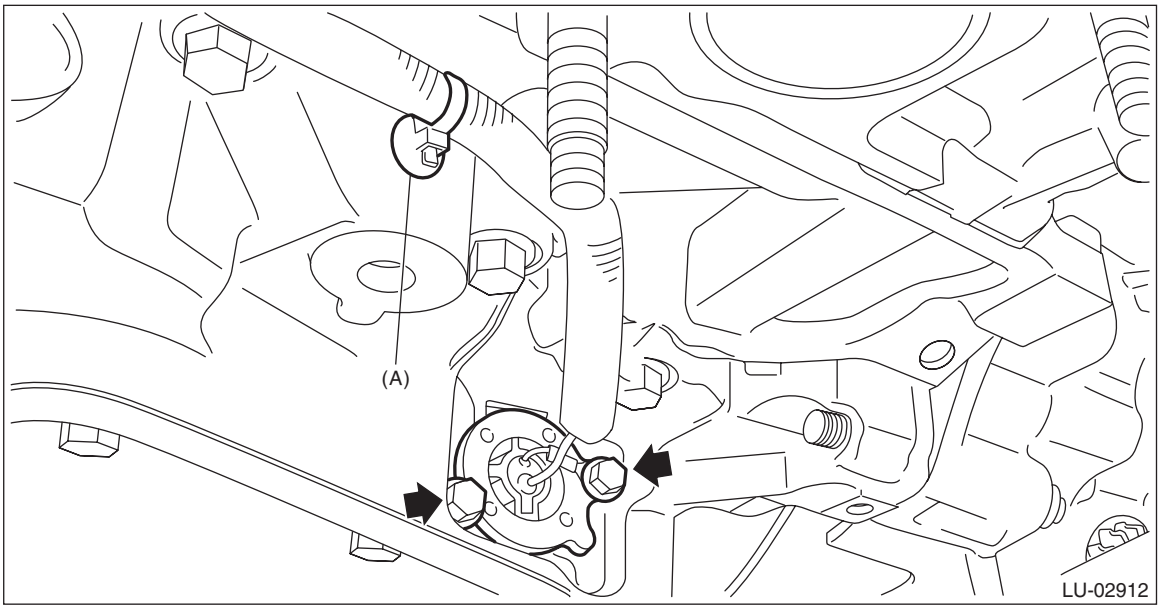


30) Remove the engine mounting LH from the engine.



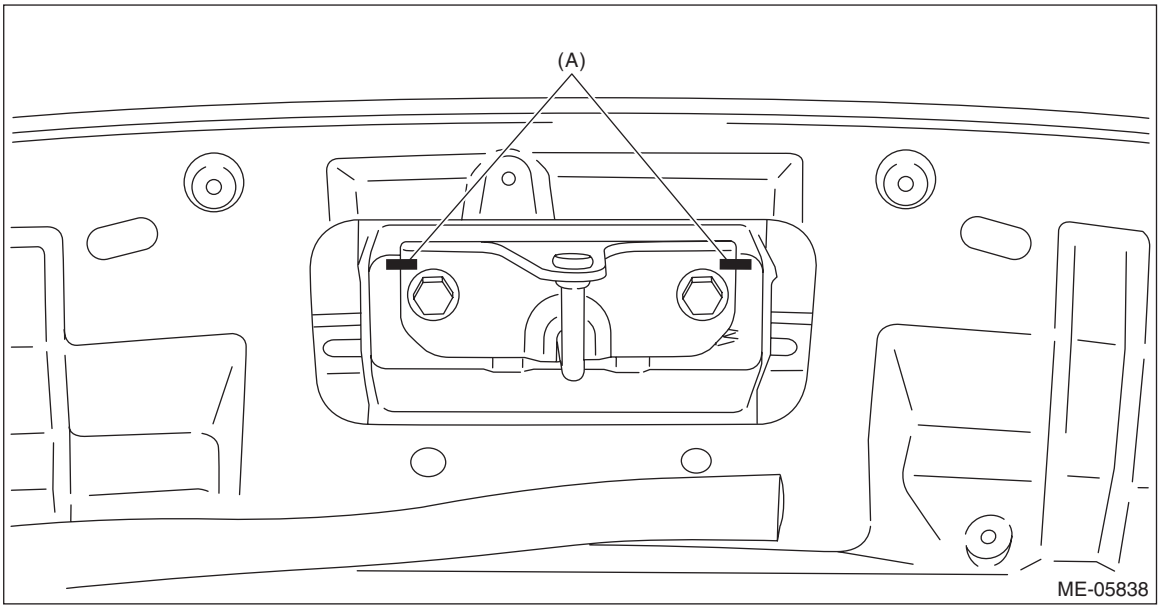
(A) Front side (B) Rear side

31) Remove clip (A) from the oil pan upper, and remove the oil level switch.

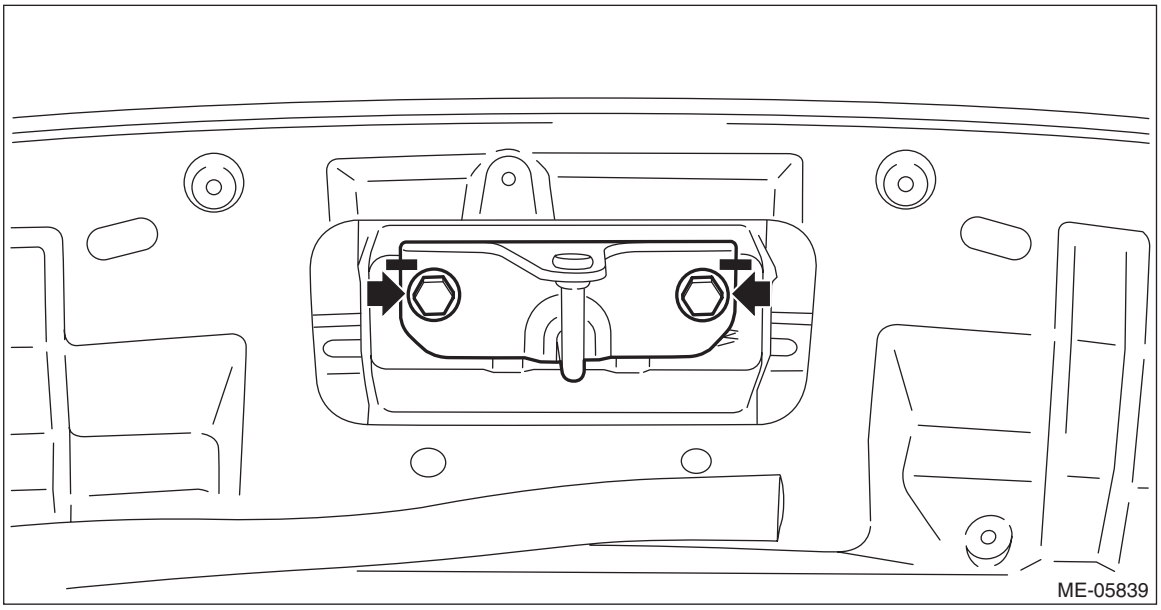


2. HEV MODEL

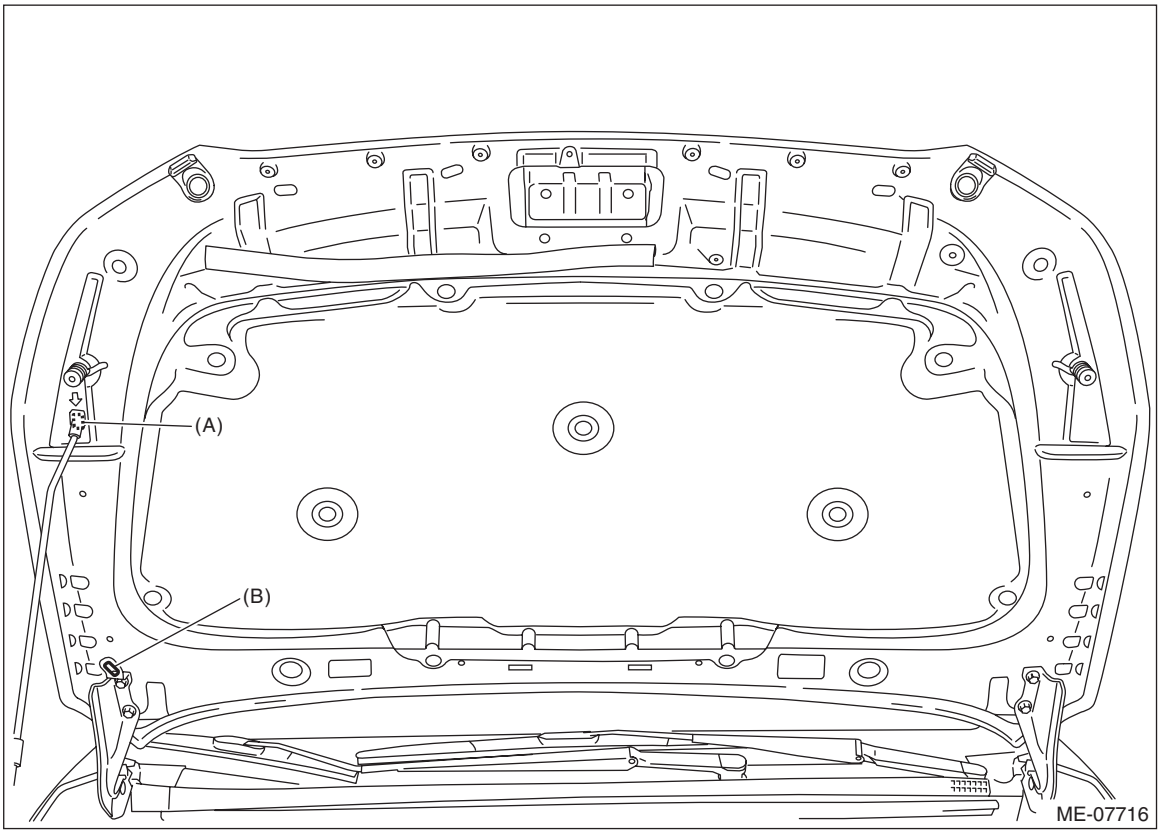
1) Turn the ignition switch to OFF.
2) Open the front hood, and make alignment marks (A) on the front hood striker and the front hood using a marker pen.



3) Remove the front hood striker from the front hood.



4) Change the front hood stay position from (A) to (B), and completely open the front hood.

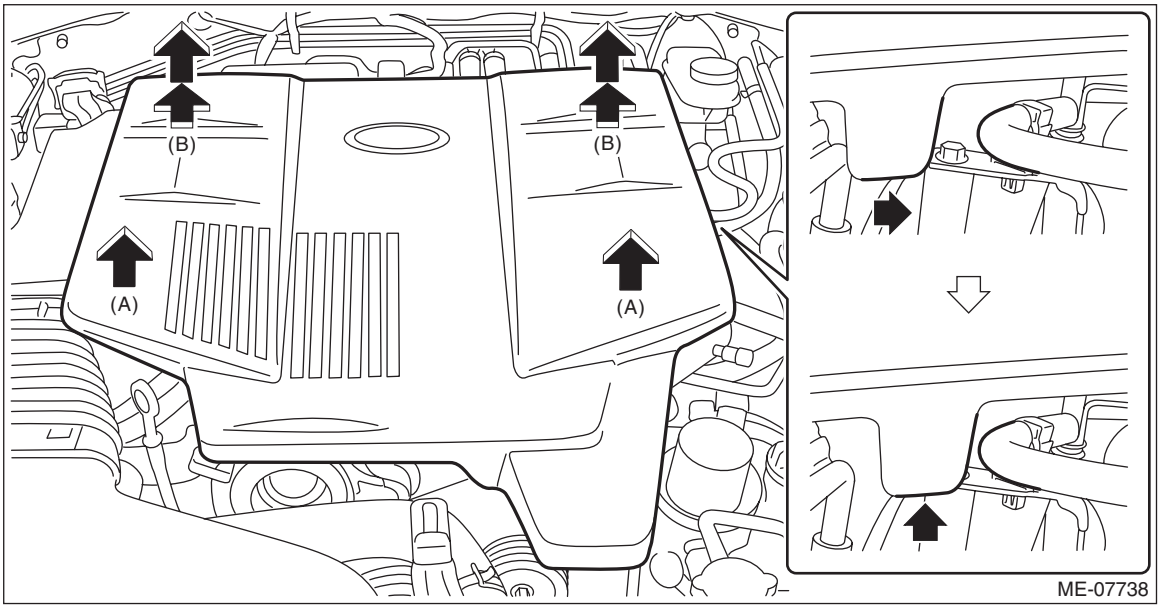


5) Disconnect the ground cable from battery. <Ref. to NT-5, BATTERY, NOTE, Note.>

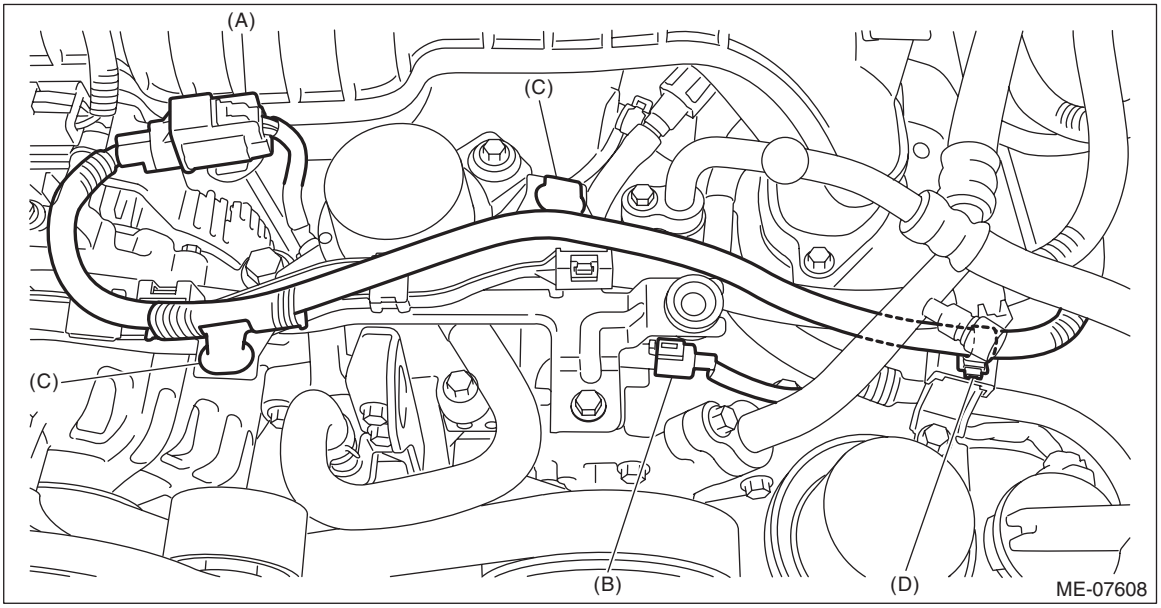
NOTE:
For the 12 volt engine restart battery, disconnect the ground terminal from 12V engine restart battery sensor.

6) Remove the collector cover.
(1) Carefully pull up the front of collector cover at two positions (A).
(2) Carefully pull up the rear of collector cover at two positions (B) while moving it backward.

NOTE:
Be careful not to contact the fuel delivery tube when moving the collector cover rearward.

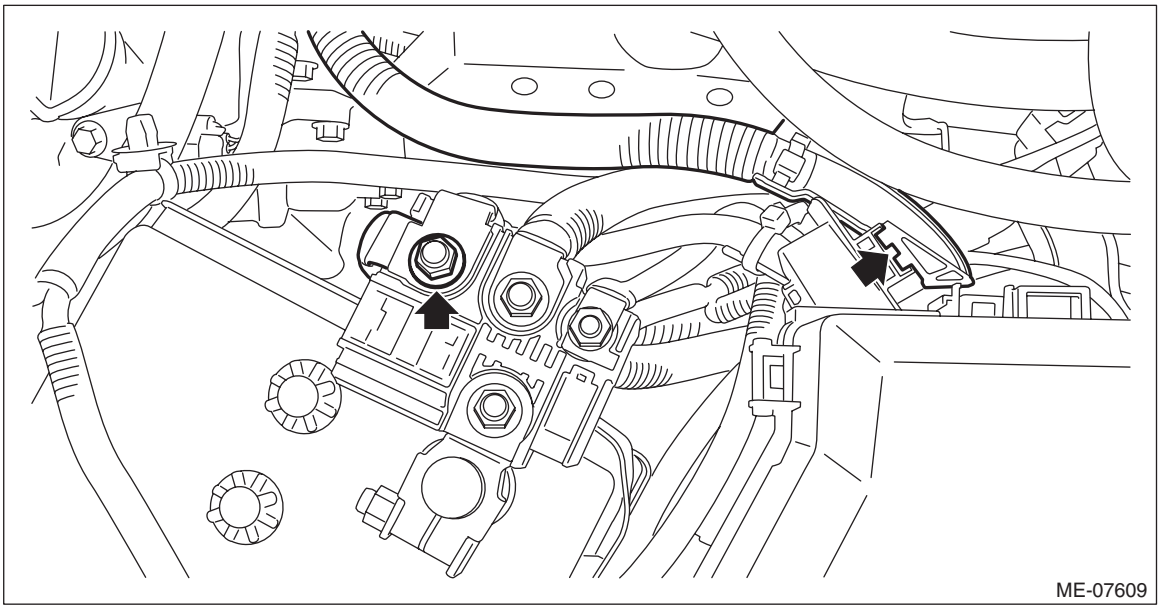


7) Remove the air intake duct. <Ref. to IN(H4DO(HEV))-15, REMOVAL, Air Intake Duct.>
8) Remove the air cleaner case. <Ref. to IN(H4DO(HEV))-6, REMOVAL, Air Cleaner Case.>
9) Disconnect the connector (A) from the brake vacuum pump, and disconnect the connector (B) from the A/C compressor.
10) Remove the clip (C) and the clip (D) securing the harness to the battery cable assembly, and move the harness to the left side wheel apron.

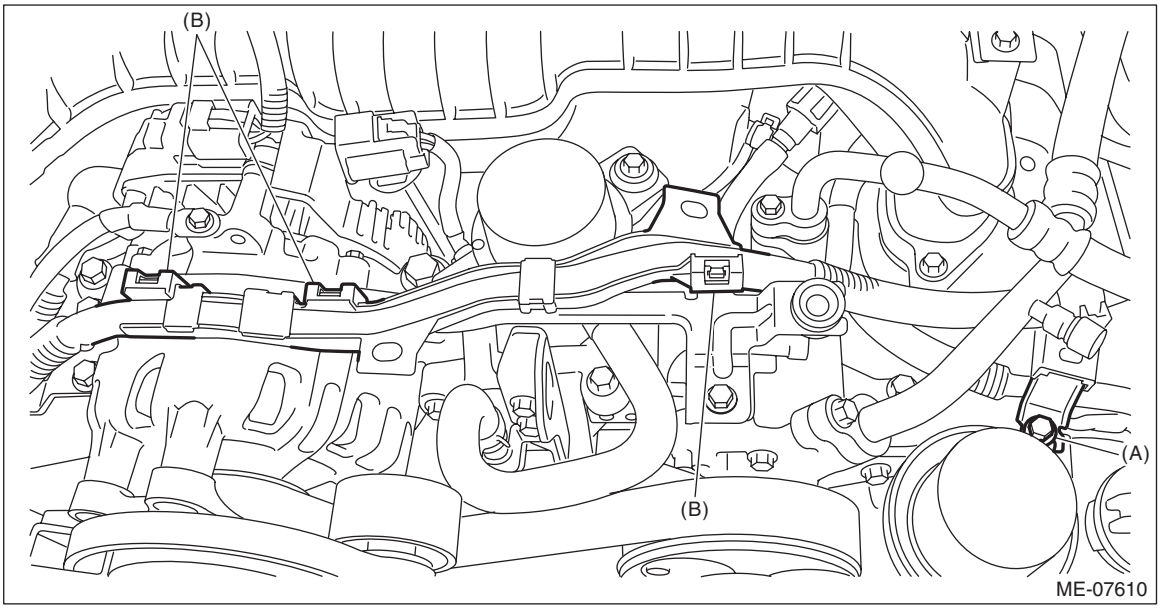


11) Remove the terminal boot from the positive terminal of the 12 volt auxiliary battery.

12) Remove the nuts fastening the battery cable assembly to the slow blow fuse (12 volt auxiliary battery), and remove the battery cable assembly from the main fuse box.

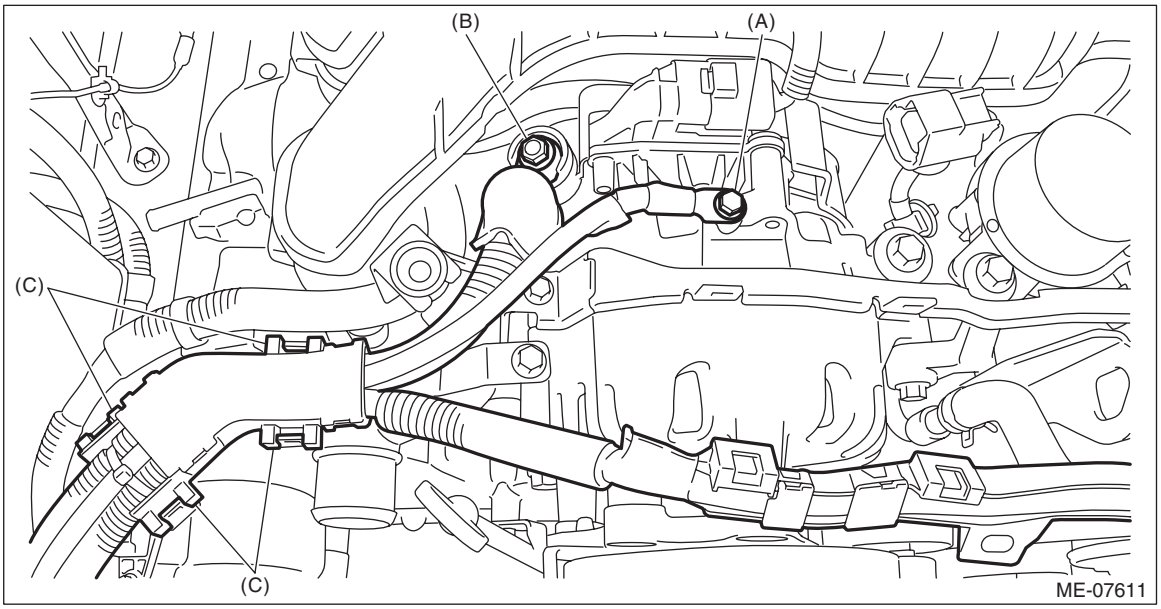


13) Remove the bolt (A) securing the battery cable stay to the chain cover, and remove the clip (B) securing the battery cable assembly to the collector cover bracket.

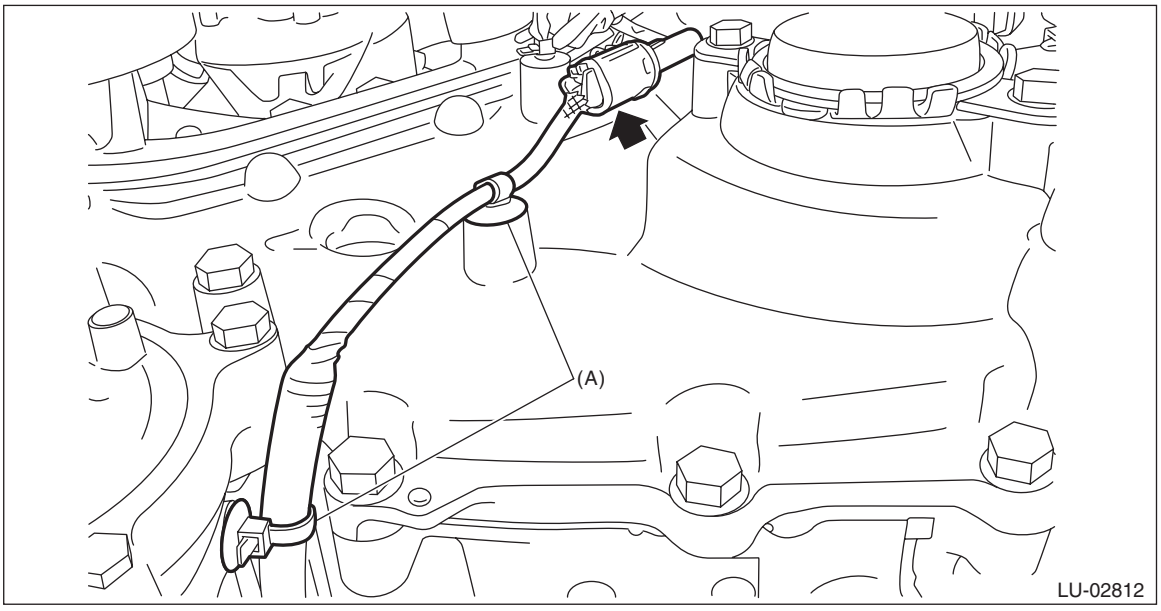


14) Disconnect the terminal (A) and the terminal (B) from ISG.

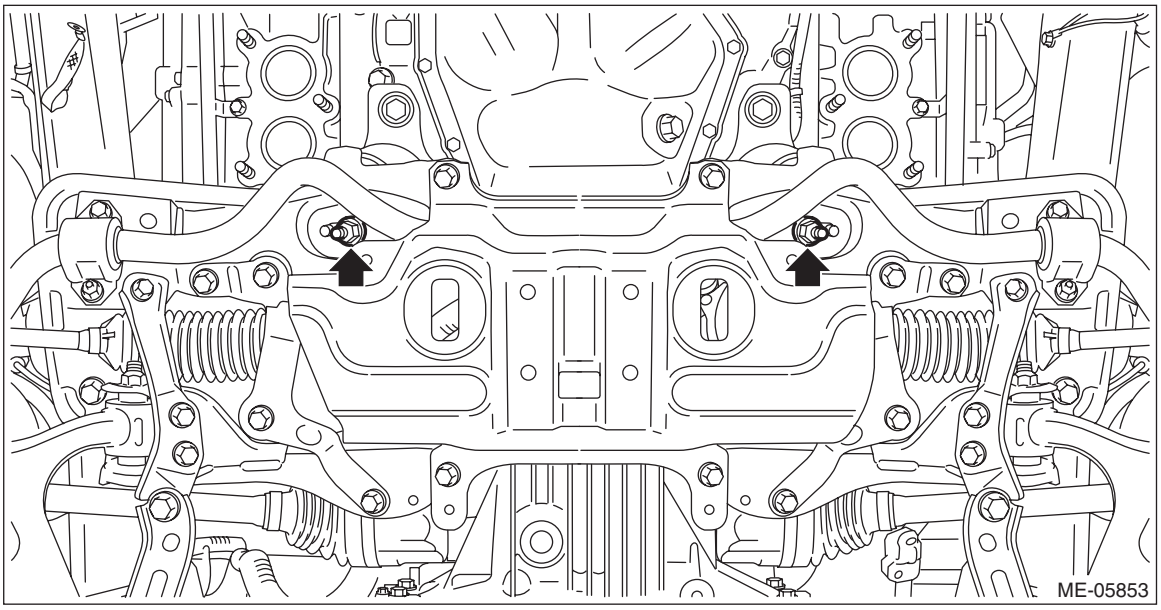
15) Remove the clip (C) securing the battery cable assembly to the battery cable bracket No. 1, and move the battery cable assembly to the right side wheel apron.



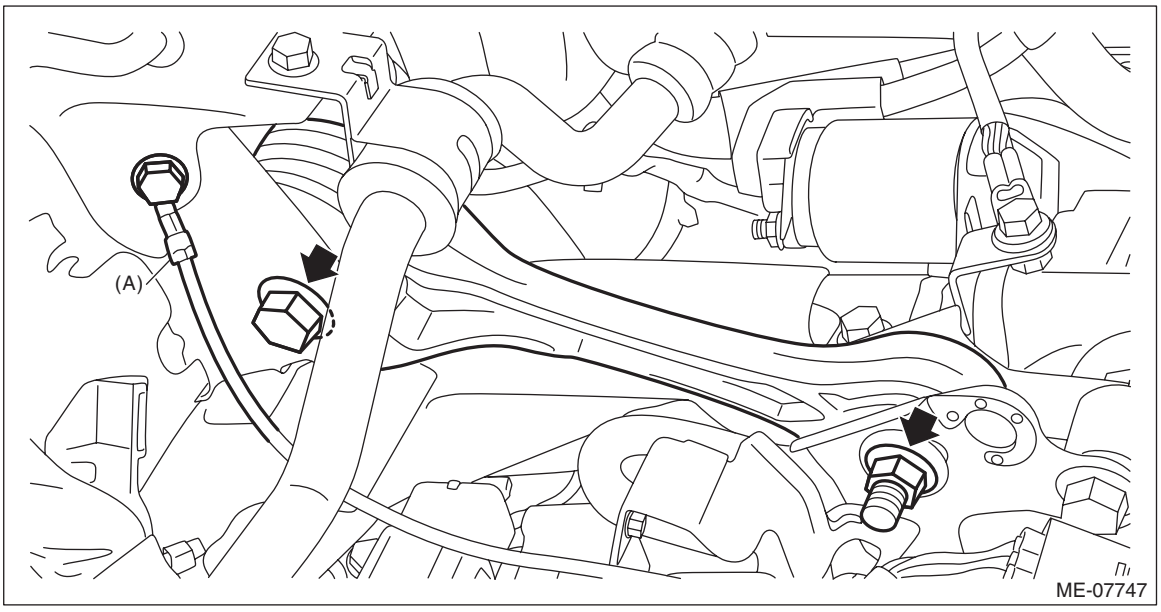
16) Lift up the vehicle.
17) Remove the under cover. <Ref. to EI-32, REMOVAL, Front Under Cover.>
18) Drain the engine oil. <Ref. to LU(H4DO(w/o HEV))-13, REPLACEMENT, Engine Oil.>
19) Remove the front exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-6, REMOVAL, Front Exhaust Pipe.>
20) Disconnect the oil level switch connector from the engine harness, and remove the clip (A) securing the harness.



21) Remove the nuts which secure the engine mounting to the front crossmember.

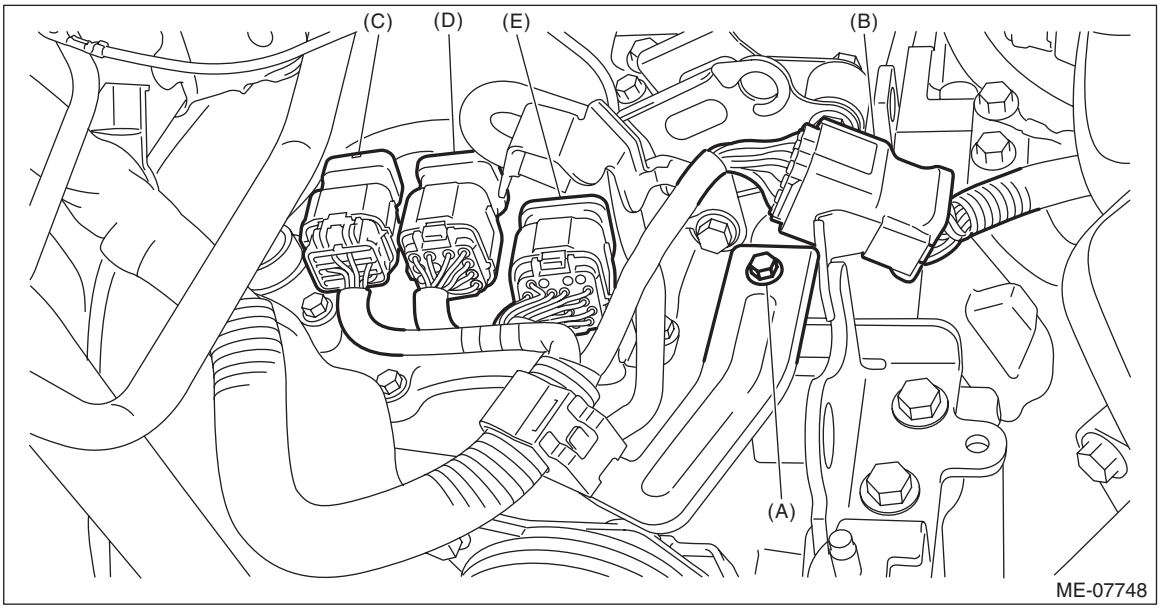


22) Remove the electric power steering gearbox. <Ref. to PS-28, REMOVAL, Electric Power Steering Gearbox.>
23) Remove the front drive shaft LH. <Ref. to DS-56, REMOVAL, Front Drive Shaft.>
24) Lower the vehicle.
25) Disconnect the transmission radio ground terminal (A) from the vehicle, and remove the pitching stopper.

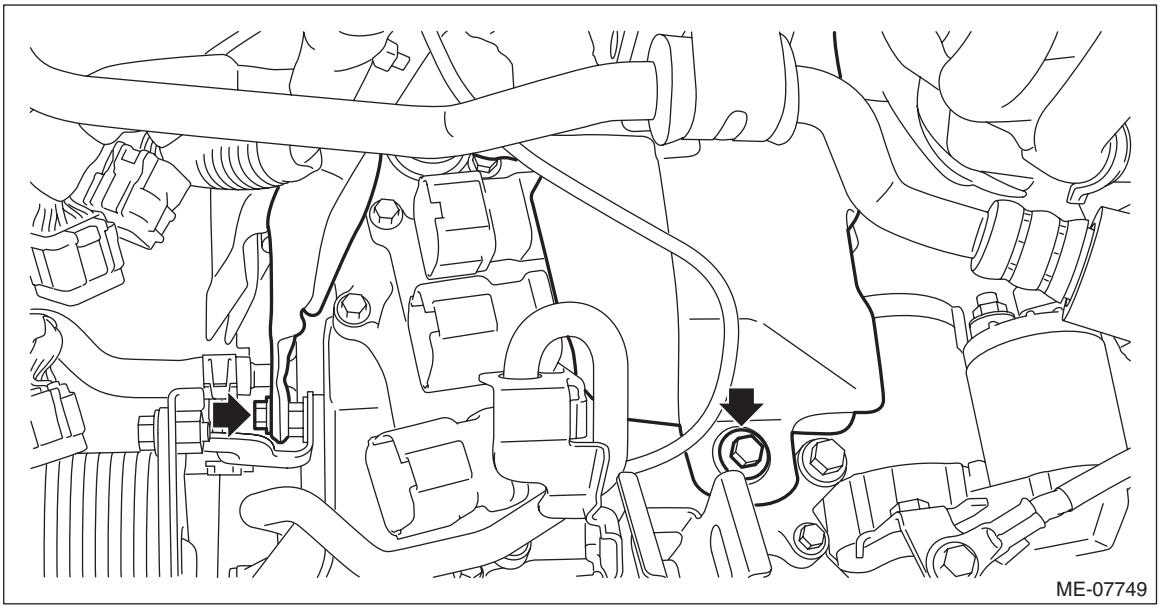


26) Remove the bolt (A) securing the bulkhead harness connector bracket, and disconnect the bulkhead harness connector from the engine harness connector (brown) (B).

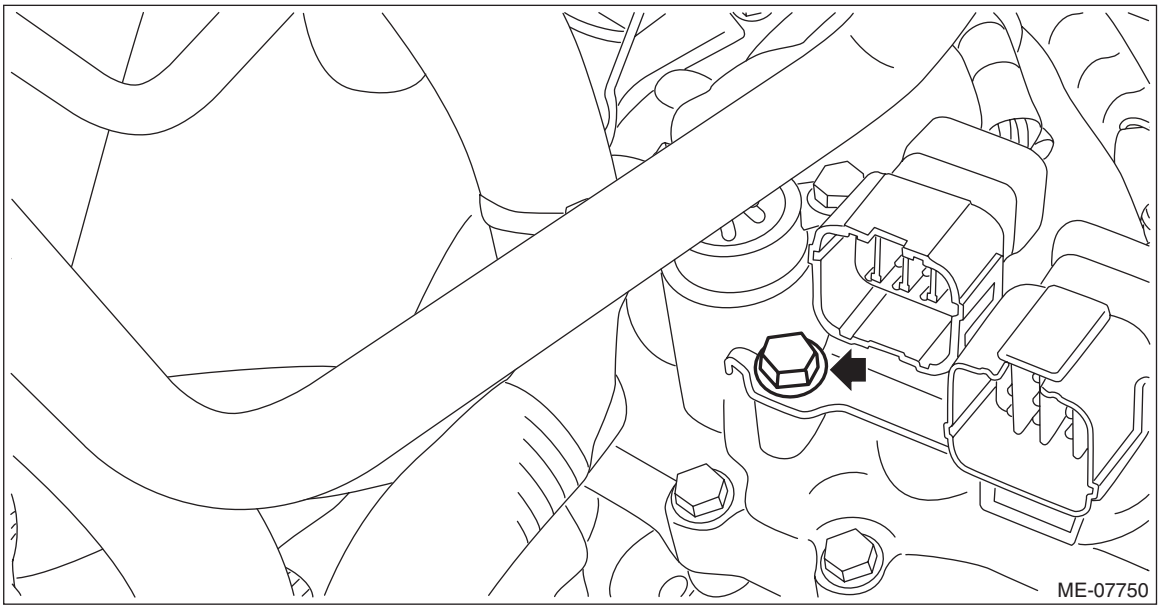
27) Disconnect the bulkhead harness connector from the transmission harness connector (C), inhibitor harness connector (D) and drive motor harness connector (E).



28) Remove the transmission case cover.

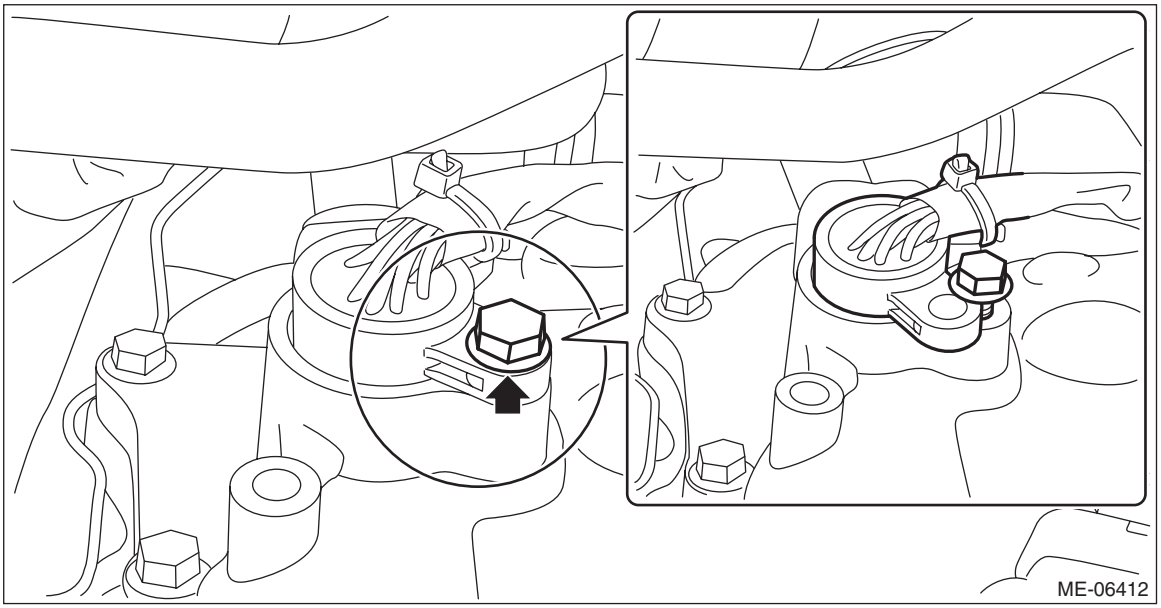


29) Remove the bolt which holds the transmission harness stay.



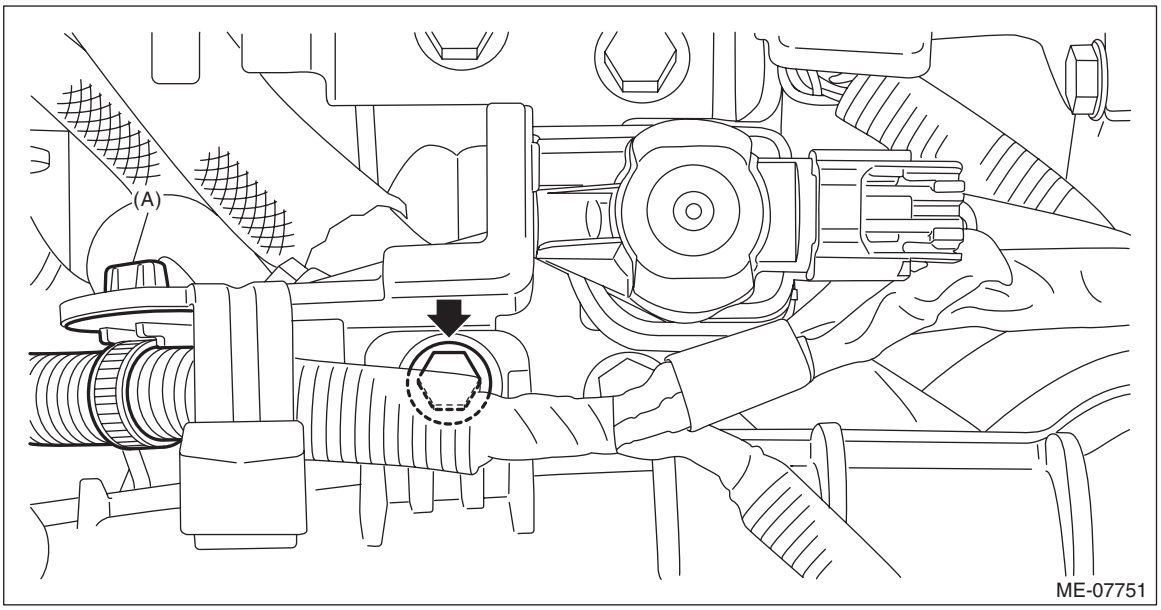
30) Remove the bolt which holds the transmission harness to the control valve body, and turn the transmission harness clockwise till the bolt hole can be seen as shown in the figure, and tighten the bolt to temporary lock the harness. (CVT model)

NOTE:
This procedure is required to prevent the transmission harness from touching the vehicle body during engine removal/installation.



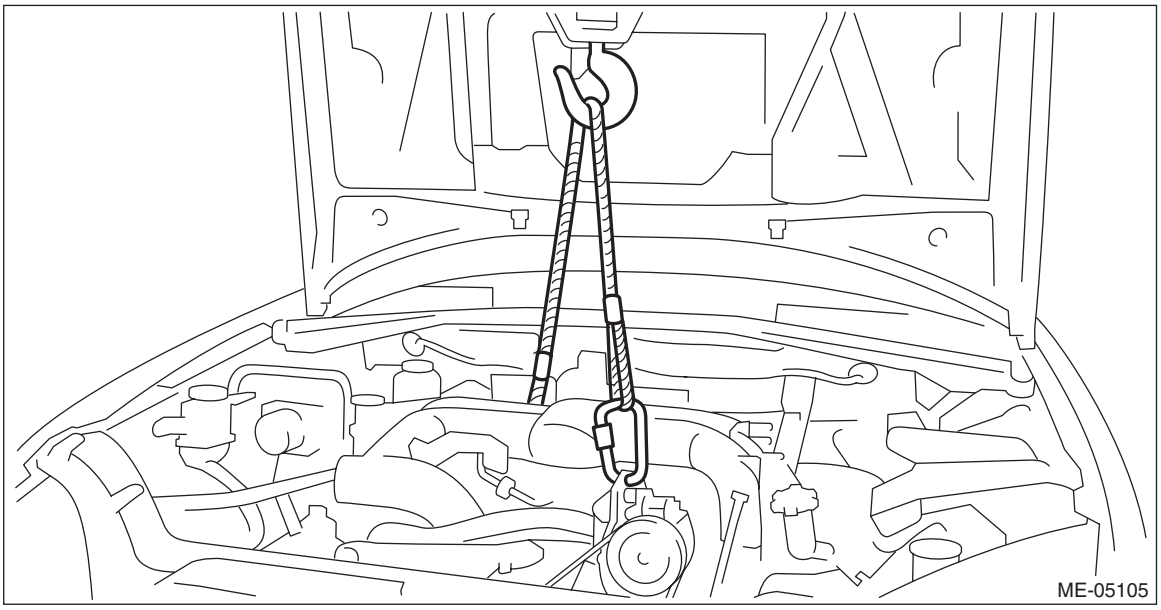
31) Remove the clip (A) securing the engine harness to the purge control solenoid valve bracket, and disconnect the bolt securing the purge control solenoid valve bracket to the intake manifold.

NOTE:
This operation is required to prevent the wire rope from contacting the purge control solenoid valve while lifting the engine.

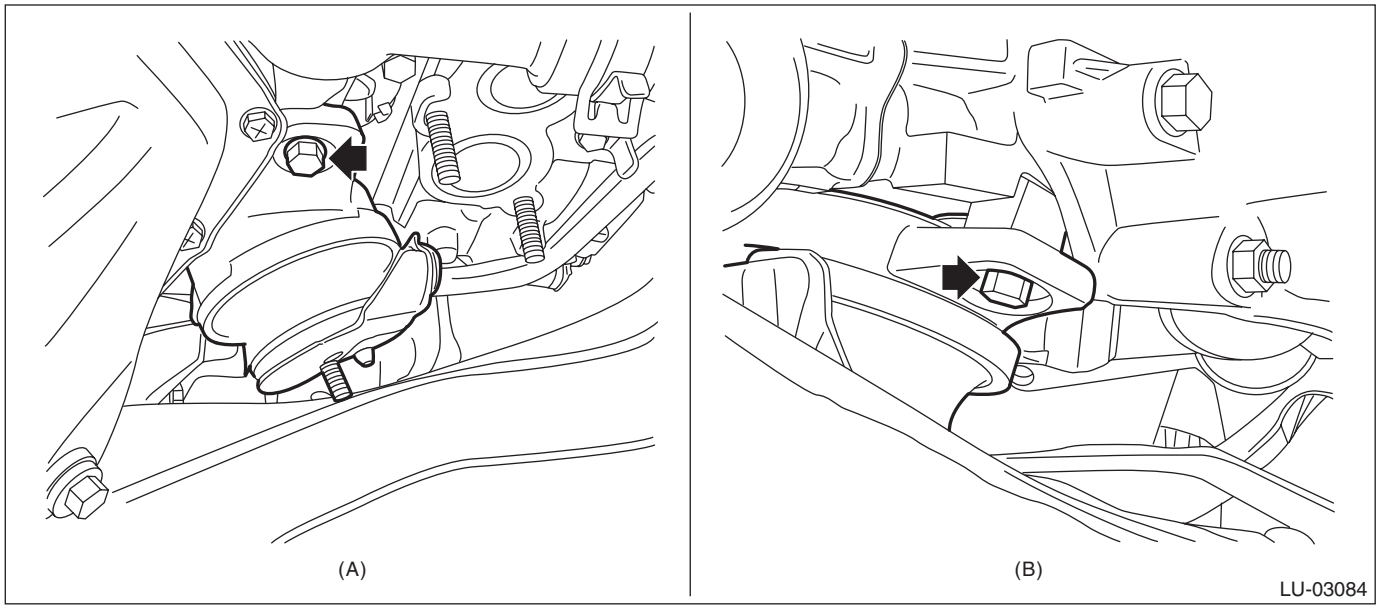


32) Lift up the engine with a lifting device and wire ropes.

CAUTION:
When lifting up the engine, pay attention to the clearance of each part and be careful not to lift the engine too much, in order to prevent damaging the vehicle.

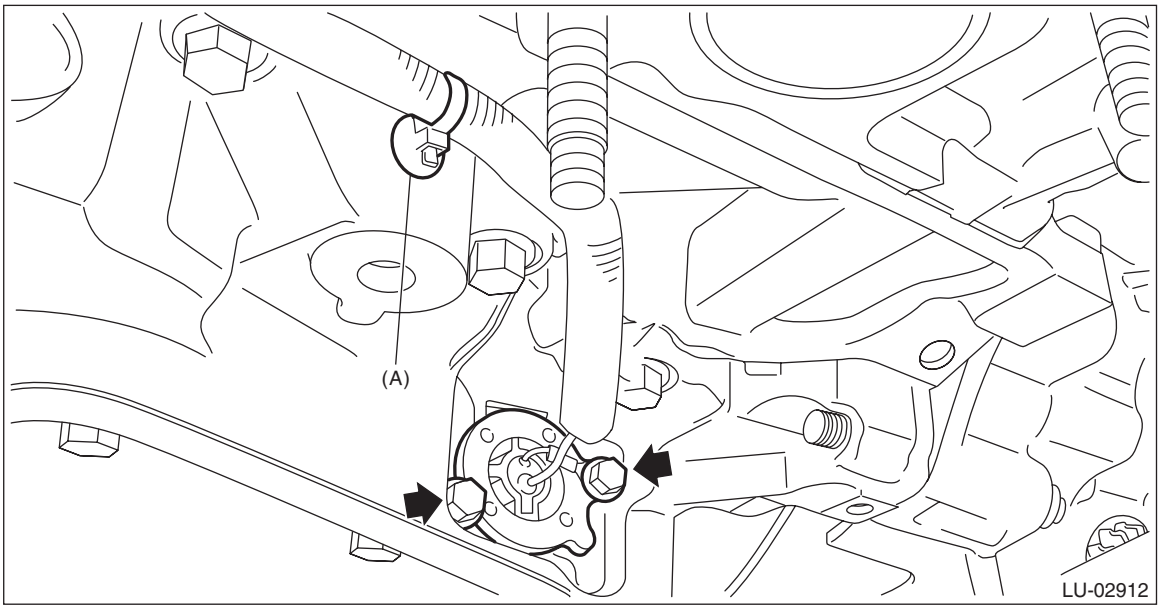


33) Remove the engine mounting LH from the engine.



(A) Front side (B) Rear side

34) Remove clip (A) from the oil pan upper, and remove the oil level switch.



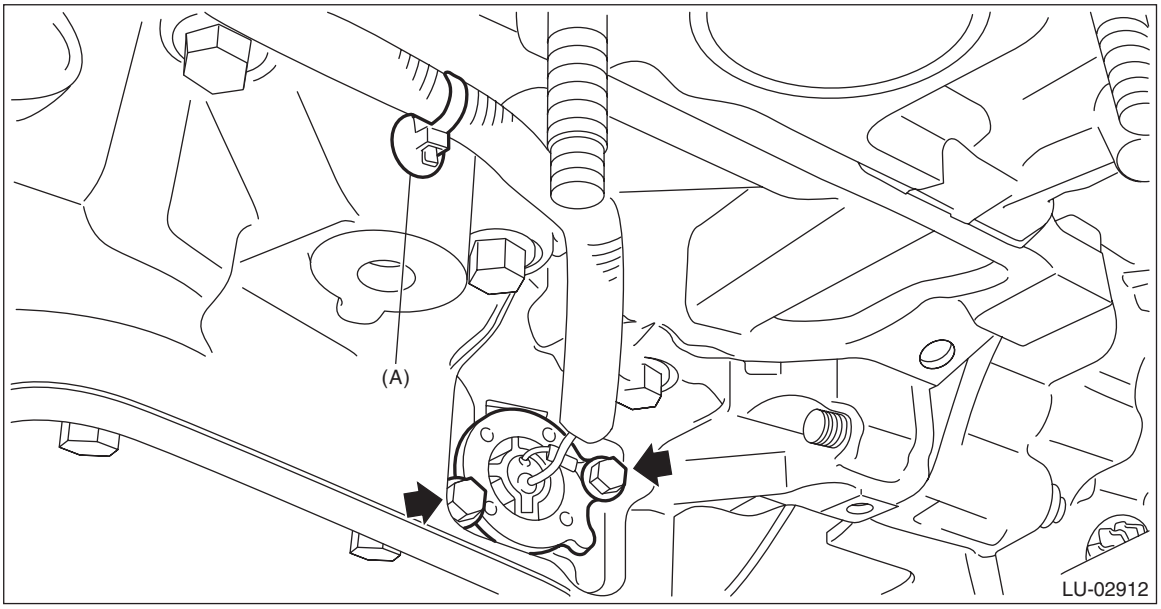
B: INSTALLATION

1. GASOLINE ENGINE MODEL

1) Install the oil level switch and the clip (A) to the oil pan upper.

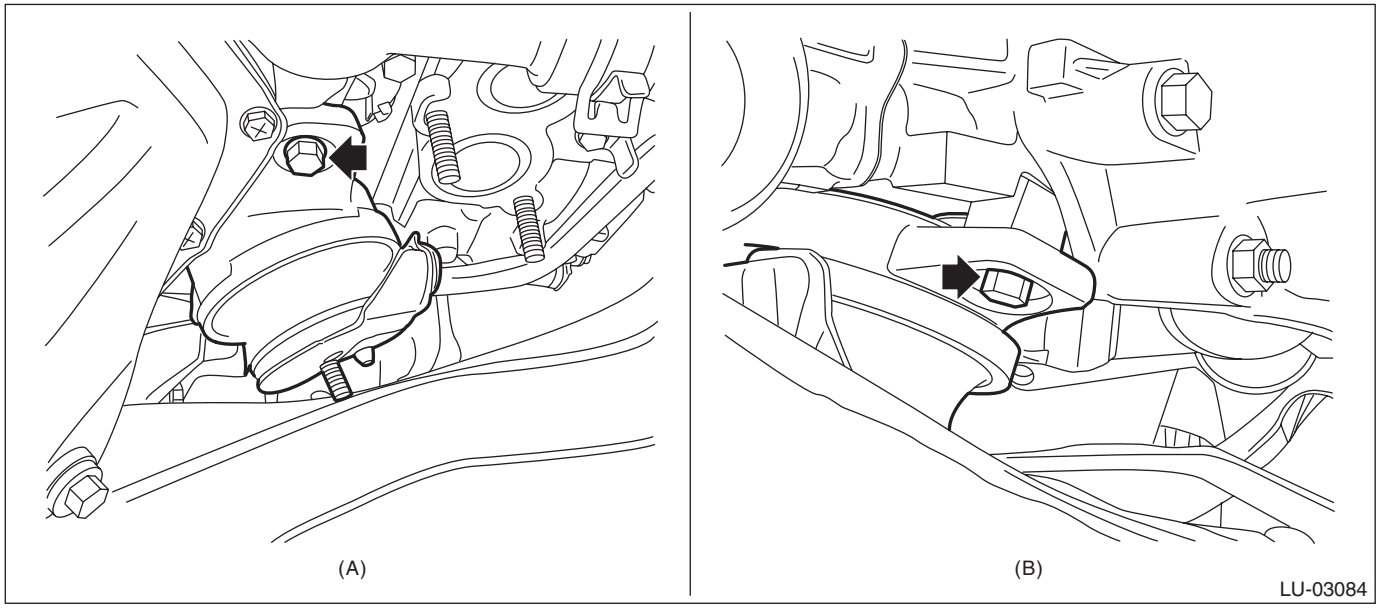
NOTE:
- Use new O-rings.
- Apply a coat of engine oil to the O-rings.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



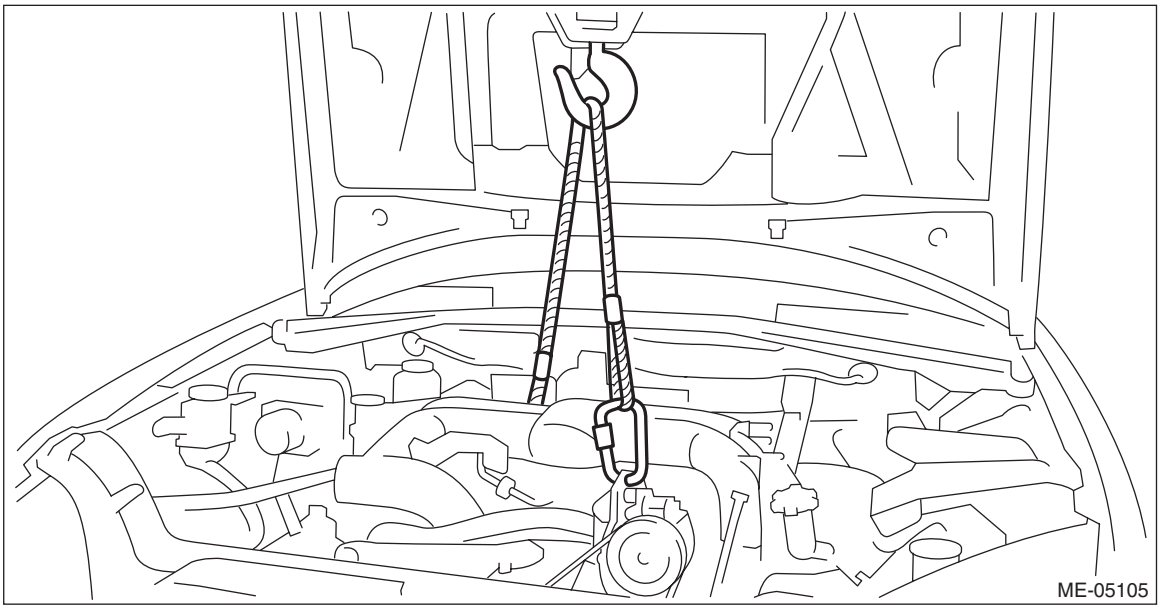
2) Install the engine mounting LH onto the engine.

Tightening torque:
35 N·m (3.6 kgf-m, 25.8 ft-lb)



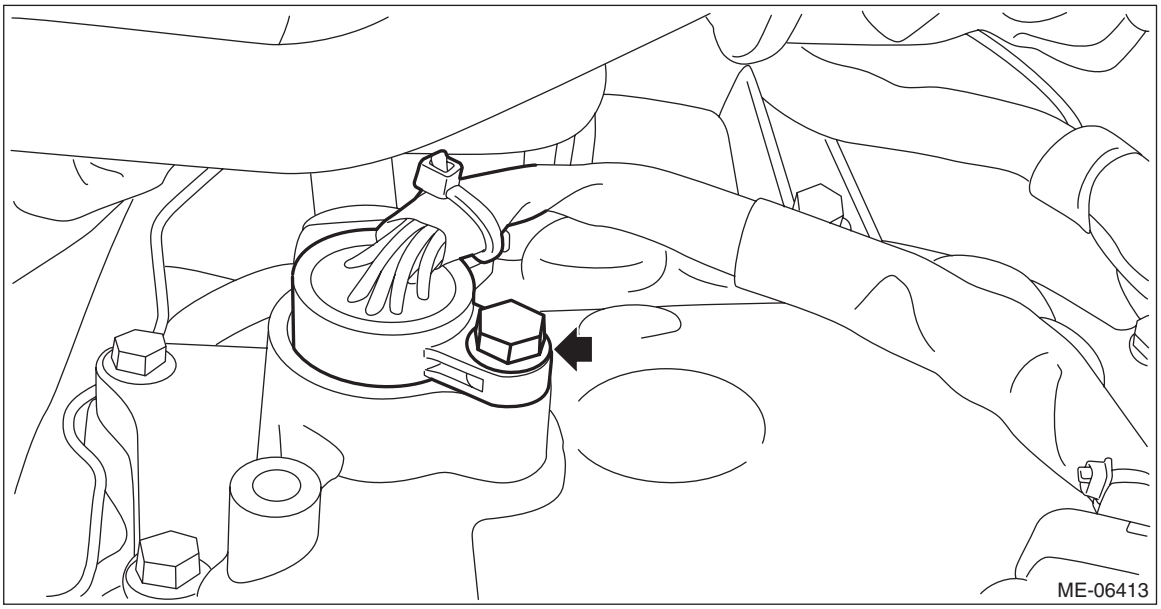
(A) Front side (B) Rear side

3) Lower the engine and remove the lifting device and wire ropes.



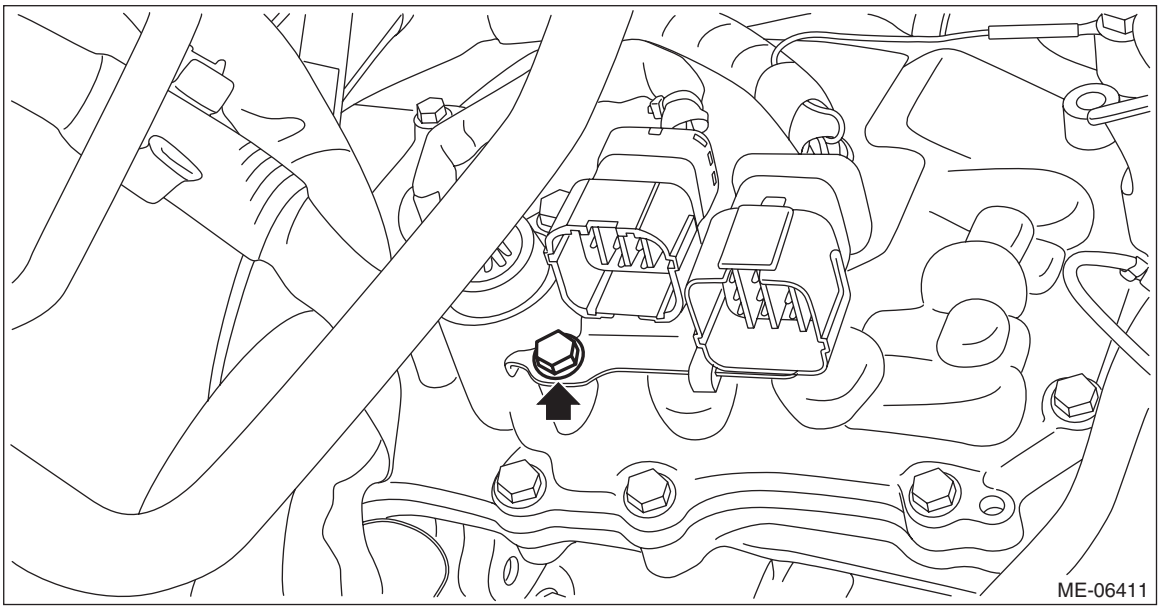
4) Remove the bolt and turn the transmission harness counterclockwise to install the transmission harness to the control valve body. (CVT model)

Tightening torque:
7 N·m (0.7 kgf-m, 5.2 ft-lb)



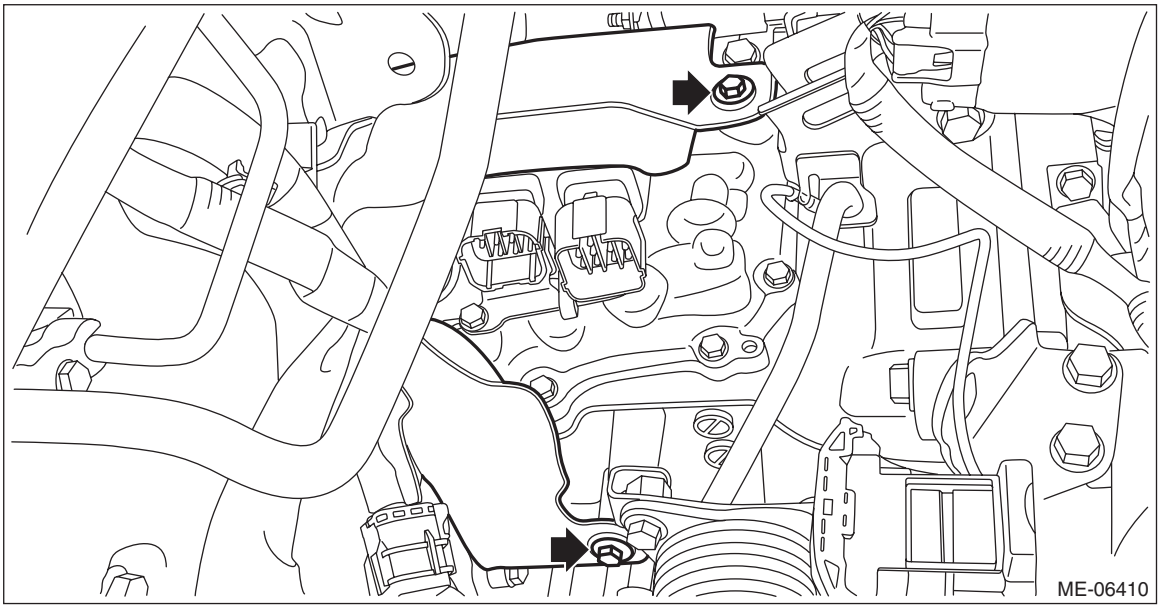
5) Install the bolt which holds the transmission harness stay. (CVT model)

Tightening torque:
7 N·m (0.7 kgf-m, 5.2 ft-lb)



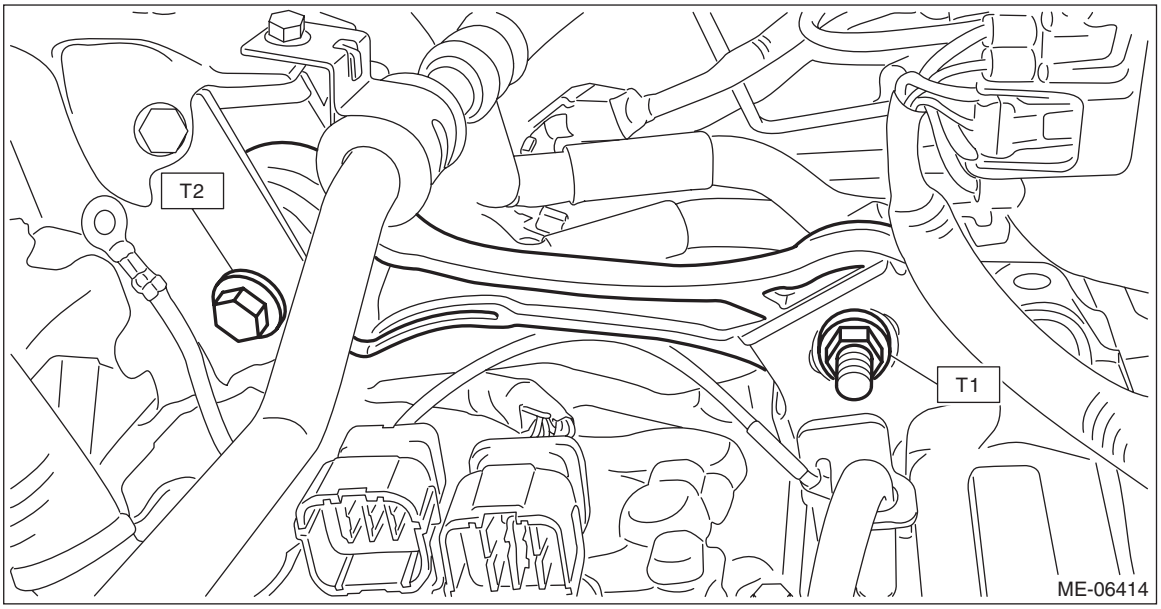
6) Install the transmission case cover. (CVT model)

Tightening torque:
8 N·m (0.8 kgf-m, 5.9 ft-lb)



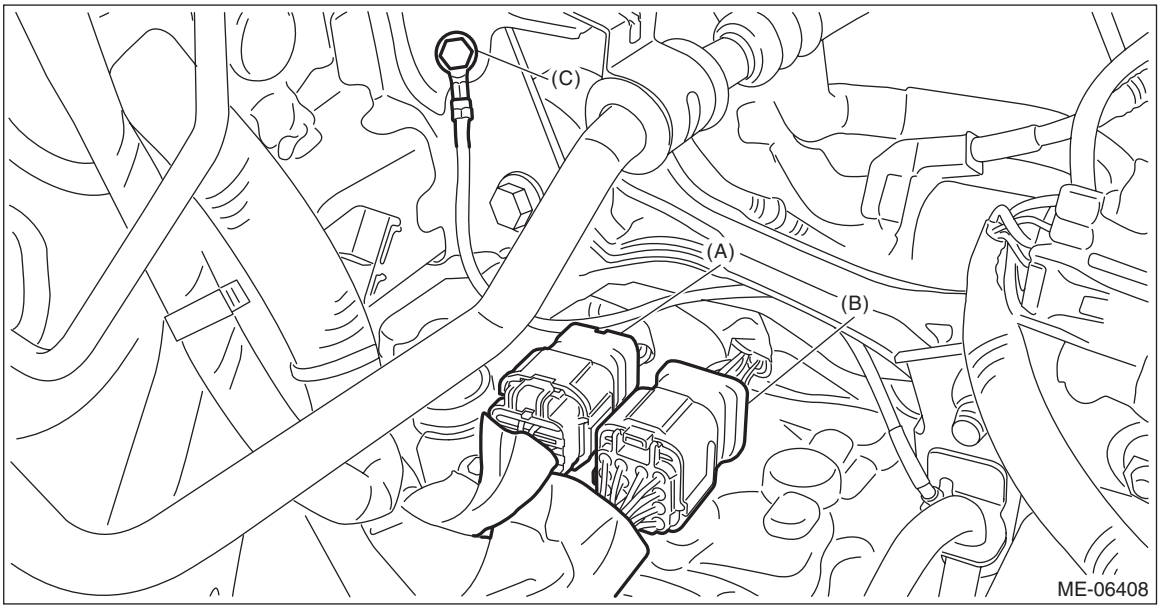
7) Install the pitching stopper.

Tightening torque:
T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)
T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)



8) Connect the transmission radio ground terminal (C) to the vehicle body, and connect the bulkhead harness connector to the transmission harness connector (A) and the inhibitor harness connector (B). (CVT model)

Tightening torque:
13 N·m (1.3 kgf-m, 9.6 ft-lb)

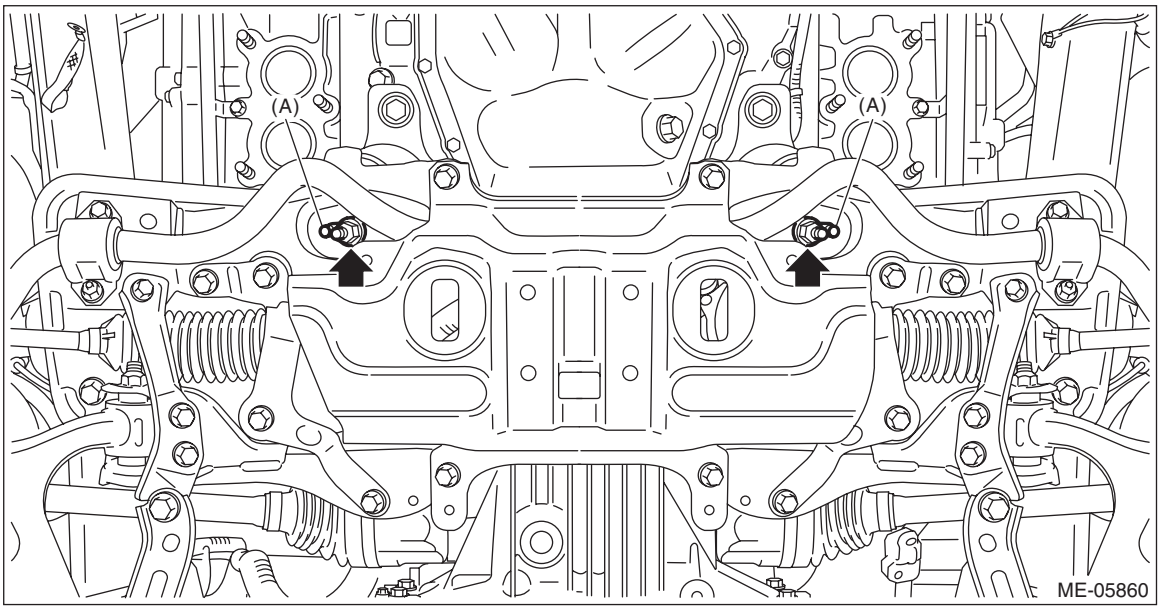


9) Install the electric power steering gearbox. <Ref. to PS-32, INSTALLATION, Electric Power Steering Gearbox.>
10) Install the front drive shaft LH. <Ref. to DS-57, INSTALLATION, Front Drive Shaft.>

11) Install the nuts which hold the engine mounting to the crossmember. (CVT model)

NOTE:
- Make sure that locators (A) of the engine mounting are securely inserted.
- Use a new nut.

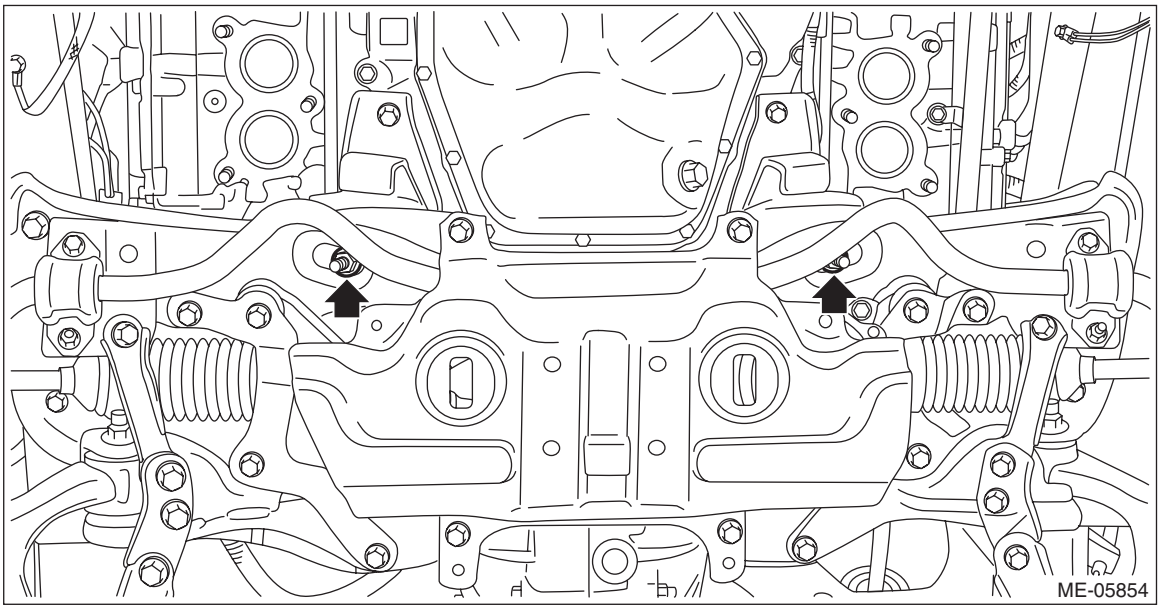
Tightening torque:
60 N·m (6.1 kgf-m, 44.3 ft-lb)



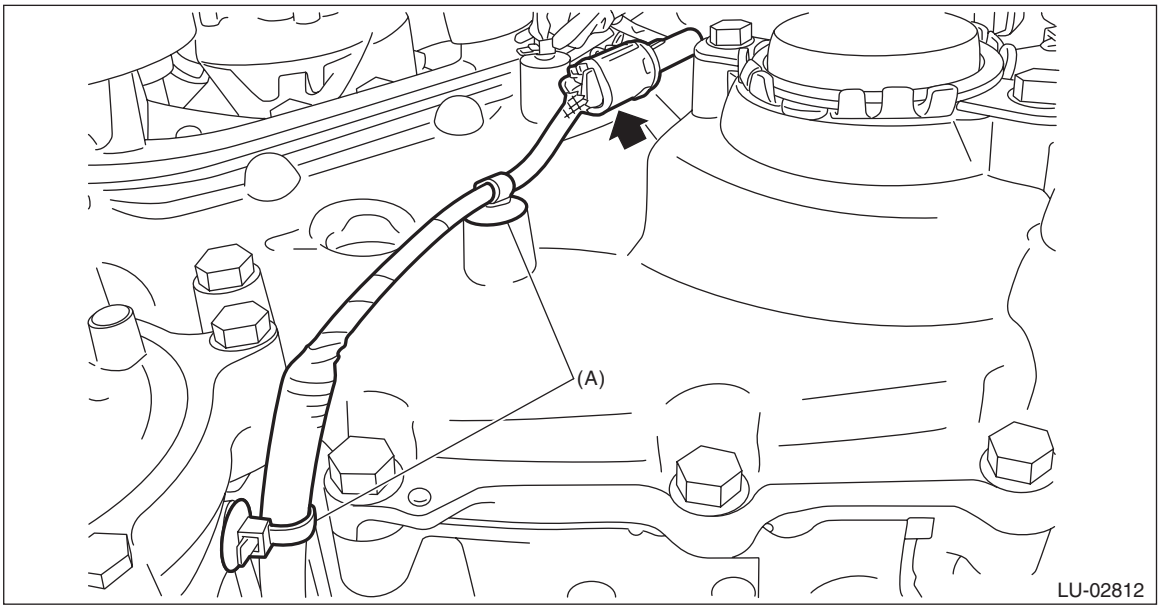
12) Install the nuts which hold the engine mounting to the crossmember. (MT model)

NOTE:
Use a new nut.

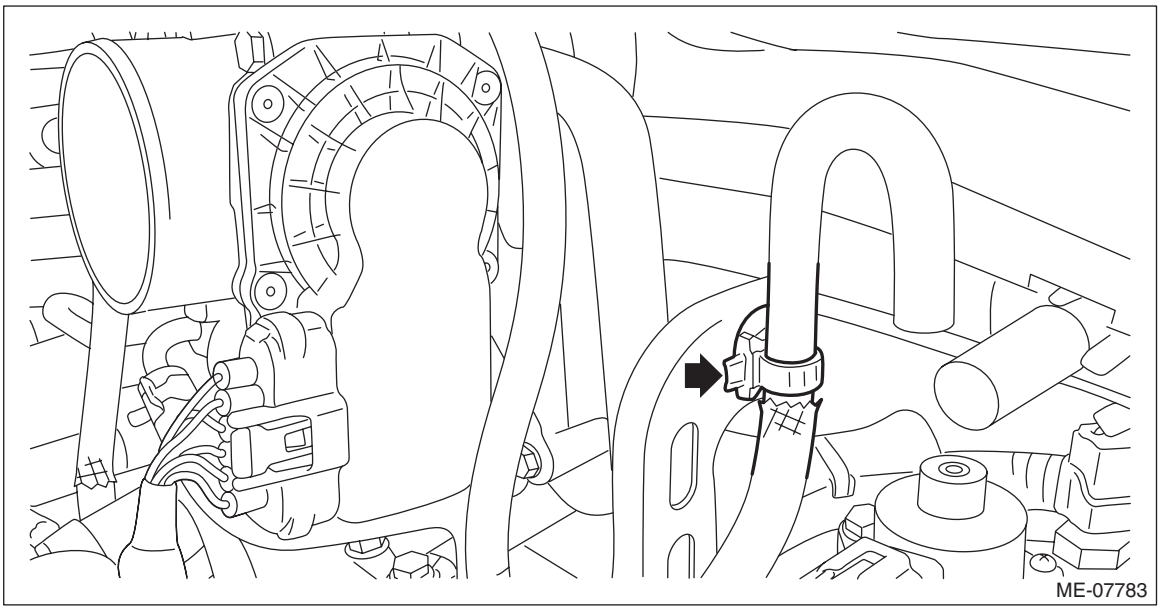
Tightening torque:
60 N·m (6.1 kgf-m, 44.3 ft-lb)



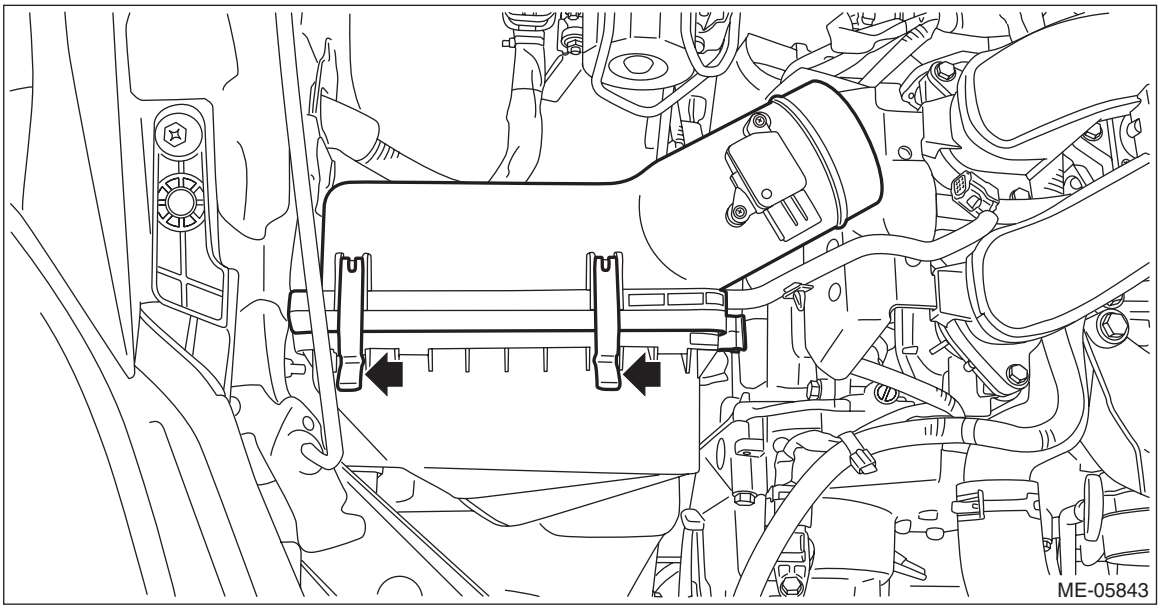
13) Connect the connector of oil level switch to the engine harness, and install the clip (A) securing the harness.



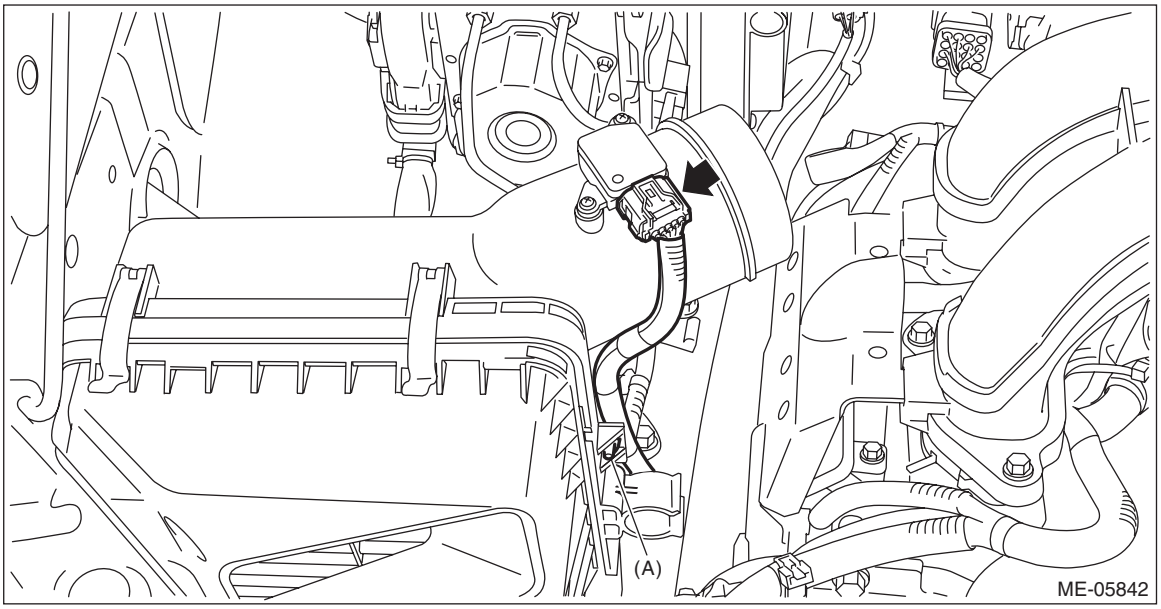
14) Install the front exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-8, INSTALLATION, Front Exhaust Pipe.>
15) Install the under cover.
16) Lower the vehicle.
17) Secure the air breather hose to the engine rear hanger using clip. (MT model)



18) Install the air intake case (rear).



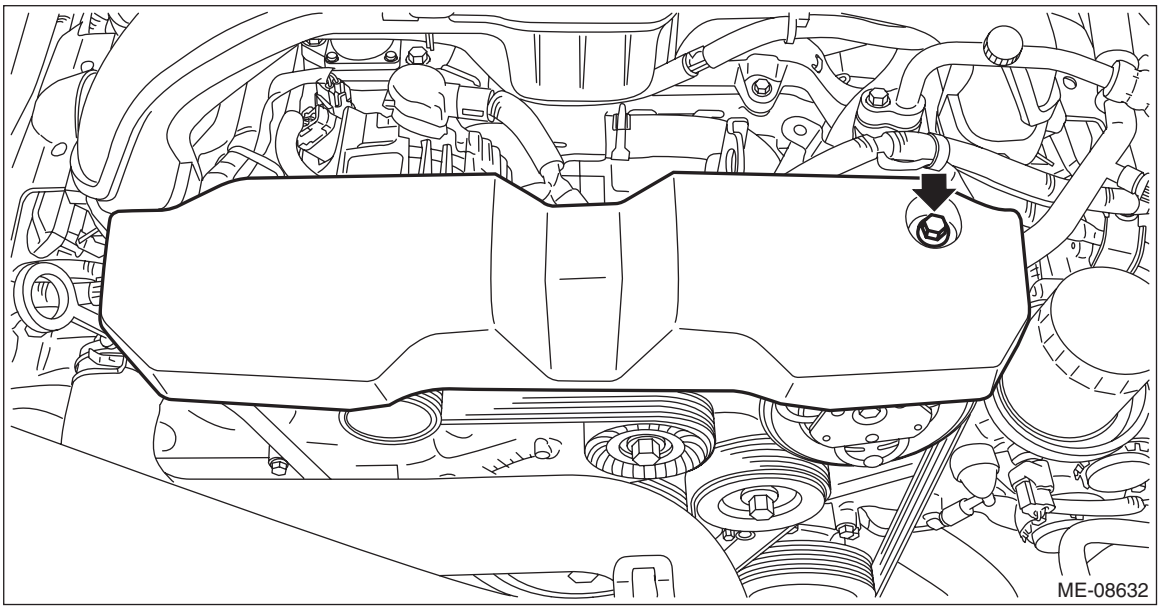
19) Install the clip (A) which secures the air flow and intake air temperature sensor harness, and connect the connector to the air flow and intake air temperature sensor.



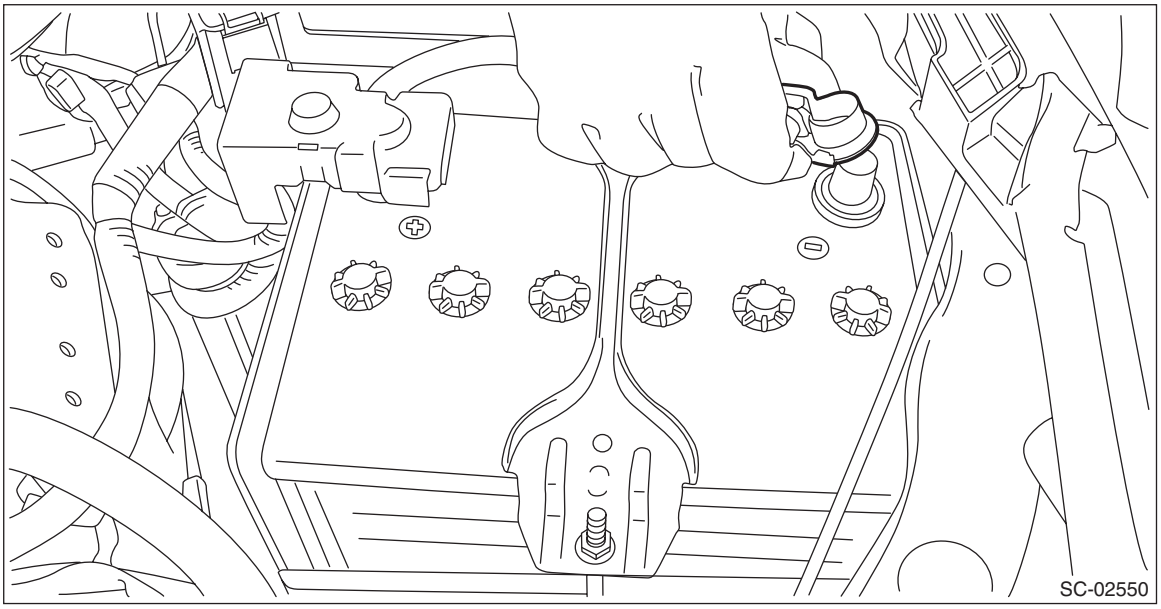
20) Install the air intake boot. <Ref. to IN(H4DO(w/o HEV))-12, INSTALLATION, Air Intake Boot.>
21) Install the air intake duct. <Ref. to IN(H4DO(w/o HEV))-13, INSTALLATION, Air Intake Duct.>

22) Install the V-belt cover.

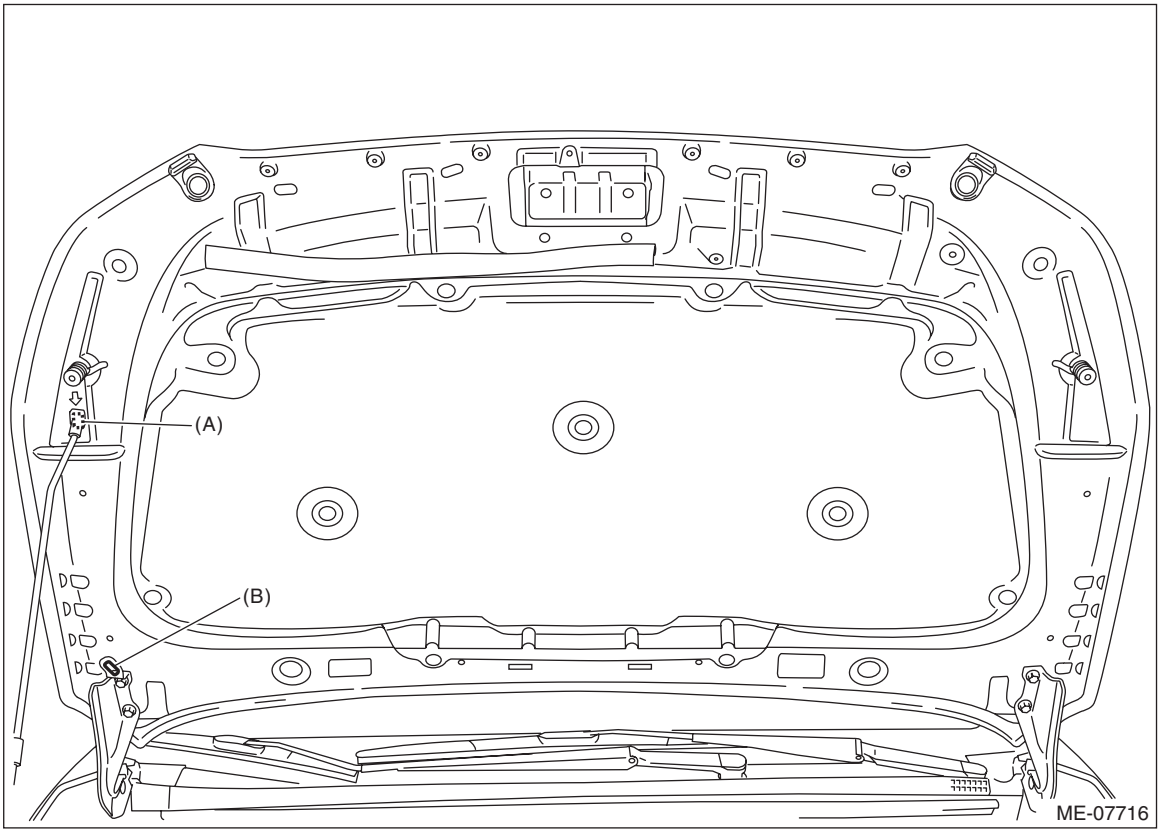
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



23) Refill the engine oil. <Ref. to LU(H4DO(w/o HEV))-13, REPLACEMENT, Engine Oil.>
24) Connect the battery ground terminal.

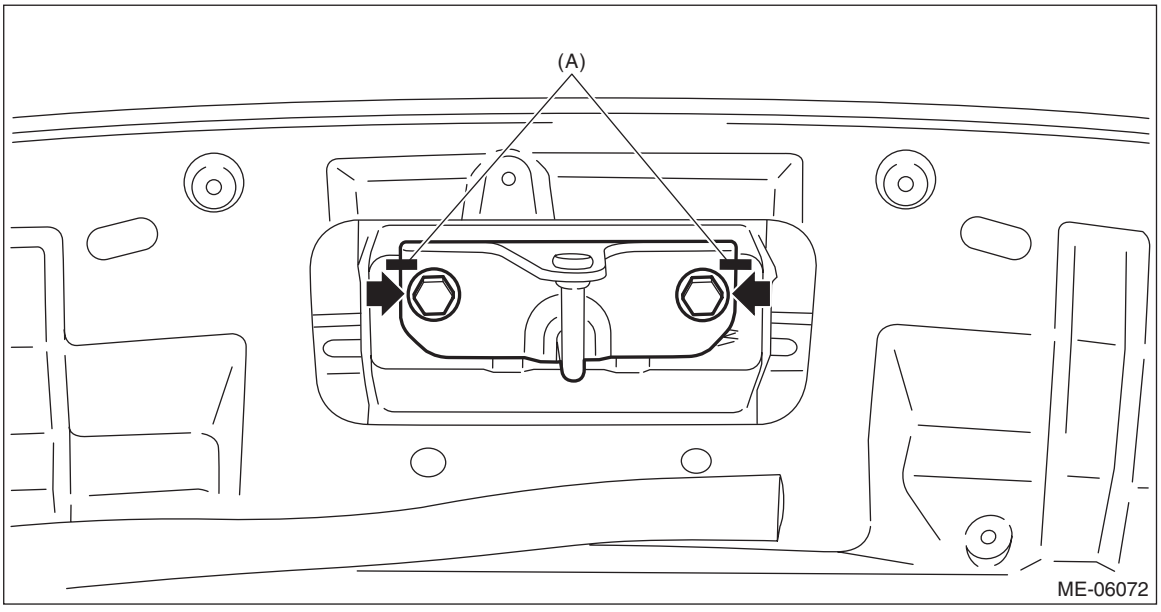


25) Change the front hood stay position from (B) to (A).



26) Install the front hood striker to the front hood by aligning the alignment marks (A), and close the front hood.

Tightening torque:
33 N·m (3.4 kgf-m, 24.3 ft-lb)

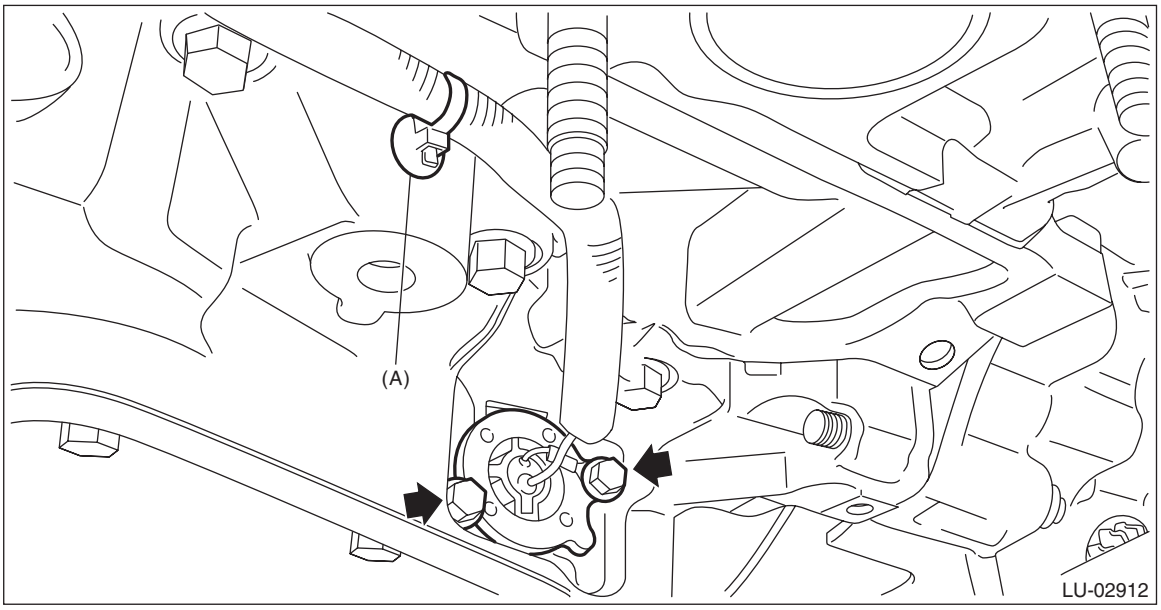


2. HEV MODEL

1) Install the oil level switch and the clip (A) to the oil pan upper.

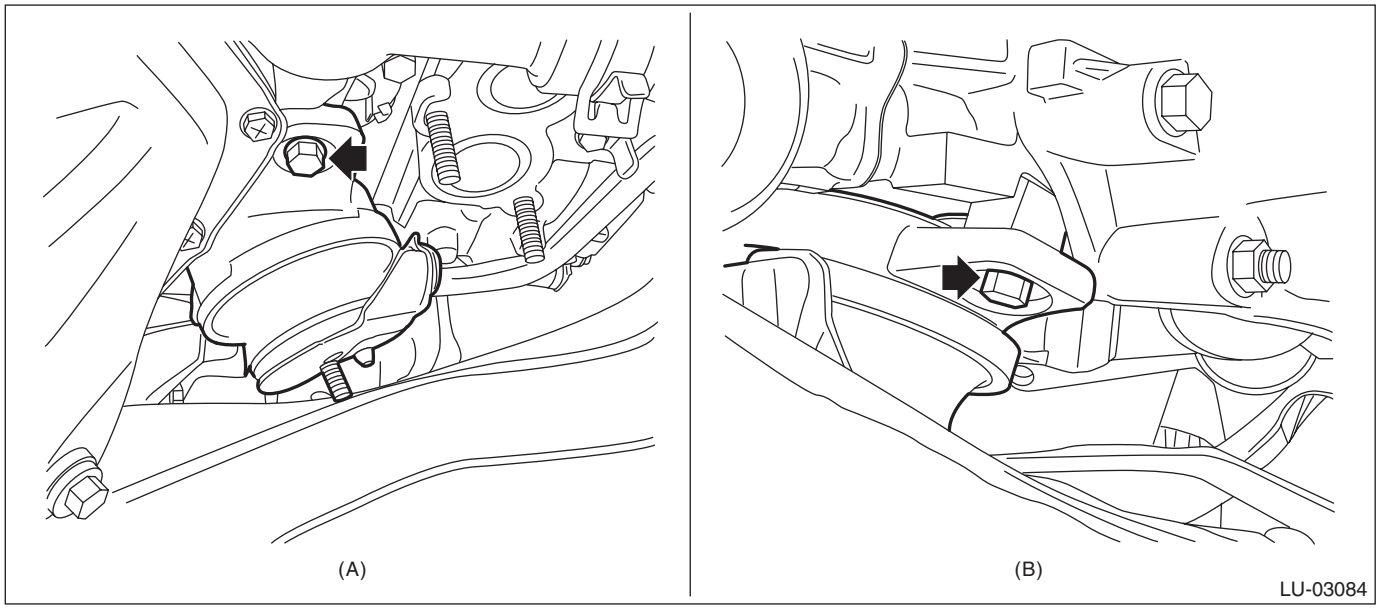
NOTE:
- Use new O-rings.
- Apply a coat of engine oil to the O-rings.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



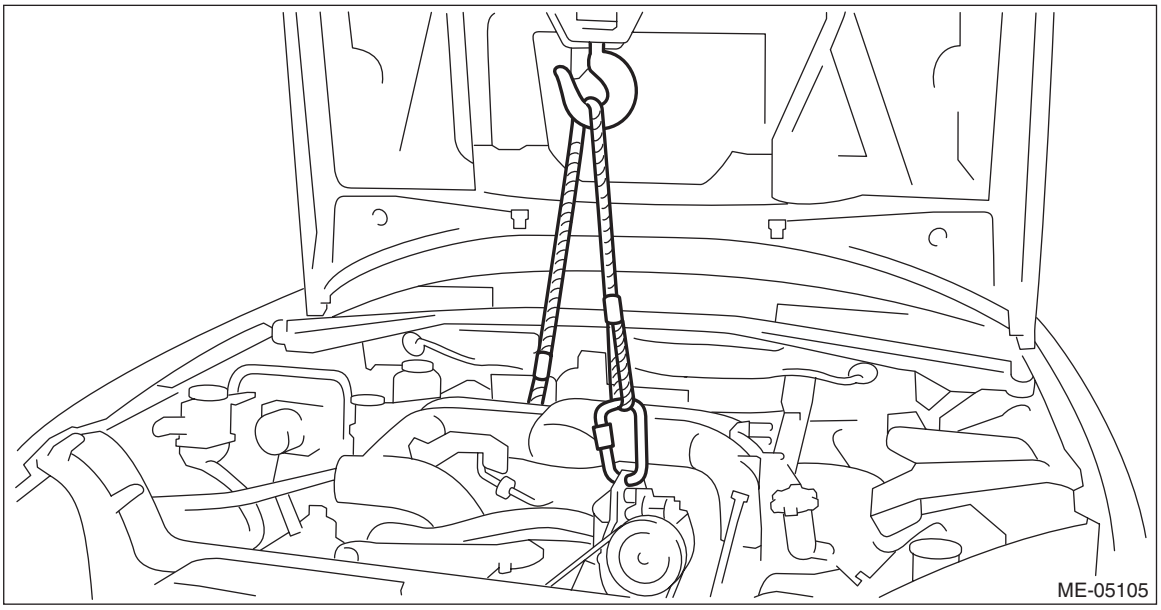
2) Install the engine mounting LH onto the engine.

Tightening torque:
35 N·m (3.6 kgf-m, 25.8 ft-lb)



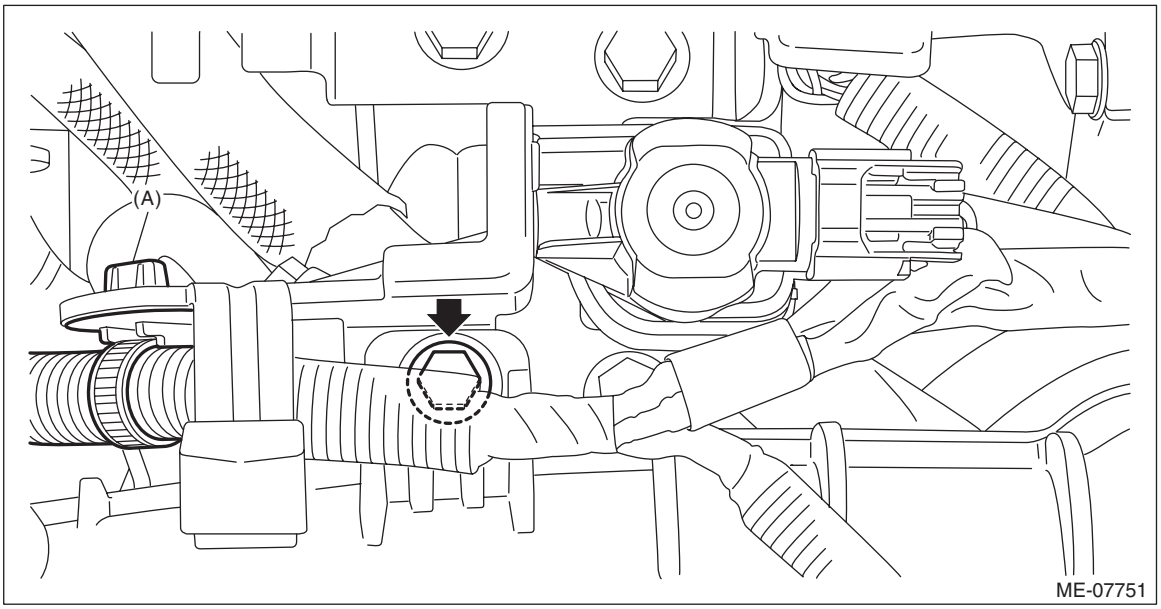
(A) Front side (B) Rear side

3) Lower the engine and remove the lifting device and wire ropes.



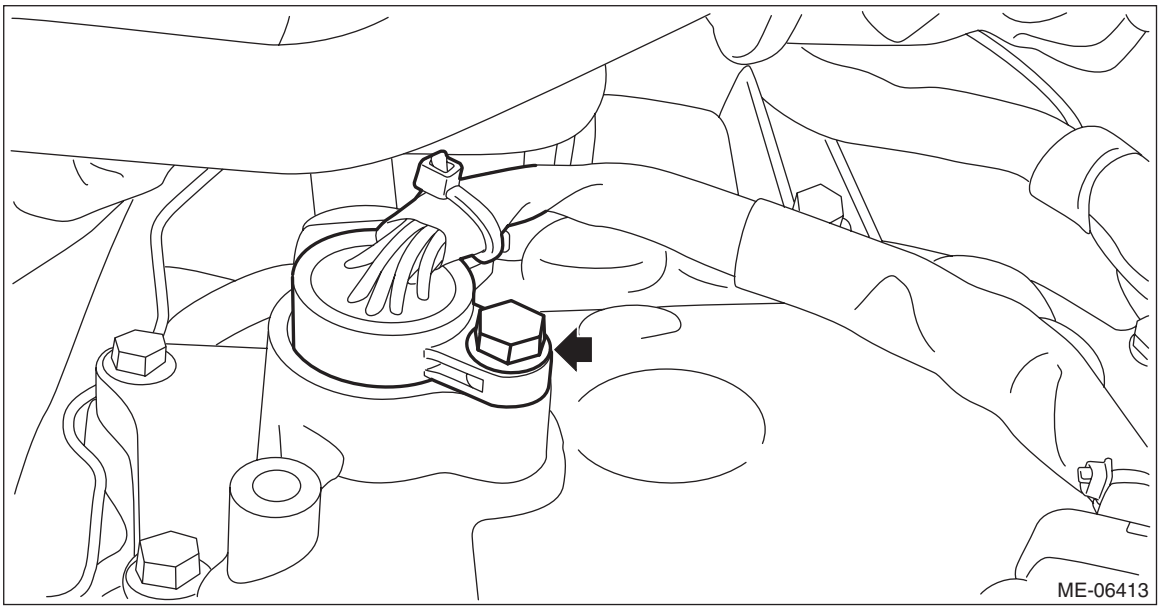
4) Install the bolts which secure the purge control solenoid valve bracket to the intake manifold, and secure the engine harness to the purge control solenoid valve bracket with the clip (A).

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



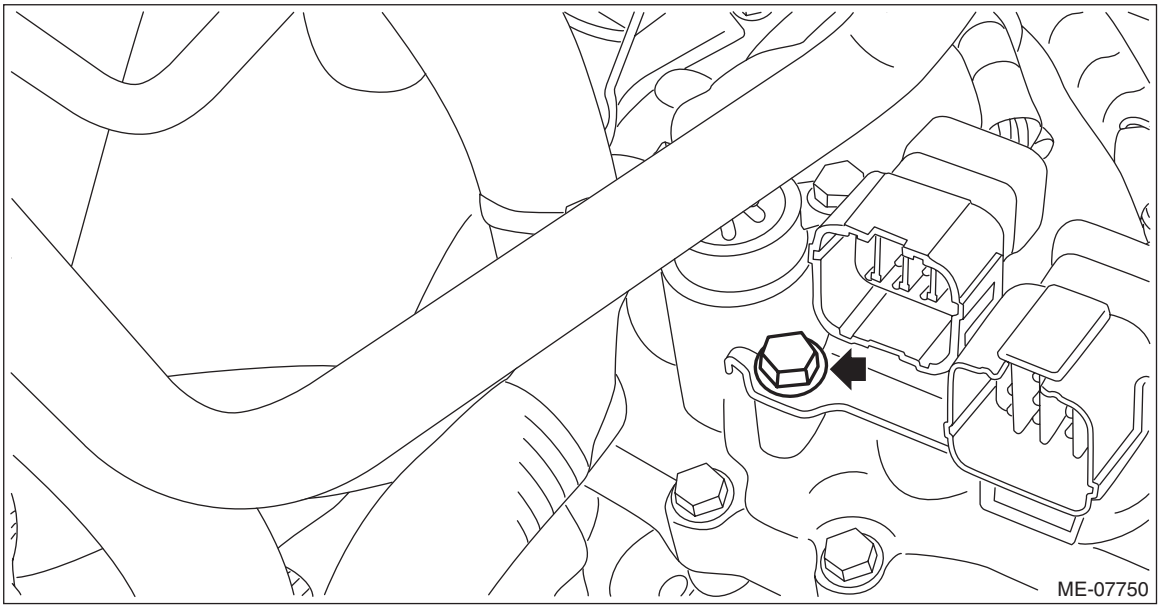
5) Remove the bolt and turn the transmission harness counterclockwise to install the transmission harness to the control valve body.

Tightening torque:
7 N·m (0.7 kgf-m, 5.2 ft-lb)



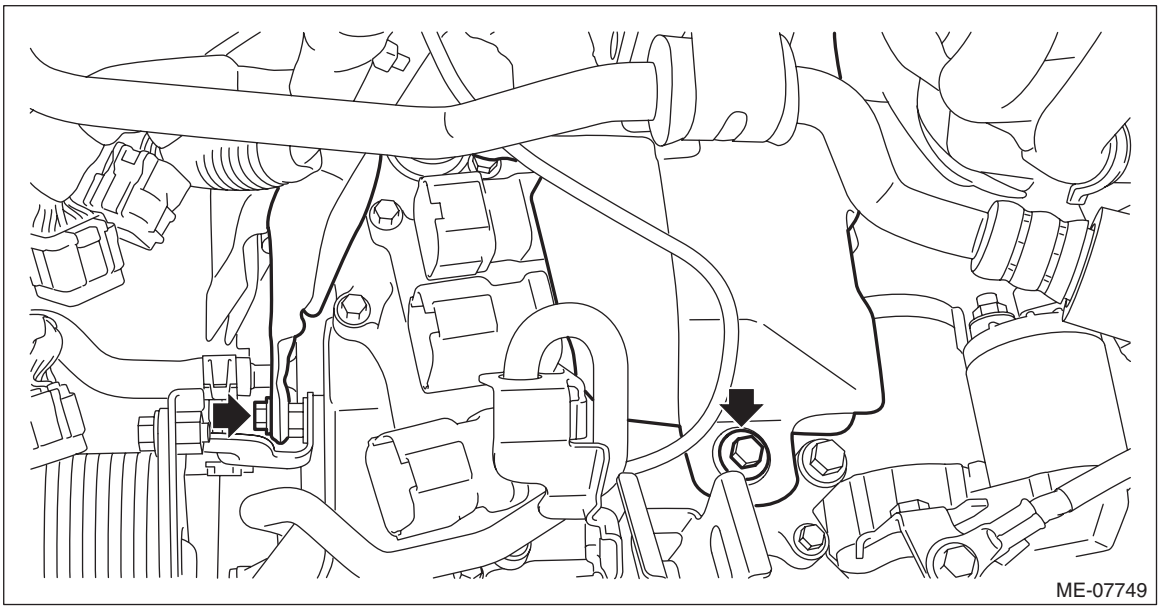
6) Install the bolt which holds the transmission harness stay.

Tightening torque:
7 N·m (0.7 kgf-m, 5.2 ft-lb)



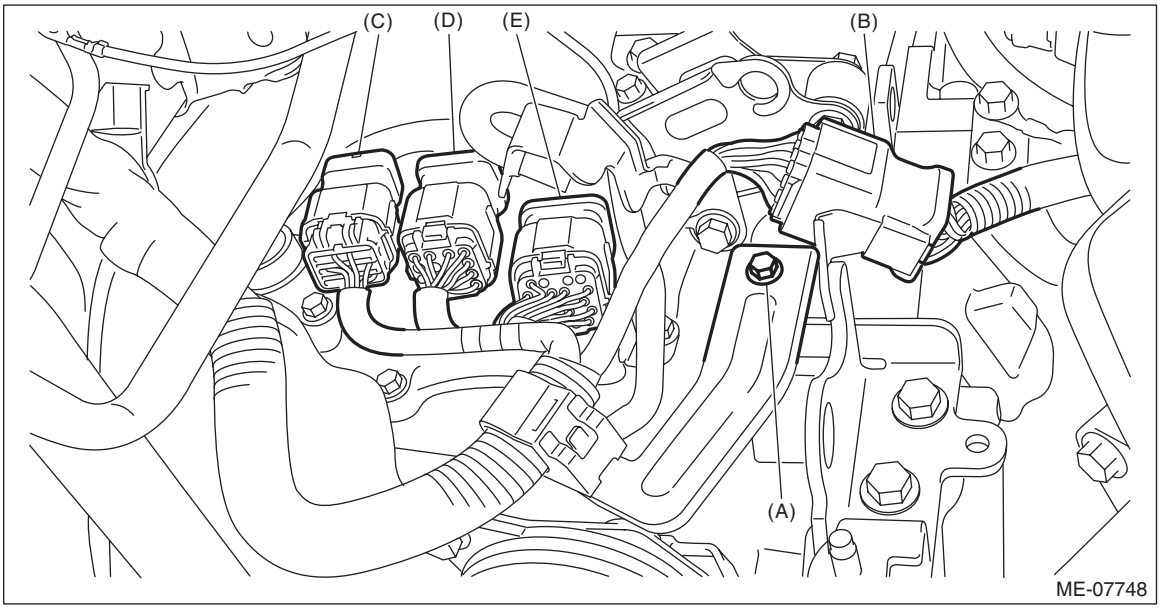
7) Install the transmission case cover.

Tightening torque:
8 N·m (0.8 kgf-m, 5.9 ft-lb)



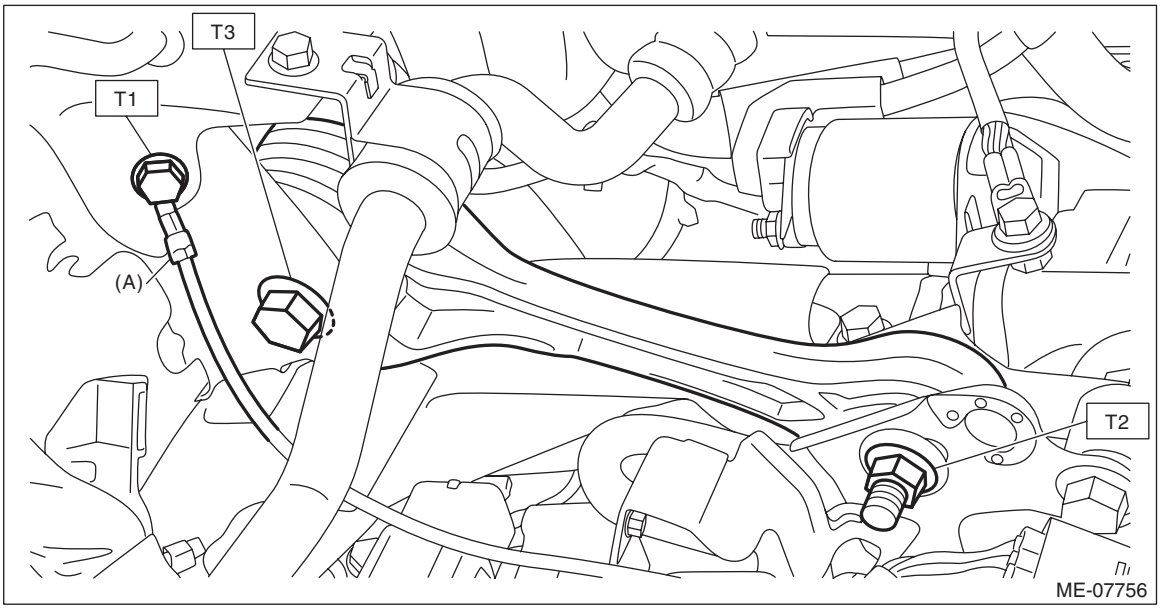
8) Connect the bulkhead harness connector to the transmission harness connector (C), inhibitor harness connector (D) and drive motor harness connector (E).
9) Connect the bulkhead harness connector to the engine harness connector (brown) (B), and install the bolt (A) securing the bulkhead harness connector bracket.

Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



10) Install the pitching stopper, and connect the transmission radio ground terminal (A) to the vehicle.

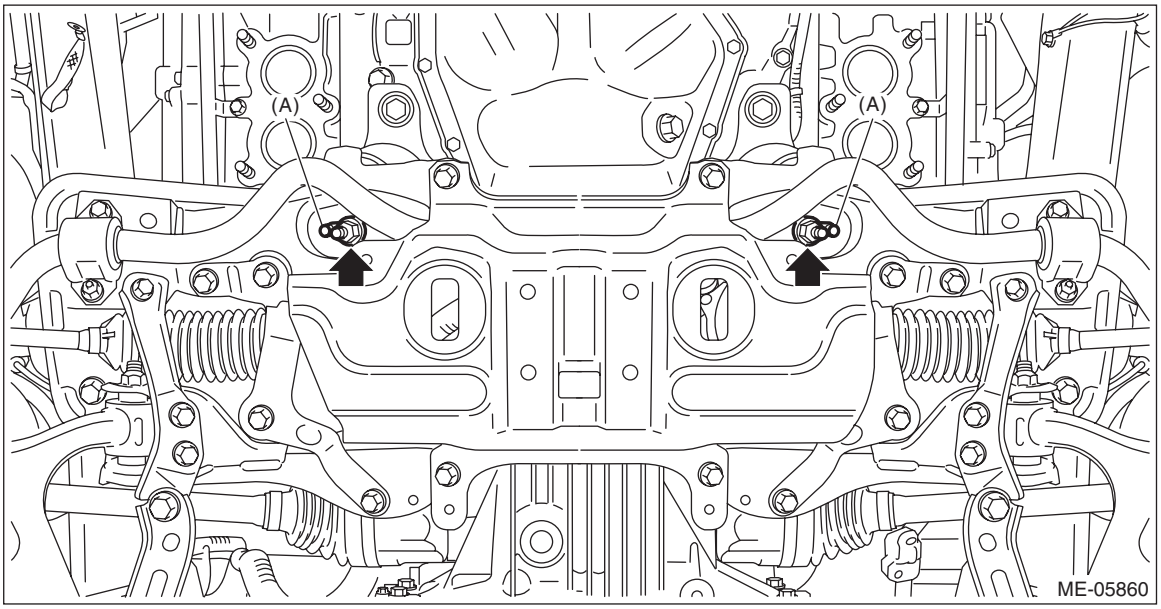
Tightening torque:
T1: 13 N·m (1.3 kgf-m, 9.6 ft-lb)
T2: 50 N·m (5.1 kgf-m, 36.9 ft-lb)
T3: 58 N·m (5.9 kgf-m, 42.8 ft-lb)



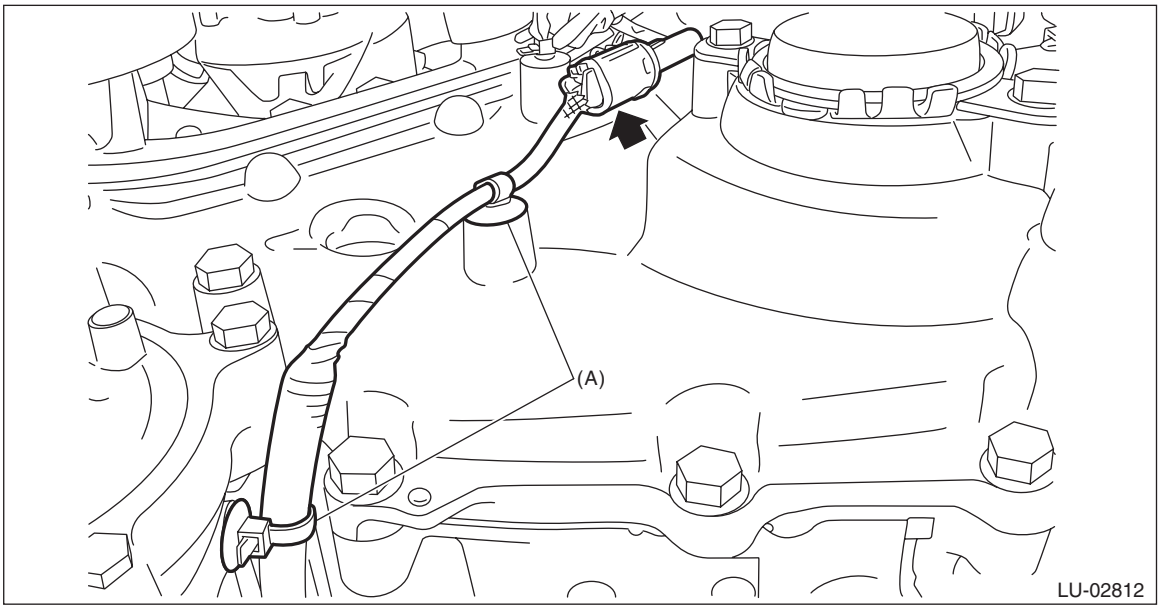
11) Install the electric power steering gearbox. <Ref. to PS-32, INSTALLATION, Electric Power Steering Gearbox.>
12) Install the front drive shaft LH. <Ref. to DS-57, INSTALLATION, Front Drive Shaft.>
13) Install the nuts which hold the engine mounting to the crossmember.

NOTE:
- Make sure that locators (A) of the engine mounting are securely inserted.
- Use a new nut.

Tightening torque:
60 N·m (6.1 kgf-m, 44.3 ft-lb)

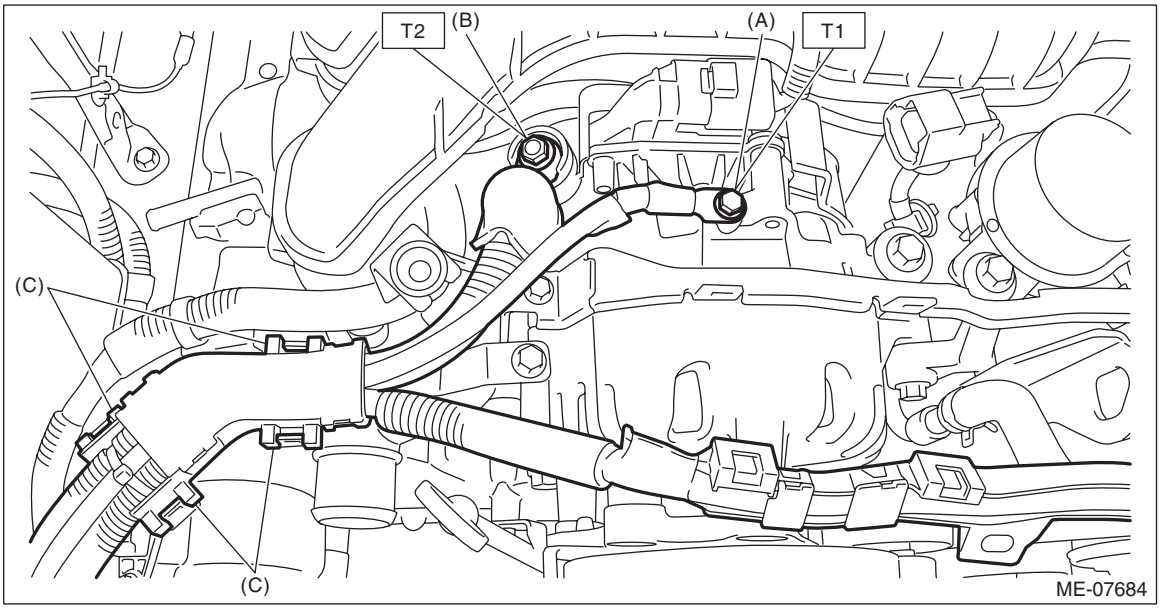


14) Connect the connector of oil level switch to the engine harness, and install the clip (A) securing the harness.



15) Install the front exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-8, INSTALLATION, Front Exhaust Pipe.>
16) Install the under cover.
17) Lower the vehicle.
18) Set the battery cable assembly, and install the clip (C) which secures the battery cable assembly to the battery cable bracket No. 1.
19) Connect the terminal (A) and the terminal (B) to ISG.

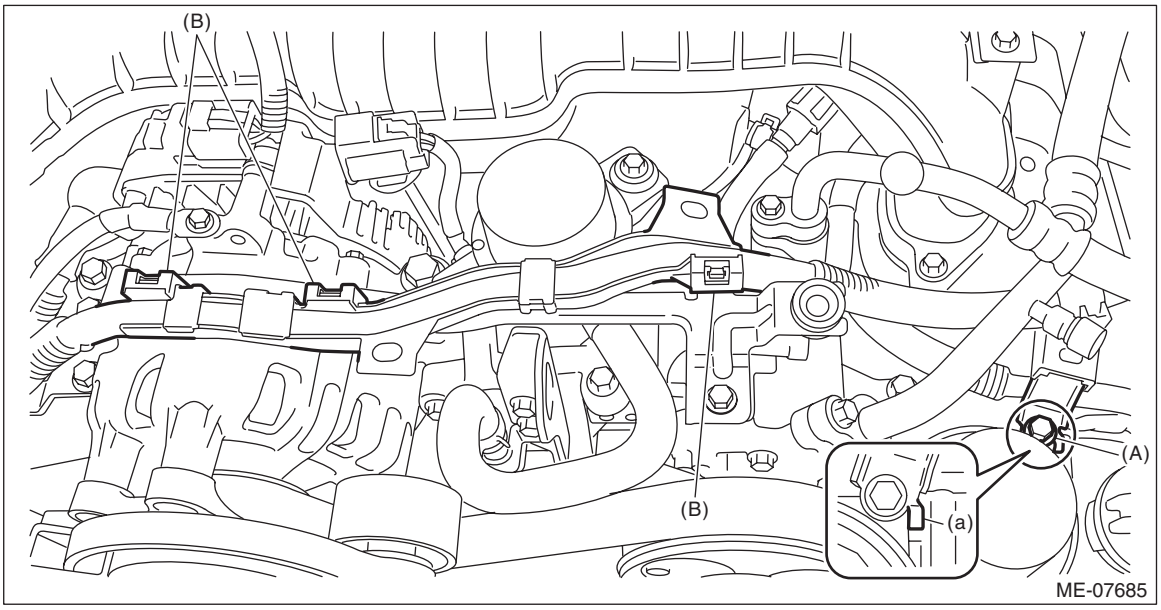
Tightening torque:
T1: 7.5 N·m (0.8 kgf-m, 5.5 ft-lb)
T2: 15.5 N·m (1.6 kgf-m, 11.4 ft-lb)



20) Install the clip (B) which secures the battery cable assembly to the collector cover bracket, and install the bolt (A) which secures the battery cable stay to the chain cover.

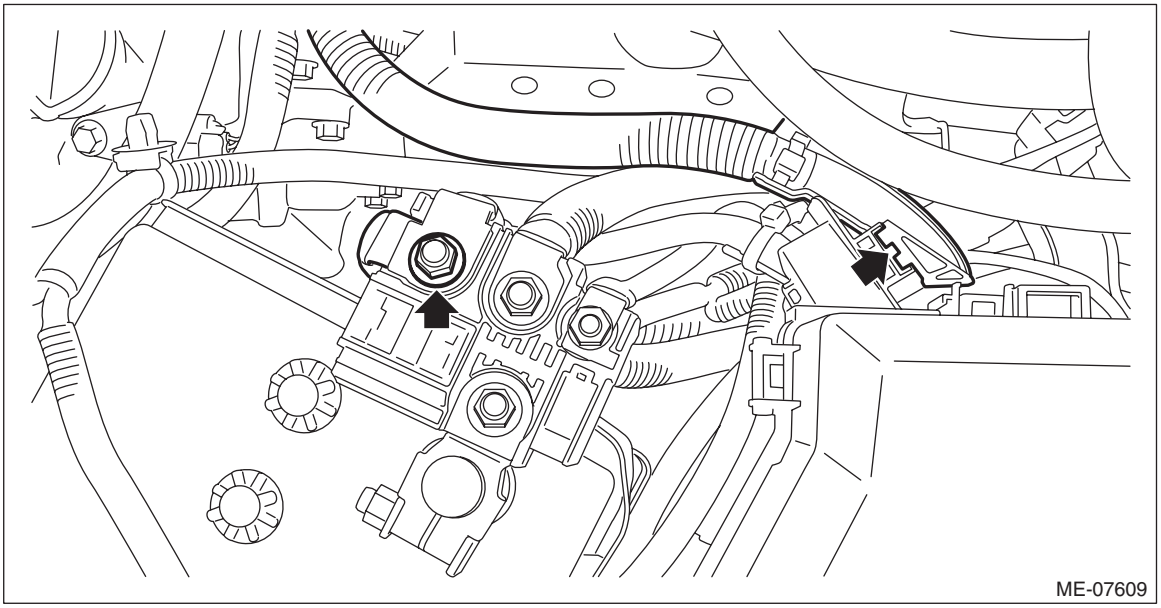
NOTE:
When installing the battery cable stay, install it by fitting the folded end (a) of the battery cable stay to the chain cover boss.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



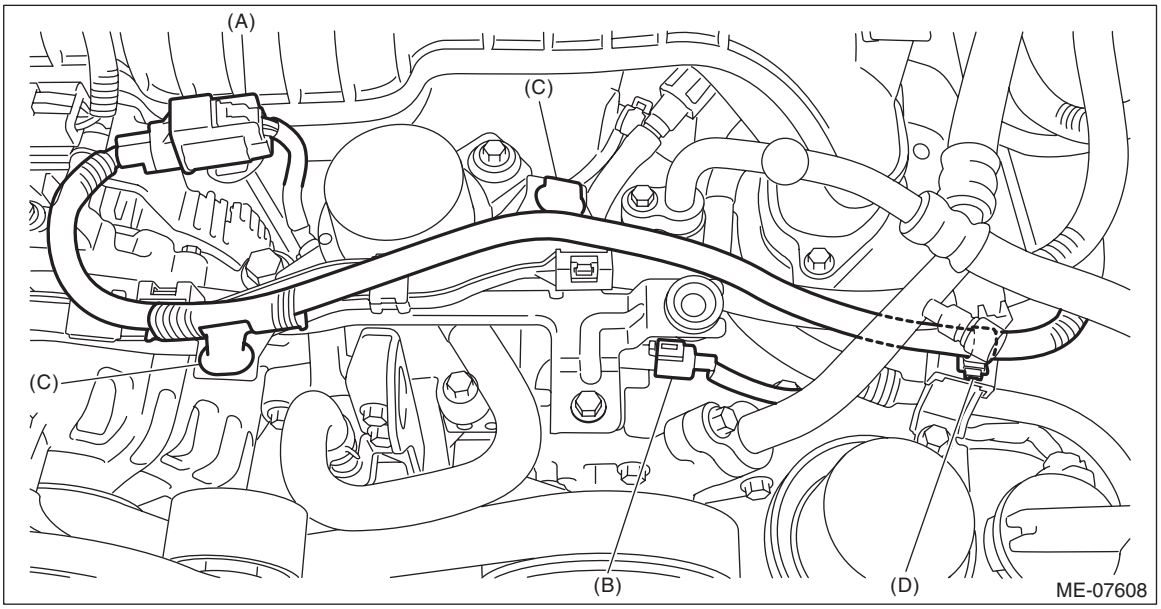
21) Install the battery cable assembly to the main fuse box, and install the nut which secures the battery cable assembly to the slow blow fuse (12 volt auxiliary battery).

Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

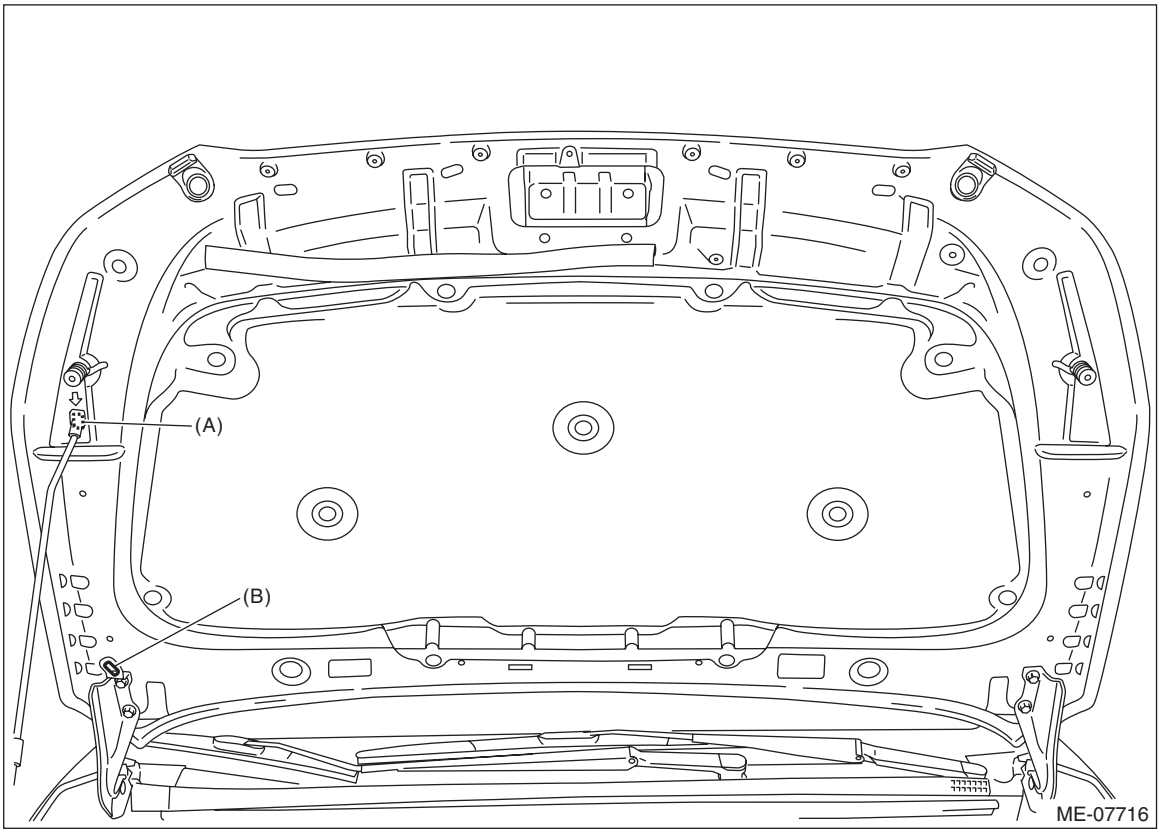


22) Install the terminal boot to the positive terminal of the 12 volt auxiliary battery.
23) Set the harness, and install the clip (C) and the clip (D) which secure the harness to the battery cable assembly.

24) Connect the connector (A) to the brake vacuum pump, and connect the connector (B) to the A/C compressor.

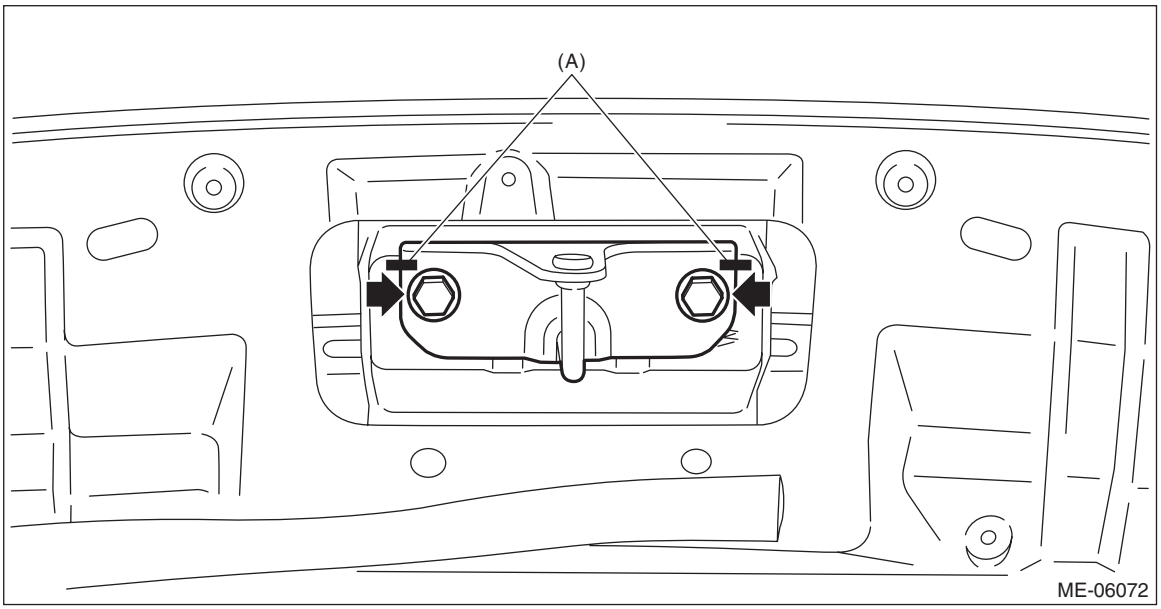


25) Install the air cleaner case. <Ref. to IN(H4DO(HEV))-8, INSTALLATION, Air Cleaner Case.>
26) Install the air intake duct. <Ref. to IN(H4DO(HEV))-15, INSTALLATION, Air Intake Duct.>
27) Install the collector cover.
28) Refill the engine oil. <Ref. to LU(H4DO(w/o HEV))-13, REPLACEMENT, Engine Oil.>
29) Connect the battery ground terminal. <Ref. to NT-5, BATTERY, NOTE, Note.>
30) Change the front hood stay position from (B) to (A).



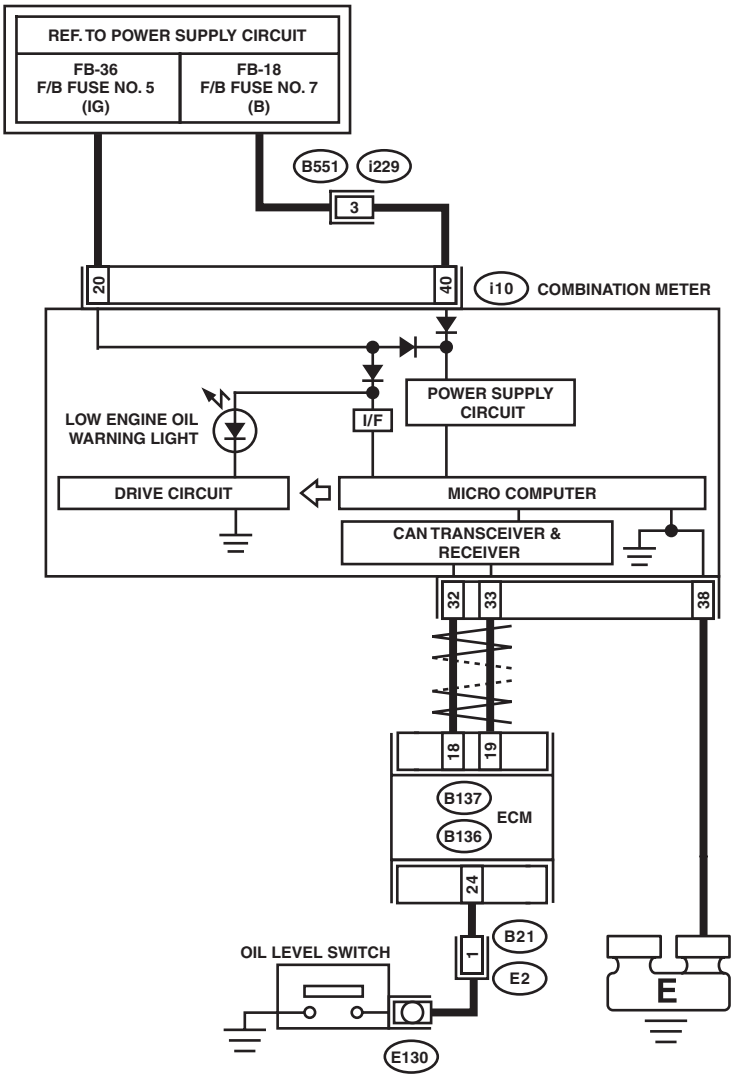
31) Install the front hood striker to the front hood by aligning the alignment marks (A), and close the front hood.

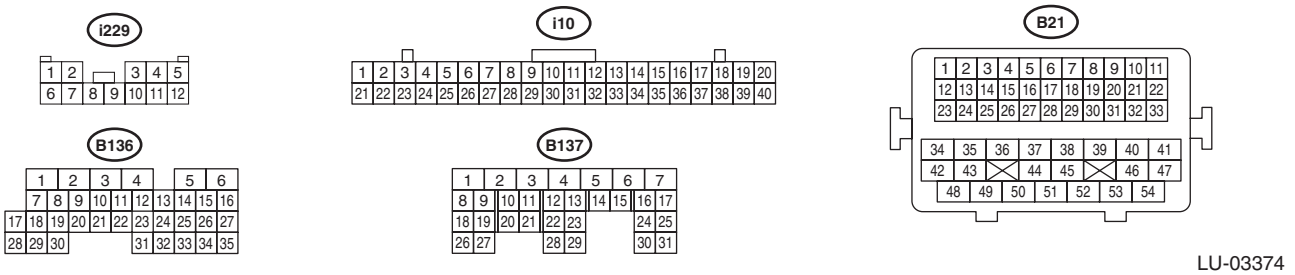
Tightening torque:
33 N·m (3.4 kgf-m, 24.3 ft-lb)



C: WIRING DIAGRAM

- Engine electrical system <Ref. to WI(w/o HEV)-98, WIRING DIAGRAM, Engine Electrical System.>
- CAN communication system <Ref. to WI(w/o HEV)-65, WIRING DIAGRAM, CAN Communication System.>





LU-03374

D: INSPECTION

1. INSPECTION WHEN LOW ENGINE OIL WARNING LIGHT IS ILLUMINATED

Step	Check	Yes	No
1 **CHECK ENGINE OIL LEVEL.**	Is engine oil level normal?	Go to step **2**.	Replace engine oil or refill, and check again while the oil level is normal condition. <Ref. to LU(H4DO(w/o HEV))-13, REPLACEMENT, Engine Oil.> To turn off the low engine oil warning light, install the spare fuse at the delivery (test) mode fuse in the main fuse box. Then turn the ignition switch to ON (engine off) again, to confirm the low engine oil warning light turns off. Remove the spare fuse installed to finish. NOTE: The engine oil level switch is normal if the low engine oil warning light turns off with the delivery (test) mode fuse inserted.
2 **CHECK LAN SYSTEM.**	Has a DTC of the LAN system been input?	Perform the diagnosis according to DTC.	Go to step **3**.

Step		Check	Yes	No
3	**CHECK OIL LEVEL SWITCH CIRCUIT.** 1) Turn the ignition switch to ON (engine OFF). 2) Read the current data for engine in the Subaru Select Monitor to confirm the item for "Oil level switch". <Ref. to EN(H4DO w/o HEV)(diag)-37, DISPLAY ENGINE CURRENT DATA, OPERATION, Subaru Select Monitor.> <Ref. to EN(H4DO HEV)(diag)-36, DISPLAY CURRENT ENGINE DATA, OPERATION, Subaru Select Monitor.>	Is the "Oil level switch" signal displayed in Subaru Select Monitor HIGH?	To turn off the low engine oil warning light, install the spare fuse at the delivery (test) mode fuse in the main fuse box. Then turn the ignition switch to ON (engine off) again, to confirm the low engine oil warning light turns off. Remove the spare fuse installed to finish. NOTE: The engine oil level switch is normal if the low engine oil warning light turns off with the delivery (test) mode fuse inserted.	Go to step **4**.
4	**CHECK COMBINATION METER.** Perform the self-diagnosis of combination meter to check if there are any faults in the combination meter. <Ref. to IDI-8, OPERATION, Combination Meter System.>	Is combination meter OK?	Go to step **5**.	Replace the combination meter. <Ref. to IDI-20, REMOVAL, Combination Meter.>
5	**CHECK SECURE CONNECTION OF CONNECTOR BETWEEN ENGINE HARNESS AND OIL LEVEL SWITCH.**	Is there any insecure connection?	Remedy the connection condition. Then, to turn off the low engine oil warning light, install the spare fuse at the delivery (test) mode fuse in the main fuse box. Then turn the ignition switch to ON (engine off) again, to confirm the low engine oil warning light turns off. Remove the spare fuse installed to finish. NOTE: The engine oil level switch is normal if the low engine oil warning light turns off with the delivery (test) mode fuse inserted.	Go to step **6**.

	Step	Check	Yes	No
6	**CHECK OIL LEVEL SWITCH.** 1) Deliberately short circuits by connecting the engine harness connector terminal and chassis ground. 2) Turn the ignition switch to ON (engine OFF). 3) Read the current data for engine in the Subaru Select Monitor to confirm the item for "Oil level switch". <Ref. to EN(H4DO w/o HEV)(diag)-37, DISPLAY ENGINE CURRENT DATA, OPERATION, Subaru Select Monitor.> <Ref. to EN(H4DO HEV)(diag)-36, DISPLAY CURRENT ENGINE DATA, OPERATION, Subaru Select Monitor.> ***Connector & terminal*** ***(E130) No. 1 — Chassis ground:***	Is the "Oil level switch" signal displayed in Subaru Select Monitor HIGH?	Replace the oil level switch. <Ref. to LU(H4DO(w/o HEV))-31, REMOVAL, Oil Level Switch.>	Go to step **7**.
7	**CHECK SECURE CONNECTION OF CONNECTOR BETWEEN BULKHEAD HARNESS AND ENGINE HARNESS.**	Is there any insecure connection?	Remedy the connection condition. Then, to turn off the low engine oil warning light, install the spare fuse at the delivery (test) mode fuse in the main fuse box. Then turn the ignition switch to ON (engine off) again, to confirm the low engine oil warning light turns off. Remove the spare fuse installed to finish. NOTE: The engine oil level switch is normal if the low engine oil warning light turns off with the delivery (test) mode fuse inserted.	Go to step **8**.
8	**CHECK ENGINE HARNESS.** 1) Disconnect the connector on the oil level switch side for the engine harness. 2) Disconnect the connector on the bulkhead harness side for the engine harness. 3) Measure the resistance between connector terminals. ***Connector & terminal*** ***(E2) No. 1 — (E130) No. 1:***	Is the resistance less than 1 Ω?	Go to step **9**.	Repair or replace the open circuit of engine harness.

	Step	Check	Yes	No
9	**CHECK SECURE CONNECTION OF CONNECTOR BETWEEN ENGINE CONTROL MODULE (ECM) AND BULKHEAD HARNESS.** Remove the glove box lid assembly. <Ref. to EI-78, REMOVAL, Glove Box.>	Is there any insecure connection?	Remedy the connection condition. Then, to turn off the low engine oil warning light, install the spare fuse at the delivery (test) mode fuse in the main fuse box. Then turn the ignition switch to ON (engine off) again, to confirm the low engine oil warning light turns off. Remove the spare fuse installed to finish. NOTE: The engine oil level switch is normal if the low engine oil warning light turns off with the delivery (test) mode fuse inserted.	Go to step **10**.
10	**CHECK BULKHEAD HARNESS.** 1) Remove the glove box lid assembly. <Ref. to EI-78, REMOVAL, Glove Box.> 2) Disconnect the engine control module (ECM) side connector for the bulkhead harness. 3) Disconnect the engine harness connectors from the bulkhead harness. 4) Measure the resistance between connector terminals. ***Connector & terminal*** ***(B136) No. 24 — (B21) No. 1:***	Is the resistance less than 1 Ω?	Replace the engine control module (ECM). <Ref. to FU(H4DO(w/o HEV))-100, REMOVAL, Engine Control Module (ECM).> <Ref. to FU(H4DO(HEV))-85, REMOVAL, Engine Control Module (ECM).>	Repair or replace the open circuit of the bulkhead harness.

2. OTHER INSPECTIONS

1) Check that the oil level switch does not have deformation, cracks, or damage.
2) Check the oil level switch installation part for oil leakage and oil seepage.

9. Engine Lubrication System Trouble in General

A: INSPECTION

Before performing diagnostics, make sure that the engine oil level is correct and no oil leakage exists.

Trouble	Possible cause	Corrective action
Warning light remains ON.	a. Oil pressure switch failure	
	❍ Cracked diaphragm or oil leakage within switch	Replace.
	❍ Broken spring or seized contacts	Replace.
	b. Low oil pressure	
	❍ Clogging of oil filter	Replace.
	❍ Malfunction of oil by-pass valve in oil filter	Replace.
	❍ Clogged oil passage	Clean.
	❍ Excessive tip clearance and side clearance of oil pump rotor	Replace.
	❍ Clogged oil strainer or broken pipe	Clean or replace.
	c. No oil pressure	
	❍ Insufficient engine oil (degradation, etc.)	Replace.
	❍ Broken pipe of oil strainer	Replace.
	❍ Stuck oil pump rotor	Replace.
Warning light does not illuminate.	a. Malfunction of combination meter	Replace.
	b. Poor contact of switch contact points	Replace.
	c. Disconnection of wiring	Repair.
Warning light flickers momentarily.	a. Defective terminal contact	Repair.
	b. Defective wiring harness	Repair.
	c. Oil pressure switch failure	
	❍ Cracked diaphragm or oil leakage within switch	Replace.
	❍ Broken spring or seized contacts	Replace.
	d. Low oil pressure	
	❍ Clogging of oil filter	Replace.
	❍ Malfunction of oil by-pass valve in oil filter	Replace.
	❍ Clogged oil passage	Clean.
	❍ Excessive tip clearance and side clearance of oil pump rotor	Replace.
	❍ Clogged oil strainer or broken pipe	Clean or replace.

SPEED CONTROL SYSTEMS

SP(H4DO(w/o HEV))

Page

1. General Description 2
2. Accelerator Pedal 4

1. General Description

A: SPECIFICATION

Engine	Model				2.0 L
	Cylinder arrangement				Horizontally opposed, liquid cooled, 4-cylinder, 4-stroke gasoline engine
	Valve system mechanism				Chain driven, double overhead camshaft, 4-valve/cylinder
	Bore × Stroke mm (in)				84.0 × 90.0 (3.31 × 3.54)
	Displacement cm^3 (cu in)				1,995 (121.73)
	Compression ratio				Gasoline engine model: 10.5
					HEV model: 10.8
	Compression pressure (at 200 — 300 r/min) kPa (kg/cm^2, psi)			Standard	1,050 — 1,400 (11 — 14, 152 — 203)
	Number of piston rings				Compression ring: 2 Oil ring: 1
	Intake valve timing	Open	Max. retard		ATDC 25°
			Min. advance		BTDC 43°
		Close	Max. retard		ABDC 85°
			Min. advance		ABDC 17°
	Exhaust valve timing	Open	Max. retard		ABDC 3°
			Min. advance		BBDC 52°
		Close	Max. retard		ATDC 47°
			Min. advance		BTDC 8°
	Cam clearance mm (in)		Intake	Standard	$0.13^{+0.02}_{-0.03}$ ($0.0051^{+0.0008}_{-0.0012}$)
			Exhaust	Standard	0.22±0.02 (0.0087±0.0008)
	Idle speed (For CVT model, select lever in “P” or “N” range. For MT model, gear shift lever in neutral position.) r/min		No load	Standard	650±100
			A/C ON	Standard	800 — 900±50
	Ignition order				1 → 3 → 2 → 4
	Ignition timing BTDC/{r/min}			Standard	Gasoline engine CVT model: 16°±10°/650
					Gasoline engine MT model: 12°±10°/650
					HEV model: 10°±10°/650

NOTE:
OS: Oversize US: Undersize

Camshaft	Bending mm (in)		Limit	0.020 (0.00079)
	Cam lobe height mm (in)	Intake	Standard	40.34 — 40.44 (1.588 — 1.592)
		Exhaust	Standard	39.66 — 39.76 (1.561 — 1.565)
	Cam base circle diameter mm (in)		Standard	34.0 (1.339)
	Journal outer diameter mm (in)		Standard	25.946 — 25.963 (1.0215 — 1.0222)
	Thrust clearance mm (in)		Standard	0.068 — 0.116 (0.0027 — 0.0047)
	Oil clearance mm (in)		Standard	0.037 — 0.072 (0.0015 — 0.0028)
Cylinder head	Warpage (mating surface with cylinder block) mm (in)		Limit	0.020 (0.0008)
	Grinding limit mm (in)			To 98.4 (3.874)
	Height mm (in)		Standard	98.5 (3.878)

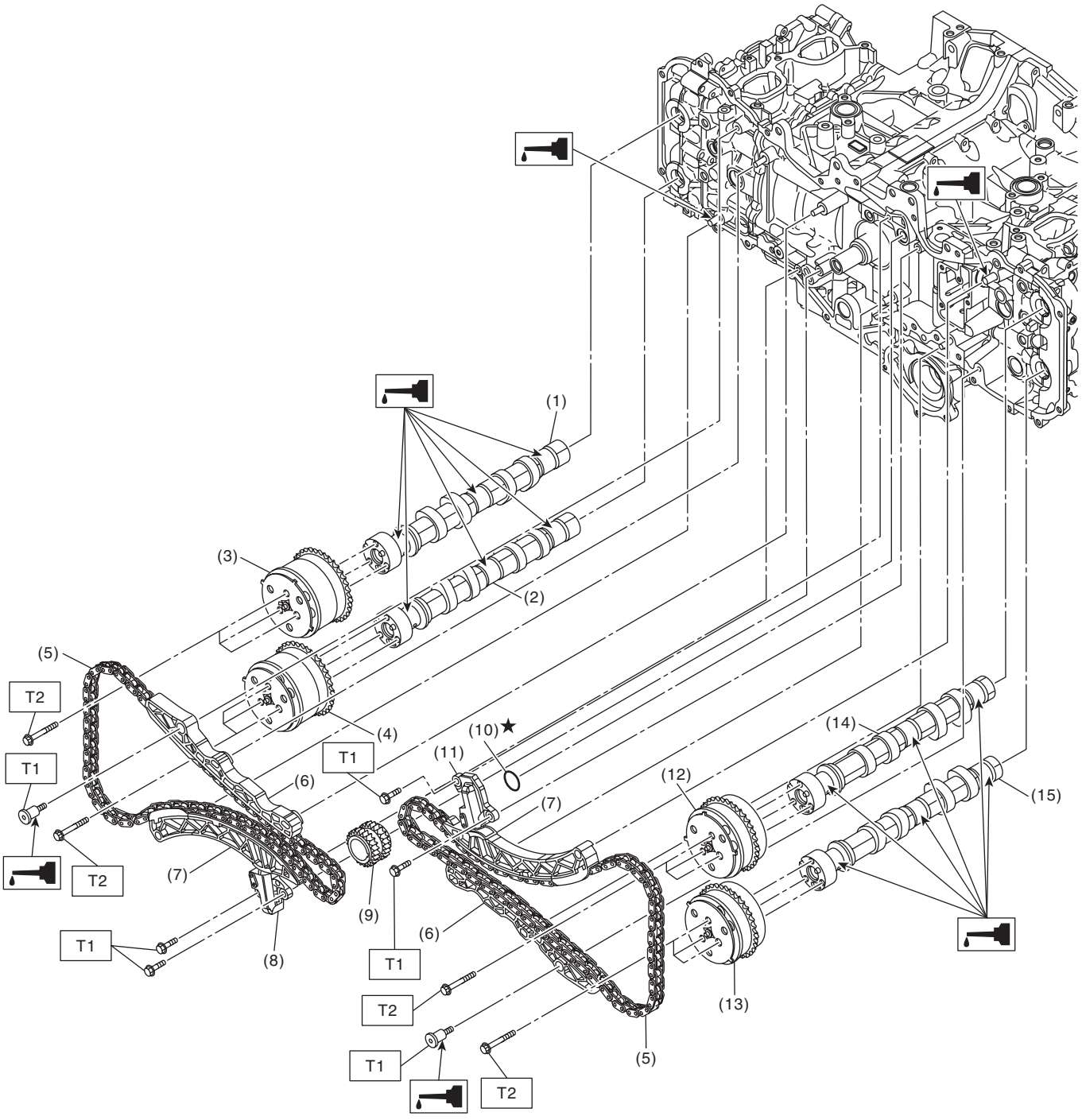
Valve & valve guide	Valve overall length mm (in)		Intake		104.95 (4.132)
			Exhaust		96.5 (3.799)
	Valve head edge thickness mm (in)	Intake		Standard	0.8 — 1.2 (0.031 — 0.047)
		Exhaust		Standard	1.0 — 1.4 (0.039 — 0.055)
	Valve stem outer diameter mm (in)	Intake		Standard	5.455 — 5.470 (0.2148 — 0.2154)
		Exhaust		Standard	5.445 — 5.460 (0.2144 — 0.2150)
	Valve guide inner diameter mm (in)			Standard	5.500 — 5.512 (0.2165 — 0.2170)
	Clearance between valve and valve guide mm (in)	Intake		Standard	0.030 — 0.057 (0.0012 — 0.0022)
		Exhaust		Standard	0.040 — 0.067 (0.0016 — 0.0026)
	Valve guide protrusion amount mm (in)			Standard	11.4 — 11.8 (0.449 — 0.465)
Valve & valve shim	Valve stem end outer diameter mm (in)	Intake		Standard	5.455 — 5.470 (0.2148 — 0.2154)
		Exhaust		Standard	5.445 — 5.460 (0.2144 — 0.2150)
	Valve shim inner diameter mm (in)			Standard	5.500 — 5.560 (0.2165 — 0.2189)
	Clearance between valve and valve shim mm (in)	Intake		Standard	0.030 — 0.105 (0.0012 — 0.0041)
		Exhaust		Standard	0.040 — 0.115 (0.0016 — 0.0045)
Valve seat	Seating width between valve and valve seat mm (in)	Intake		Standard	0.8 — 1.6 (0.031 — 0.063)
		Exhaust		Standard	1.1 — 1.7 (0.043 — 0.067)
	Seating angle between valve and valve seat				45°
	Seating position between valve and valve seat				Valve face center
Valve spring	Free length mm (in)			Standard	MT model: 41.06 (1.617)
					CVT model: 41.68 (1.641)
	Tension/spring height N (kgf, lb)/mm (in)		Set	Standard	182 — 210 (18.56 — 21.41, 40.92 — 47.22)/ 33.0 (1.299)
			Lift	Standard	MT model: 552 — 610 (56.29 — 62.20, 124.11 — 137.15)/ 22.0 (0.866)
					CVT model: 502 — 554 (51.19 — 56.49, 112.87 — 124.56)/ 22.0 (0.866)
	Squareness			Standard	2.5°, 1.8 mm (0.071 in) or less
Cylinder block & piston	Cylinder block warpage (Mating surface with cylinder head) mm (in)			Limit	0.025 (0.00098)
	Grinding limit of cylinder block mm (in)				To 204.9 (8.067)
	Height of cylinder block mm (in)			Standard	205.0 (8.071)
	Inner diameter of cylinder liner mm (in)	Cylinder bore size mark A		Standard	84.005 — 84.015 (3.3073 — 3.3077)
		Cylinder bore size mark B		Standard	83.995 — 84.005 (3.3069 — 3.3073)
	Cylindricality of cylinder liner mm (in)			Limit	0.030 (0.0012)
	Out-of-roundness of cylinder liner mm (in)			Limit	0.030 (0.0012)
	Piston grade point mm (in)				38.0 (1.50)
	Piston outer diameter mm (in)	Standard Size	Grade A	Standard	83.975 — 83.985 (3.3061 — 3.3065)
			Grade B	Standard	83.965 — 83.975 (3.3057 — 3.3061)
		0.25 (0.0098) OS		Standard	84.215 — 84.235 (3.3155 — 3.3163)
		0.50 (0.0197) OS		Standard	84.465 — 84.485 (3.3254 — 3.3262)
	Clearance between cylinder liner and piston mm (in)			Standard	0.020 — 0.040 (0.00079 — 0.00158)
	Inner diameter of cylinder liner boring limit (diameter) mm (in)				To 84.505 (3.3270)
Piston and piston pin	Degree of fit				Piston pin must be fitted into position with thumb at 20°C (68°F).
	Clearance between piston and piston pin mm (in)			Standard	0.004 — 0.008 (0.0002 — 0.0003)

Piston ring	Closed gap mm (in)	Compression ring		Top ring	Standard	0.20 — 0.35 (0.0079 — 0.0138)
				Second ring	Standard	0.40 — 0.50 (0.0157 — 0.0197)
		Oil ring (Upper rail and lower rail)			Standard	0.10 — 0.35 (0.0039 — 0.0138)
	Clearance between compression ring and piston mm (in)			Top ring	Standard	0.040 — 0.080 (0.0016 — 0.0031)
				Second ring	Standard	0.030 — 0.070 (0.0012 — 0.0028)
Connecting rod and connecting rod bearing	Bend or twist per 100 mm (3.94 in) in length mm (in)				Limit	0.10 (0.0039)
	Thrust clearance mm (in)				Standard	0.070 — 0.330 (0.0028 — 0.0130)
	Connecting rod bearing thickness (at center) mm (in)			Standard size	Standard	1.492 — 1.508 (0.0587 — 0.0594)
				0.03 (0.0012) US	Standard	1.511 — 1.515 (0.0595 — 0.0596)
				0.05 (0.0020) US	Standard	1.521 — 1.525 (0.0599 — 0.0600)
				0.25 (0.0098) US	Standard	1.621 — 1.625 (0.0638 — 0.0640)
	Oil clearance mm (in)				Standard	0.017 — 0.047 (0.0007 — 0.0019)
Piston pin & connecting rod bushing	Clearance between piston pin and connecting rod bushing mm (in)				Standard	0.004 — 0.026 (0.0002 — 0.0010)
Crankshaft and crankshaft bearing	Bending mm (in)				Limit	0.035 (0.0014)
	Crankshaft pin	Cylindricality mm (in)			Limit	0.006 (0.0002)
		Out-of-roundness mm (in)			Limit	0.005 (0.0002)
		Grinding limit (dia.) mm (in)				To 47.726 (1.8790)
	Crankshaft journal	Cylindricality mm (in)			Limit	0.006 (0.0002)
		Out-of-roundness mm (in)			Limit	0.005 (0.0002)
		Grinding limit (dia.) mm (in)				To 67.735 (2.6667)
	Crankshaft pin outer diameter mm (in)			Standard size	Standard	47.976 — 48.000 (1.8888 — 1.8898)
				0.03 (0.0012) US	Standard	47.946 — 47.970 (1.8876 — 1.8886)
				0.05 (0.0020) US	Standard	47.926 — 47.950 (1.8868 — 1.8878)
				0.25 (0.0098) US	Standard	47.726 — 47.750 (1.8790 — 1.8799)
	Crankshaft journal outer diameter mm (in)			Standard size	Standard	67.985 — 68.003 (2.6766 — 2.6773)
				0.03 (0.0012) US	Standard	67.955 — 67.979 (2.6754 — 2.6763)
				0.05 (0.0020) US	Standard	67.935 — 67.959 (2.6746 — 2.6755)
				0.25 (0.0098) US	Standard	67.735 — 67.759 (2.6667 — 2.6677)
	Crankshaft bearing thickness (at center) mm (in)		#1, #2, #3, #4	Standard size	Standard	2.498 — 2.513 (0.0983 — 0.0989)
				0.03 (0.0012) US	Standard	2.519 — 2.522 (0.0992 — 0.0993)
				0.05 (0.0020) US	Standard	2.529 — 2.532 (0.0996 — 0.0997)
				0.25 (0.0098) US	Standard	2.629 — 2.632 (0.1035 — 0.1036)
			#5	Standard size	Standard	2.496 — 2.511 (0.0983 — 0.0989)
				0.03 (0.0012) US	Standard	2.517 — 2.520 (0.0991 — 0.0992)
				0.05 (0.0020) US	Standard	2.527 — 2.530 (0.0995 — 0.0996)
				0.25 (0.0098) US	Standard	2.627 — 2.630 (0.1034 — 0.1035)
	Thrust clearance mm (in)				Standard	0.130 — 0.308 (0.00512 — 0.01213)
	Oil clearance mm (in)				Standard	0.013 — 0.031 (0.00051 — 0.00122)

B: COMPONENT

1. TIMING CHAIN

- Gasoline engine model

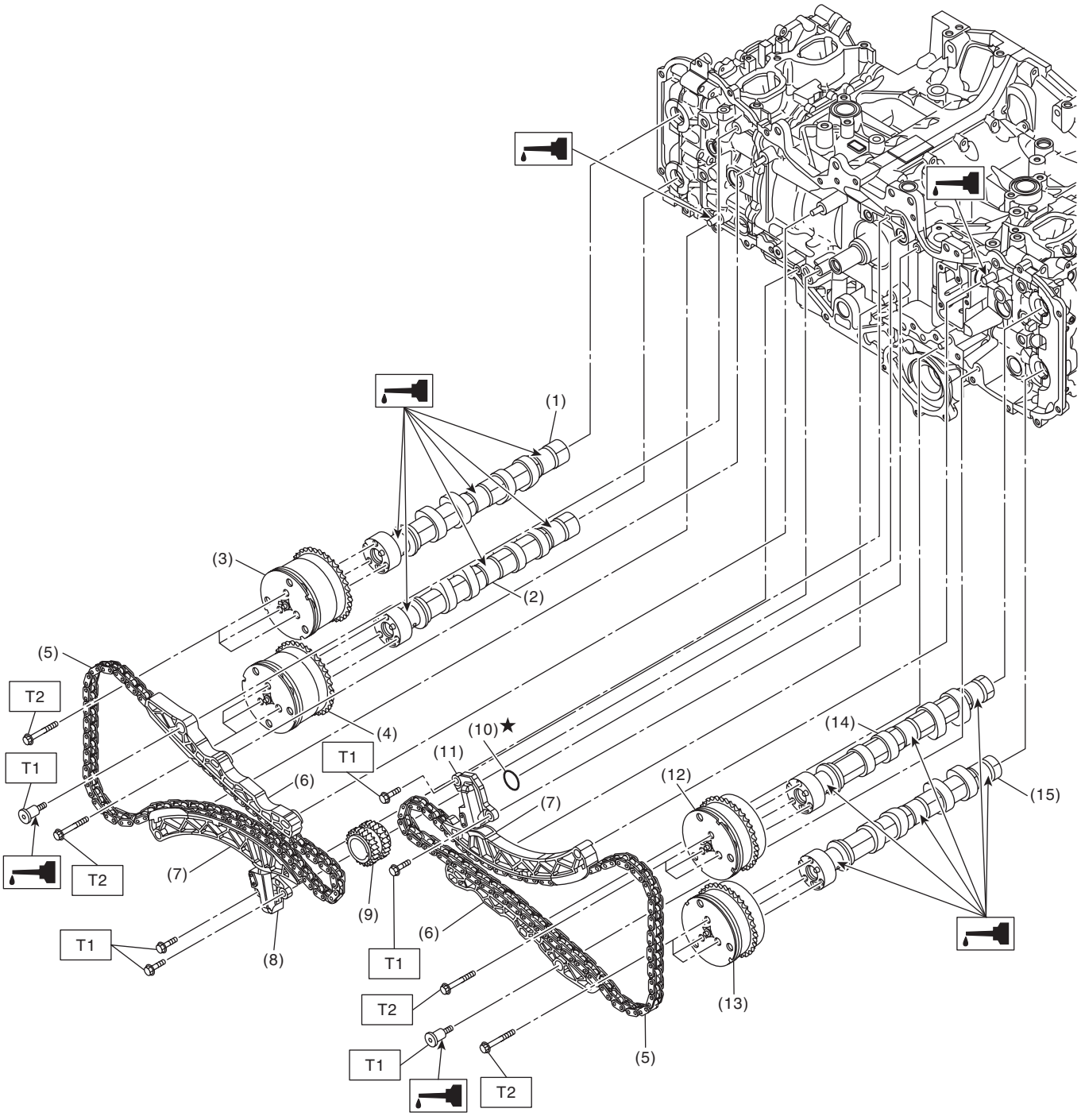


ME-08687

(1) Intake camshaft RH
(2) Exhaust camshaft RH
(3) Intake cam sprocket RH
(4) Exhaust cam sprocket RH
(5) Timing chain
(6) Chain guide
(7) Chain tension lever
(8) Chain tensioner RH
(9) Crank sprocket
(10) O-ring
(11) Chain tensioner LH
(12) Intake cam sprocket LH
(13) Exhaust cam sprocket LH
(14) Intake camshaft LH
(15) Exhaust camshaft LH

Tightening torque: N·m (kgf-m, ft-lb)
T1: 6.4 (0.7, 4.7)
T2: 18 (1.8, 13.3)

- HEV model



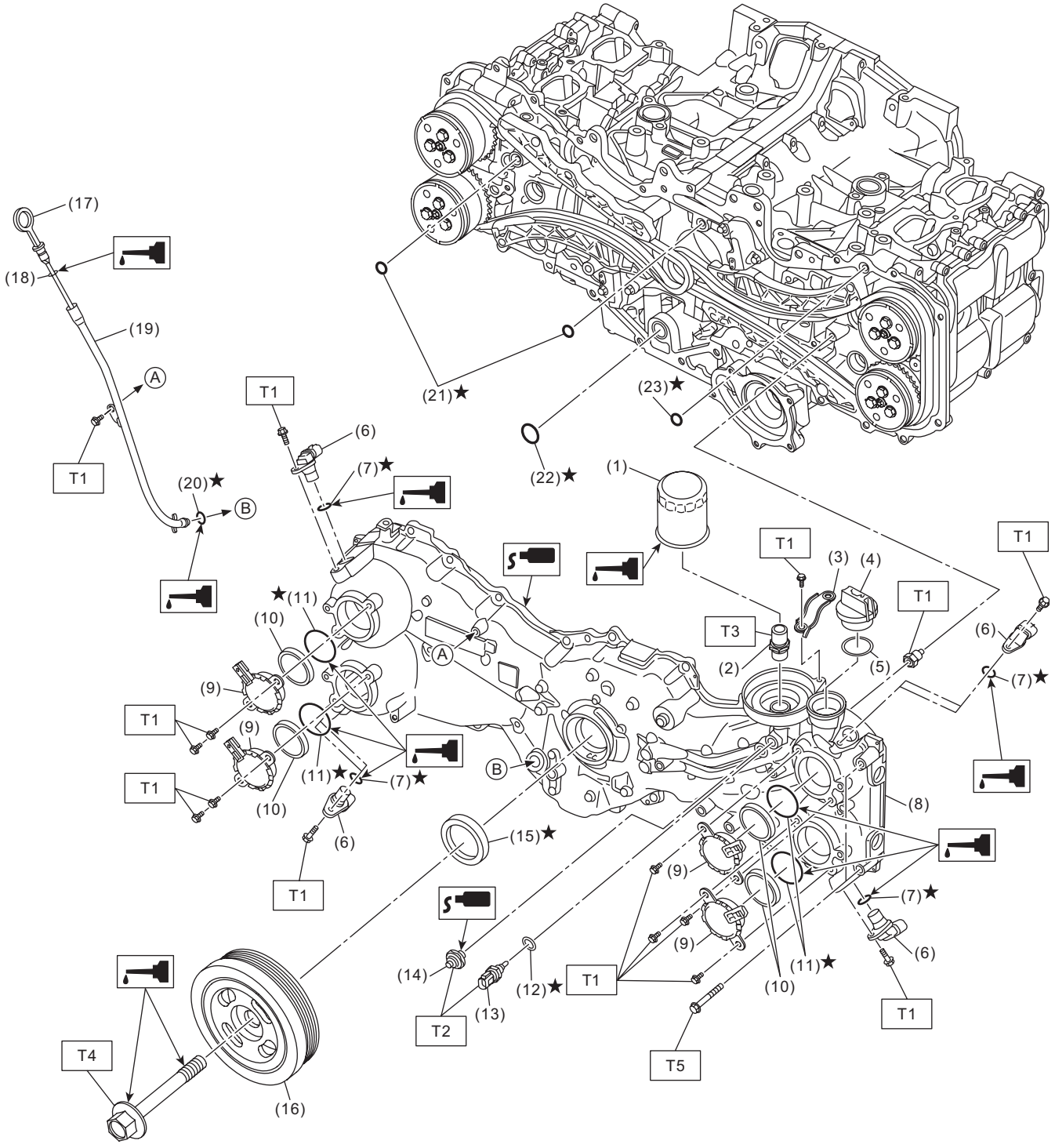
ME-06796

(1) Intake camshaft RH
(2) Exhaust camshaft RH
(3) Intake cam sprocket RH
(4) Exhaust cam sprocket RH
(5) Timing chain
(6) Chain guide
(7) Chain tension lever
(8) Chain tensioner RH
(9) Crank sprocket
(10) O-ring
(11) Chain tensioner LH
(12) Intake cam sprocket LH
(13) Exhaust cam sprocket LH
(14) Intake camshaft LH
(15) Exhaust camshaft LH

Tightening torque: N·m (kgf-m, ft-lb)
T1: 6.4 (0.7, 4.7)
T2: 18 (1.8, 13.3)

2. CHAIN COVER

- Gasoline engine model



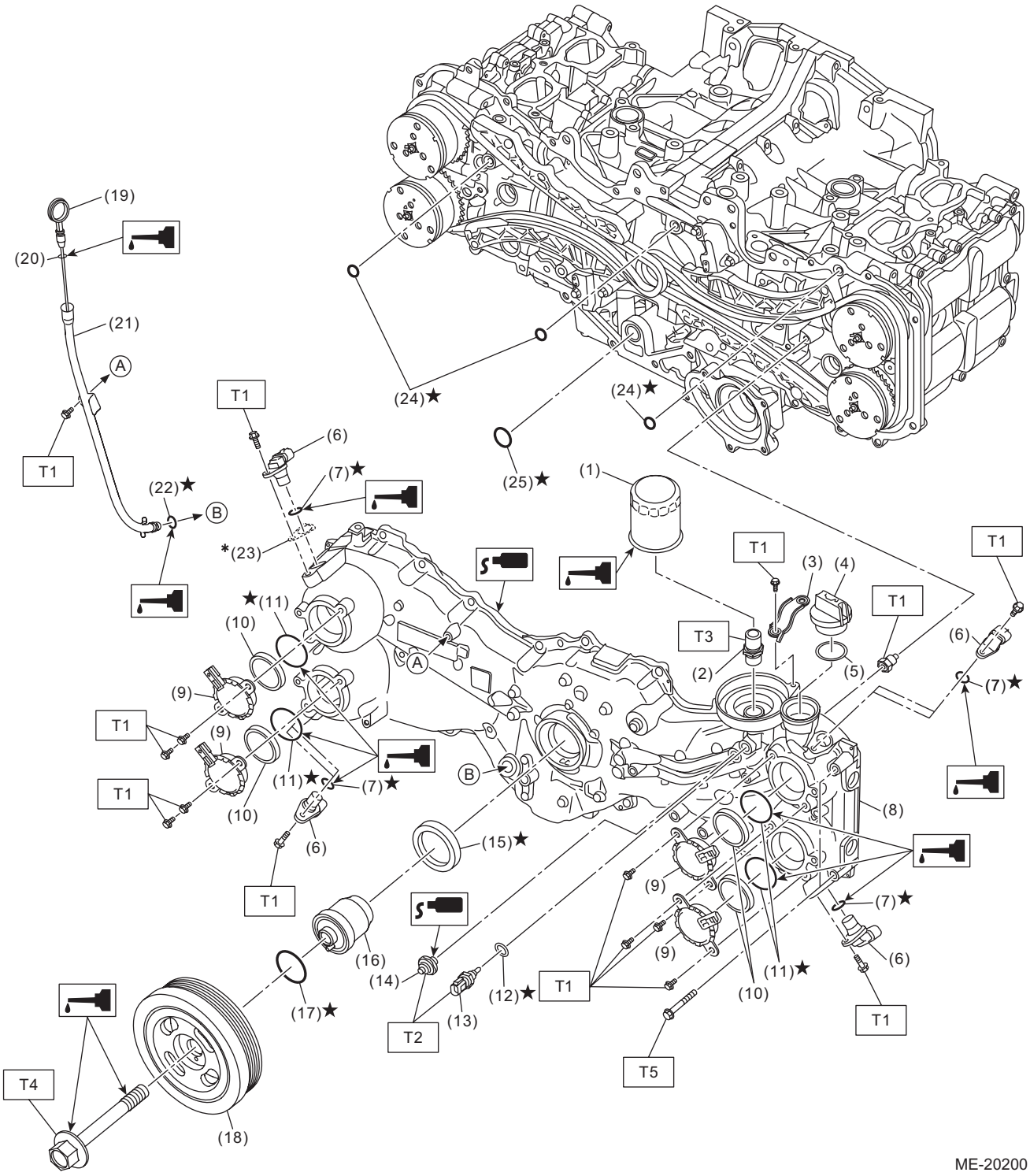
ME-20199

(1) Oil filter
(2) Oil pump union
(3) Generator cord stay
(4) Oil filler cap
(5) Gasket
(6) Camshaft position sensor
(7) O-ring
(8) Chain cover
(9) Oil control solenoid
(10) Back-up ring
(11) O-ring
(12) Gasket
(13) Engine oil temperature sensor
(14) Oil pressure switch
(15) Front oil seal
(16) Crank pulley
(17) Oil level gauge
(18) O-ring
(19) Oil level gauge guide
(20) O-ring
(21) O-ring
(22) O-ring

Tightening torque: N·m (kgf-m, ft-lb)

T1: 6.4 (0.7, 4.7)
T2: 18 (1.8, 13.3)
T3: 45 (4.6, 33.2)
T4: <Ref. to ME(H4DO(w/o HEV))-142, INSTALLATION, Crank Pulley.>
T5: <Ref. to ME(H4DO(w/o HEV))-156, INSTALLATION, Chain Cover.>

- HEV model


(19)
(20)
(21)
A
T1
(22)★
B
*(23)
(24)★
(24)★
(25)★
(1)
(6)
(7)★
T1
T1
(3)
(4)
T1
T1
T3
(2)
(5)
(6)
(7)★
★(11)
(10)
(9)
T1
(9)
(11)★
(7)★
(10)
T1
(6)
T1
(15)★
(8)
(9)
(7)★
(9)
(6)
(11)★
(10)
(16)
(14)
(12)★
T1
(13)
T2
T5
T1
(17)★
T4
(18)
ME-20200

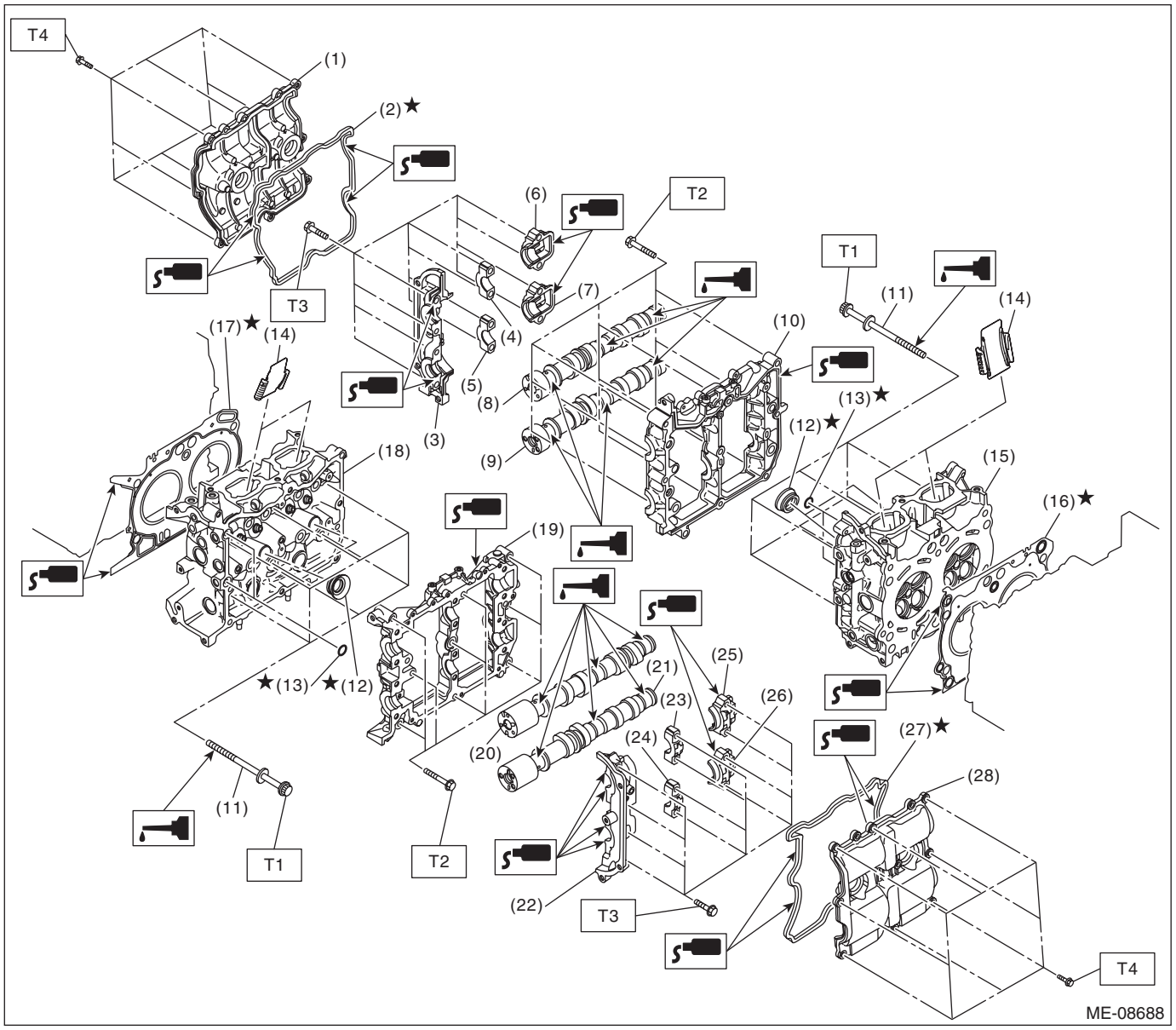
(1) Oil filter
(2) Oil pump union
(3) Battery cable stay
(4) Oil filler cap
(5) Gasket
(6) Camshaft position sensor
(7) O-ring
(8) Chain cover
(9) Oil control solenoid
(10) Back-up ring
(11) O-ring
(12) Gasket
(13) Engine oil temperature sensor
(14) Oil pressure switch
(15) Front oil seal
(16) Crank pulley boss
(17) O-ring
(18) Crank pulley
(19) Oil level gauge
(20) O-ring
(21) Oil level gauge guide
(22) O-ring
(23) Spacer
(24) O-ring
(25) O-ring

* Zero or one spacer for gap adjustment.

Tightening torque: N·m (kgf-m, ft-lb)

- ***T1: 6.4 (0.7, 4.7)***
- ***T2: 18 (1.8, 13.3)***
- ***T3: 45 (4.6, 33.2)***
- ***T4: <Ref. to ME(H4DO(w/o HEV))-142, INSTALLATION, Crank Pulley.>***
- ***T5: <Ref. to ME(H4DO(w/o HEV))-156, INSTALLATION, Chain Cover.>***

3. CYLINDER HEAD AND CAMSHAFT



(1) Rocker cover RH
(2) Rocker cover gasket RH
(3) Front camshaft cap RH
(4) Intake center camshaft cap RH
(5) Exhaust center camshaft cap RH
(6) Intake rear camshaft cap RH
(7) Exhaust rear camshaft cap RH
(8) Intake camshaft RH
(9) Exhaust camshaft RH
(10) Cam carrier RH
(11) Cylinder head bolt
(12) Spark plug pipe gasket
(13) O-ring
(14) Cylinder head plate
(15) Cylinder head RH
(16) Cylinder head gasket RH
(17) Cylinder head gasket LH
(18) Cylinder head LH
(19) Cam carrier LH
(20) Intake camshaft LH
(21) Exhaust camshaft LH
(22) Front camshaft cap LH
(23) Intake center camshaft cap LH
(24) Exhaust center camshaft cap LH
(25) Intake rear camshaft cap LH
(26) Exhaust rear camshaft cap LH
(27) Rocker cover gasket LH
(28) Rocker cover LH

Tightening torque: N·m (kgf-m, ft-lb)

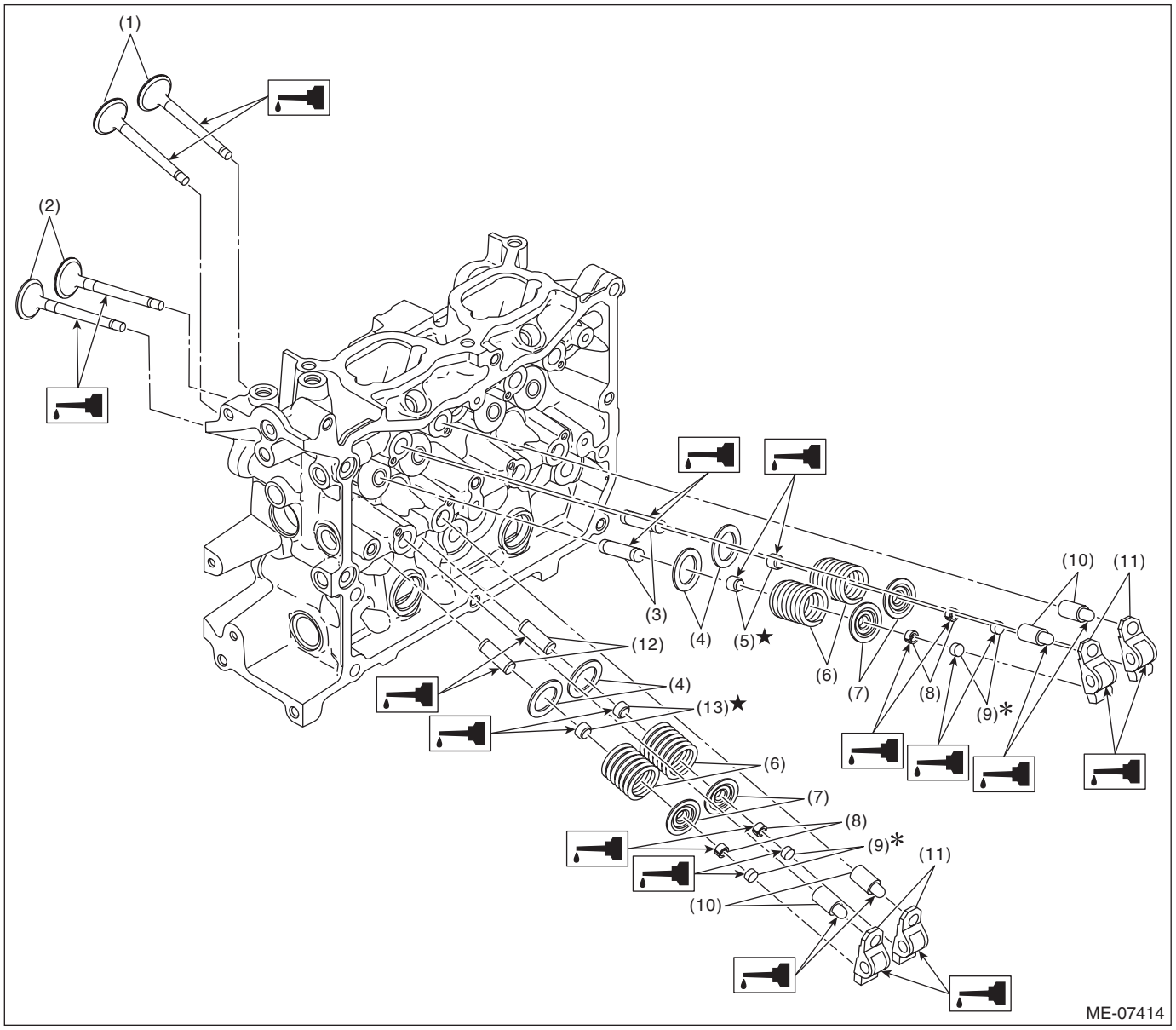
T1: ***<Ref. to ME(H4DO(w/o HEV))-265, INSTALLATION, Cylinder Head.>***

T2: ***<Ref. to ME(H4DO(w/o HEV))-230, INSTALLATION, Cam Carrier.>***

T3: ***<Ref. to ME(H4DO(w/o HEV))-253, ASSEMBLY, Cam Carrier.>***

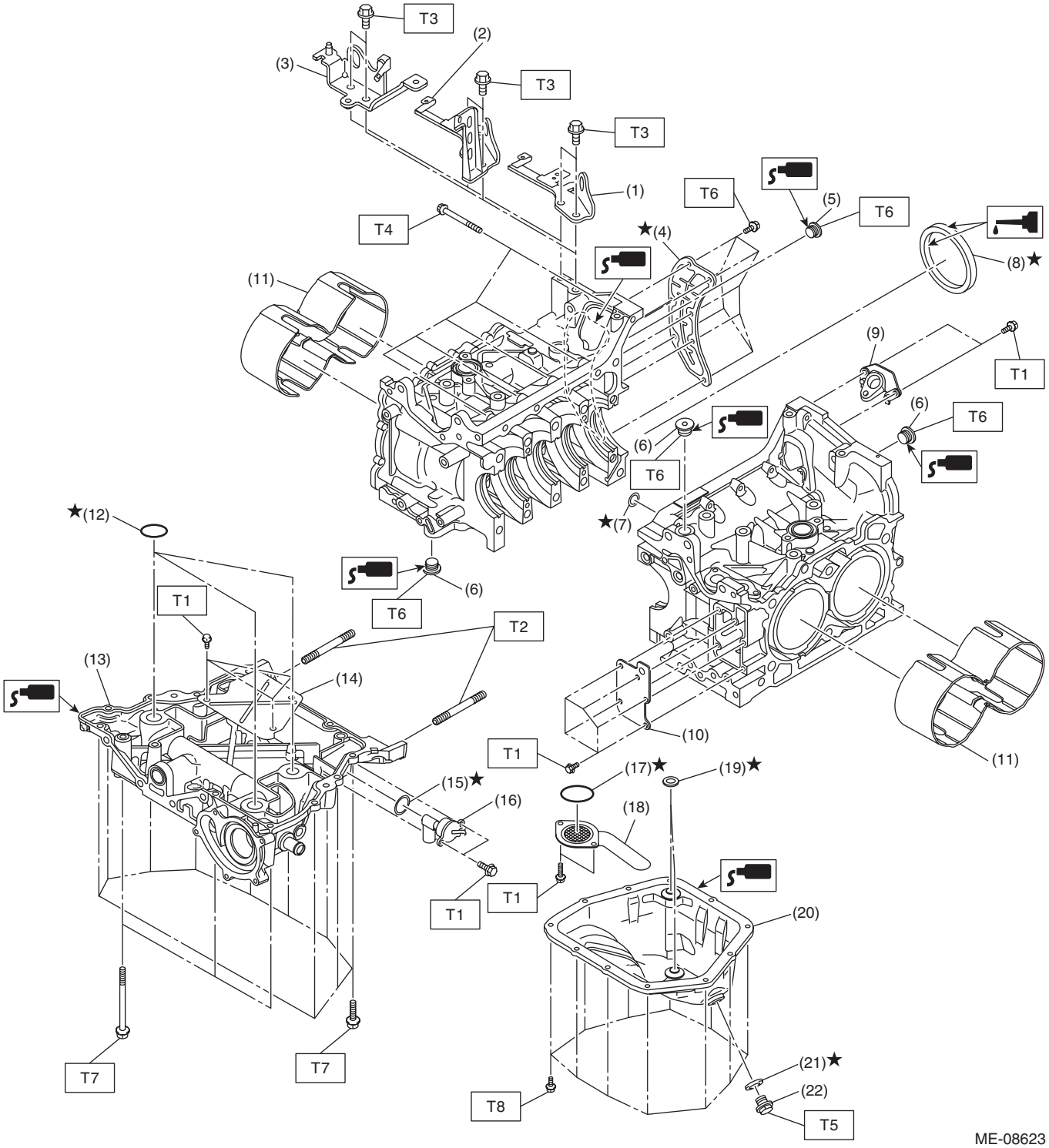
T4: ***<Ref. to ME(H4DO(w/o HEV))-210, INSTALLATION, Rocker Cover.>***

4. VALVE ASSY



(1) Exhaust valve
(2) Intake valve
(3) Intake valve guide
(4) Valve spring seat
(5) Intake valve oil seal
(6) Valve spring
(7) Valve spring retainer
(8) Valve collet
(9) Valve shim
(10) Roller rocker arm pivot
(11) Roller rocker arm
(12) Exhaust valve guide
(13) Exhaust valve oil seal

5. CYLINDER BLOCK 1

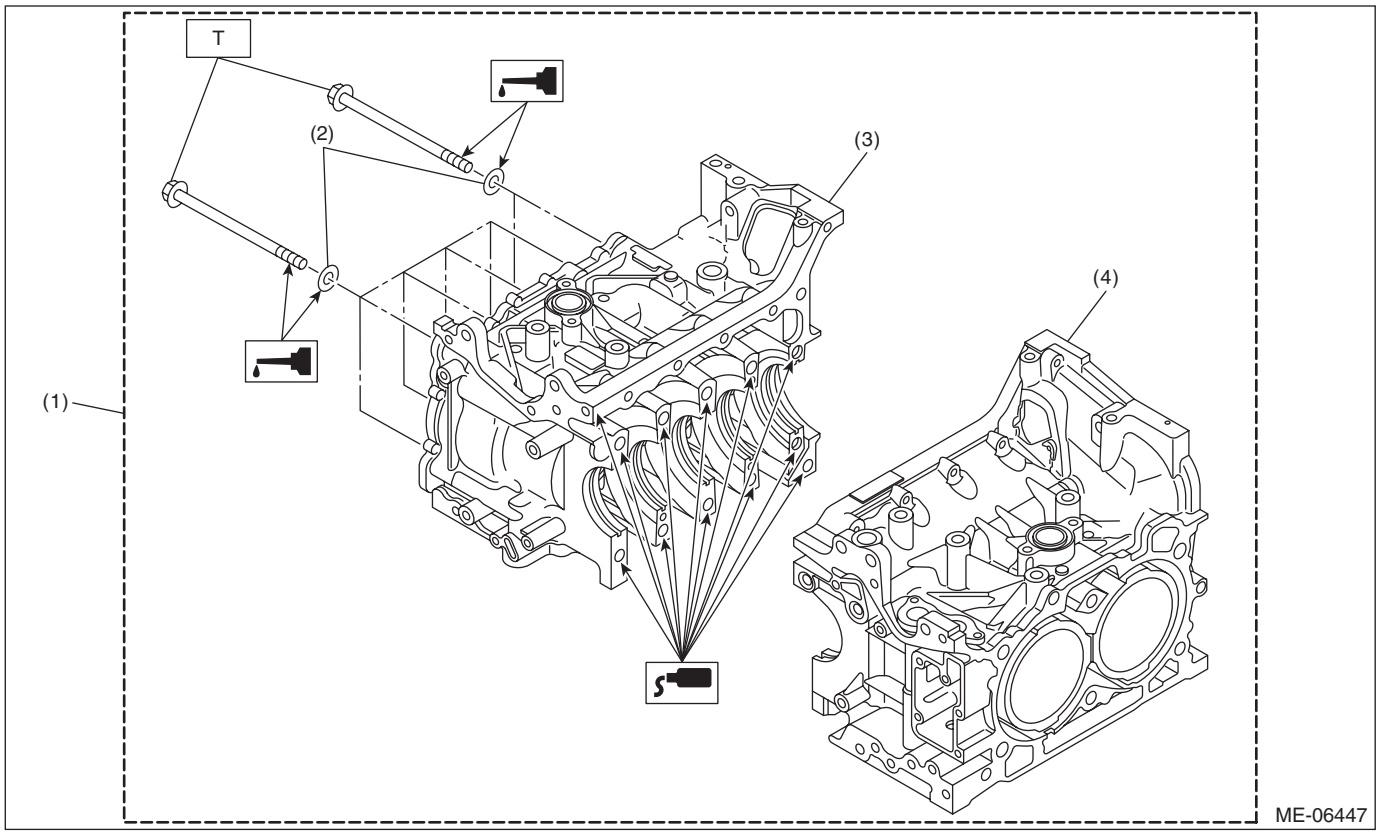


(1)	Engine rear hanger (gasoline engine CVT model)	(12)	O-ring	
(2)	Engine rear hanger (gasoline engine MT model)	(13)	Oil pan upper	
(3)	Engine rear hanger (HEV model)	(14)	Baffle plate	
(4)	Oil separator cover	(15)	O-ring	
(5)	Cylinder block plug	(16)	Oil level switch	
(6)	Main gallery plug	(17)	O-ring	
(7)	O-ring	(18)	Oil strainer	
(8)	Rear oil seal	(19)	Oil pan seal ring	
(9)	Crankshaft position sensor holder	(20)	Oil pan	
(10)	Cylinder block plate	(21)	Drain plug gasket	
(11)	Water jacket spacer	(22)	Drain plug	

Tightening torque: N·m (kgf-m, ft-lb)

- ***T1: 6.4 (0.7, 4.7)***
- ***T2: 10 (1.0, 7.4)***
- ***T3: 21 (2.1, 15.5)***
- ***T4: 25 (2.5, 18.4)***
- ***T5: 41.7 (4.3, 30.8)***
- ***T6: <Ref. to ME(H4DO(w/o HEV))-374, CYLINDER BLOCK, ASSEMBLY, Cylinder Block.>***
- ***T7: <Ref. to ME(H4DO(w/o HEV))-323, INSTALLATION, Cylinder Block.>***
- ***T8: <Ref. to LU(H4DO(w/o HEV))-19, OIL PAN, INSTALLATION, Oil Pan and Strainer.>***

6. CYLINDER BLOCK 2

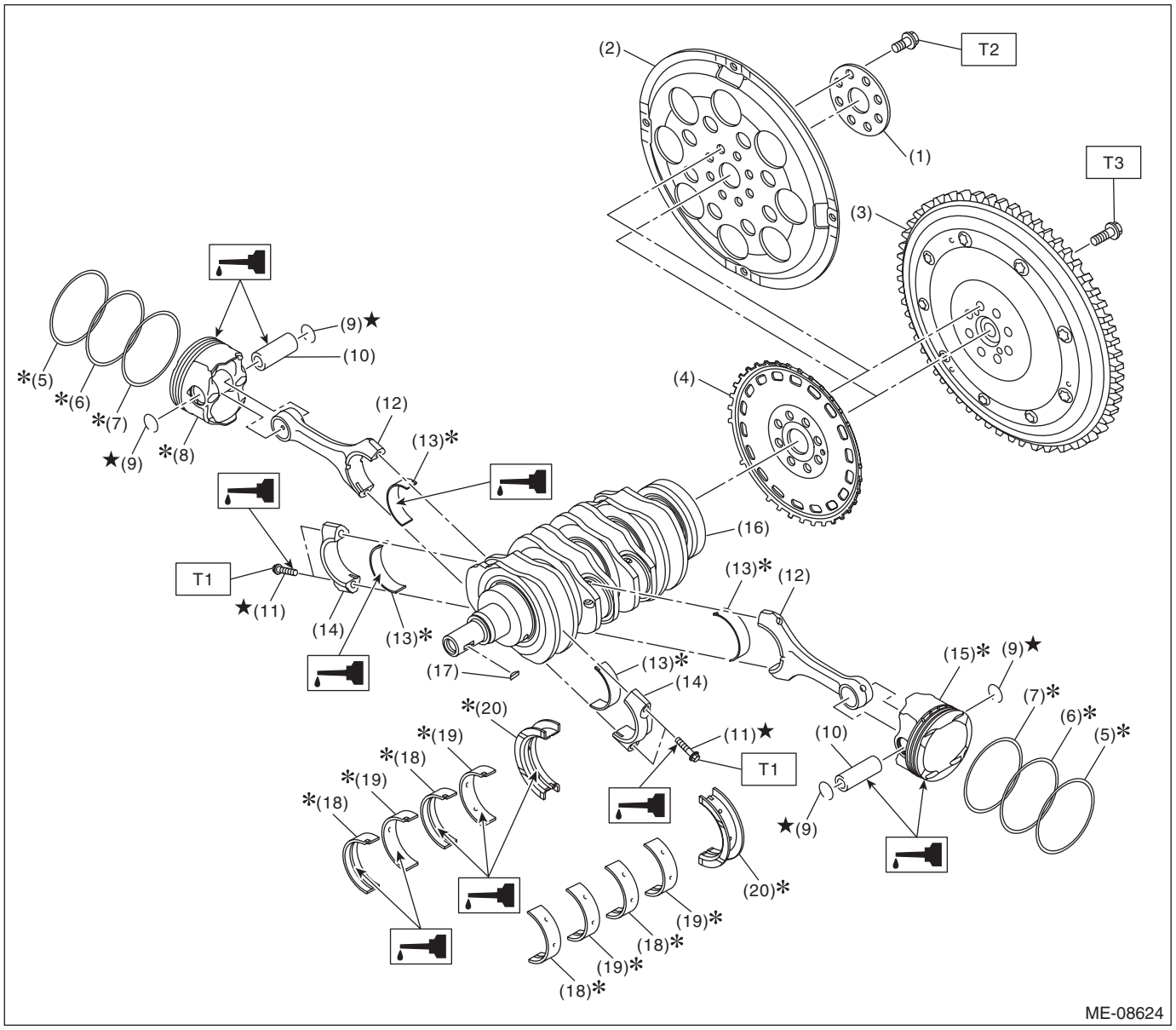


(1)	Cylinder block ASSY	(3)	Cylinder block RH
(2)	Washer	(4)	Cylinder block LH

Tightening torque: N·m (kgf-m, ft-lb)

- ***T: <Ref. to ME(H4DO(w/o HEV))-323, INSTALLATION, Cylinder Block.>***

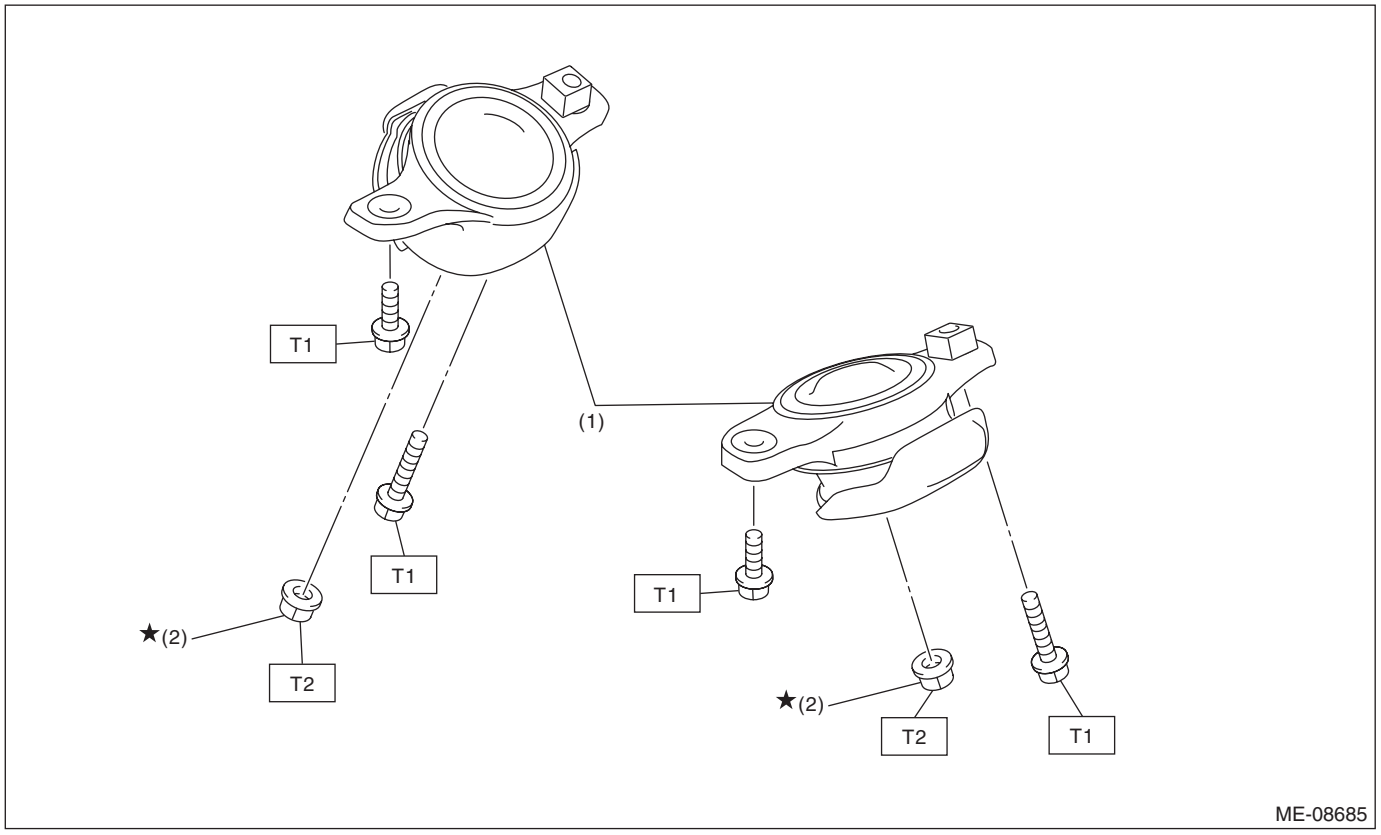
7. CRANKSHAFT AND PISTON



(1)	Reinforcement drive plate (CVT model)	(10)	Piston pin	(19)	Crankshaft bearing #2, #4
(2)	Drive plate (CVT model)	(11)	Connecting rod cap bolt	(20)	Crankshaft bearing #5
(3)	Flywheel (MT model)	(12)	Connecting rod		
(4)	Crankshaft position sensor plate	(13)	Connecting rod bearing	***Tightening torque: N·m (kgf-m, ft-lb)***	
(5)	Top ring	(14)	Connecting rod cap	***T1:***	***<Ref. to ME(H4DO(w/o HEV))-323, INSTALLATION, Cylinder Block.>***
(6)	Second ring	(15)	Piston LH	***T2:***	***<Ref. to CVT(TR580)-163, INSTALLATION, Drive Plate.> <Ref. to CVT(TH58A)-176, INSTALLATION, Drive Plate.>***
(7)	Oil ring	(16)	Crankshaft	***T3:***	***<Ref. to CL-11, INSTALLATION, Flywheel.>***
(8)	Piston RH	(17)	Woodruff key		
(9)	Circlip	(18)	Crankshaft bearing #1, #3		

8. ENGINE MOUNTING

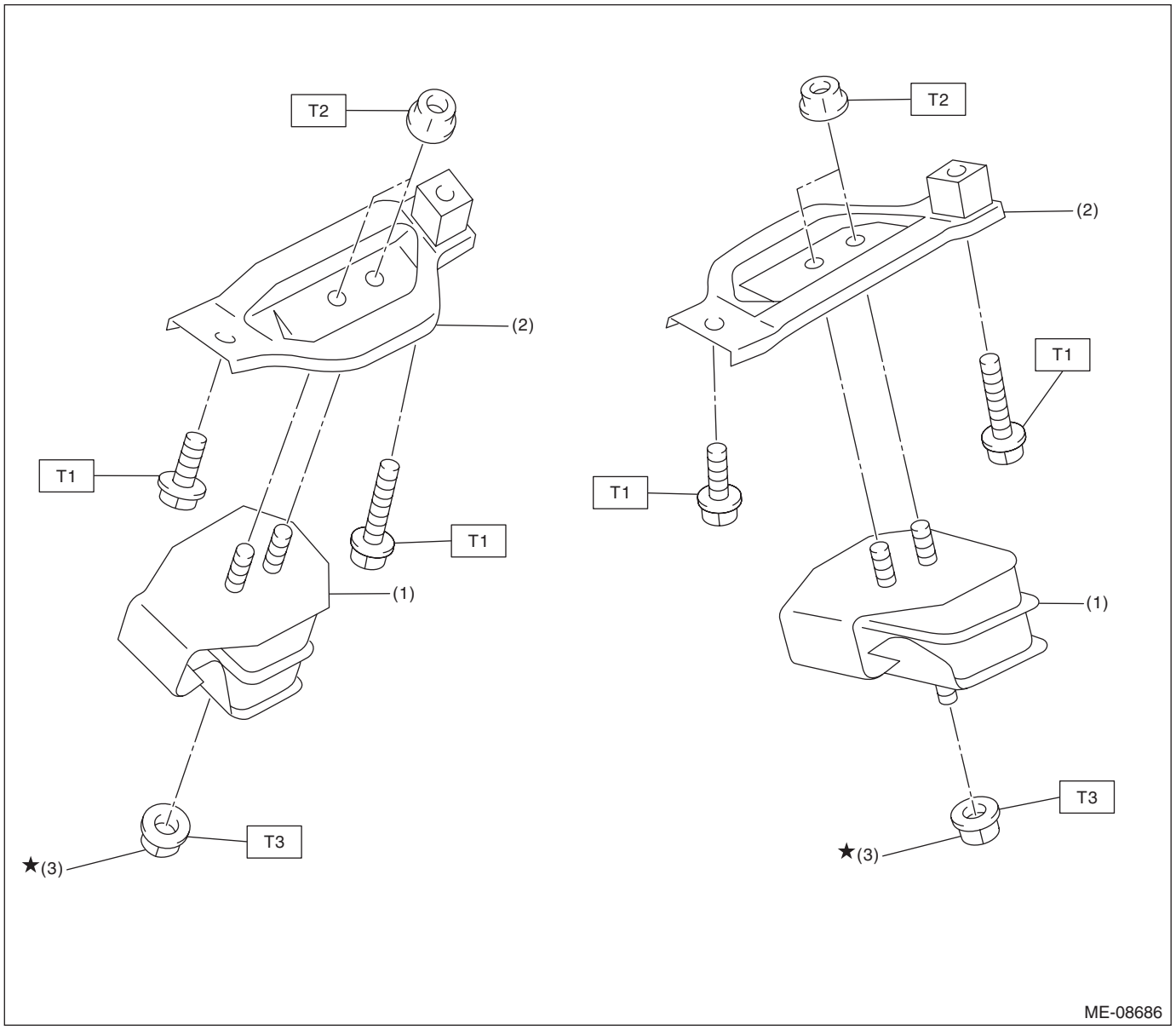
- CVT model



(1) Front cushion rubber
(2) Nut

Tightening torque: N·m (kgf-m, ft-lb)
T1: 35 (3.6, 25.8)
T2: 60 (6.1, 44.3)

- MT model



(1) Front cushion rubber
(2) Front engine mounting bracket
(3) Nut

Tightening torque: N·m (kgf-m, ft-lb)
T1: 35 (3.6, 25.8)
T2: 42 (4.3, 31.0)
T3: 60 (6.1, 44.3)

C: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a work cap, and protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove or install the engine in an area where chain hoists, lifting devices, etc. are available for ready use. When lifting up the vehicle, make sure to support the vehicle at the jack-up points.
- Be careful not to let any oil or grease contact the clutch disc or flywheel.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Rotating parts and sliding parts such as piston, bearing and gear should be coated with oil when being assembled.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.

D: PREPARATION TOOL

1. SPECIAL TOOL

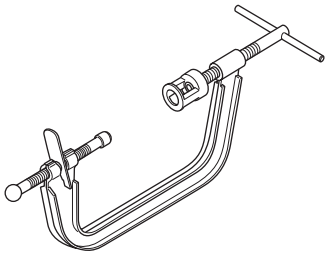
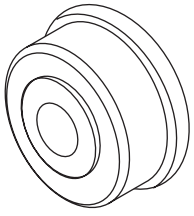
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST0920287002000	0920287002000	REMOVER AND REPLACER	Used for removing and installing valve spring.
 ST41399FG020	41399FG020	SPECIAL TOOL B	Used for installing the front oil seal of engine.

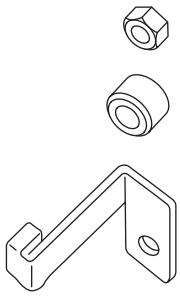
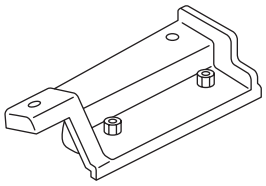
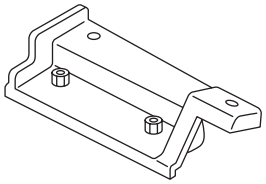
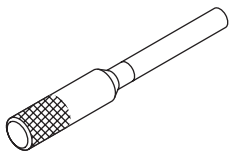
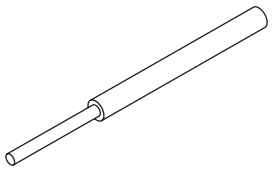
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-498277200	498277200	STOPPER SET	Used for preventing the torque converter from falling when removing and installing the engine. (CVT model)
 ST-498457000	498457000	ENGINE STAND ADAPTER RH	• Used for disassembling and assembling engine. • Used together with ENGINE STAND (499817100) and ADAPTER (18362AA020).
 ST-498457100	498457100	ENGINE STAND ADAPTER LH	• Used for disassembling and assembling engine. • Used together with ENGINE STAND (499817100) and ADAPTER (18362AA020).
 ST-499267300	499267300	STOPPER PIN	Used for removing and installing the V-belt tensioner assembly. (HEV model)
 ST-499765700	499765700	VALVE GUIDE REMOVER AND INSTALLER	Used for removing and installing valve guide.

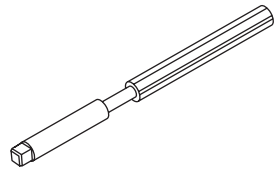
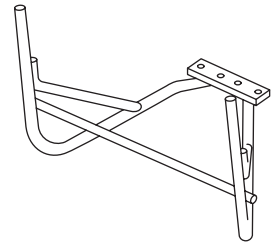
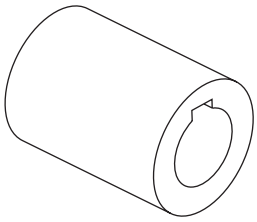
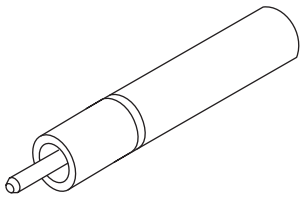
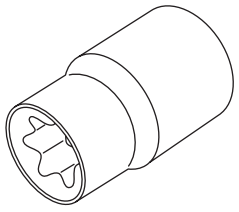
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499765900	499765900	VALVE GUIDE REAMER	Used for reaming valve guides.
 ST-499817100	499817100	ENGINE STAND	• Used for disassembling and assembling engine. • Used together with ADAPTER (18362AA020), ENGINE STAND ADAPTER RH (498457000) and LH (498457100).
 ST18252AA000	18252AA000	CRANKSHAFT SOCKET	Used for rotating crankshaft.
 ST18261AA010	18261AA010	VALVE OIL SEAL GUIDE	Used for press-fitting of intake valve guide stem seals and exhaust valve guide stem seals.
 ST18270AA020	18270AA020	SOCKET	Used for removing and installing connecting rod.

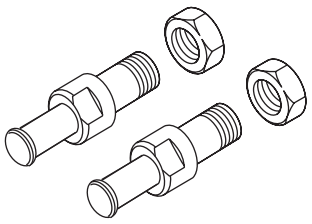
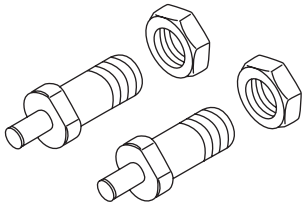
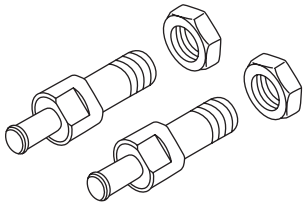
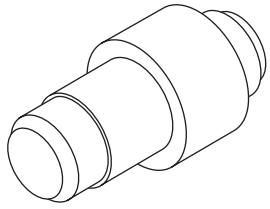
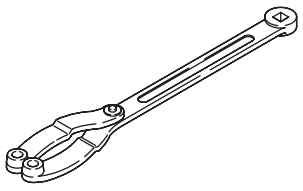
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18334AA000	18334AA000	PULLEY WRENCH PIN SET	• Used for removing and installing the crank pulley. • Used together with PULLEY WRENCH (18355AA000).
 ST18334AA020	18334AA020	PULLEY WRENCH PIN SET	• Used for removing and installing intake cam sprocket and exhaust cam sprocket. (Gasoline engine model) • Used together with PULLEY WRENCH (18355AA000).
 ST18334AA030	18334AA030	PULLEY WRENCH PIN SET	• Used for removing and installing intake cam sprocket and exhaust cam sprocket. (HEV model) • Used together with PULLEY WRENCH (18355AA000).
 ST18350AA000	18350AA000	CONNECTING ROD BUSHING REMOVER AND INSTALLER	Used for removing and installing the connecting rod bushing at connecting rod small end.
 ST18355AA000	18355AA000	PULLEY WRENCH	• Used for removing and installing the crank pulley. • Used for removing and installing intake cam sprocket and exhaust cam sprocket. • Used together with PULLEY WRENCH PIN SET (18334AA000) or PULLEY WRENCH PIN SET (18334AA030).

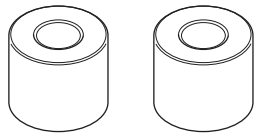
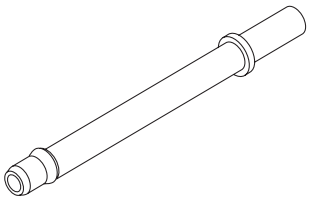
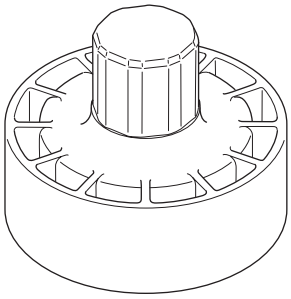
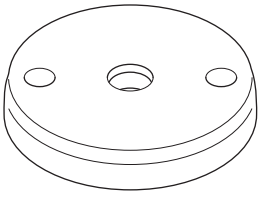
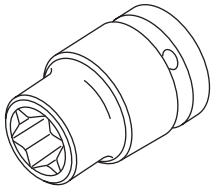
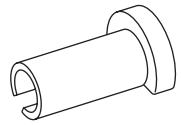
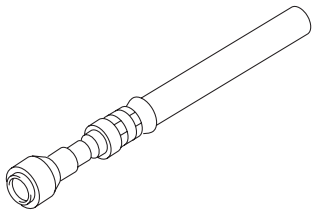
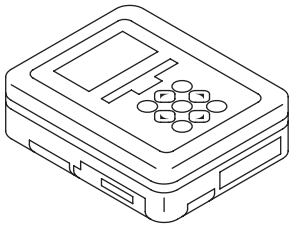
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18362AA020	18362AA020	ADAPTER	• Used for disassembling and assembling engine. • Used together with STAND (499817100), ENGINE STAND ADAPTER RH (498457000) and LH (498457100). • Bolt used: M10 × 50 (SUBARU genuine Part No.: 010410500)
 ST18471AA000	18471AA000	FUEL PIPE ADAPTER	Used for inspecting the fuel pressure.
 ST18657AA030	18657AA030	OIL SEAL INSTALLER	• Used for installing the rear oil seal of engine. • Used together with OIL SEAL GUIDE (18671AA020).
 ST18671AA020	18671AA020	OIL SEAL GUIDE	• Used for installing the rear oil seal of engine. • Used together with OIL SEAL INSTALLER (18657AA030).
 ST18270KA010	18270KA010	SOCKET	Used for installing and removing intake cam sprocket and exhaust cam sprocket.

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST42099AE000	42099AE000	QUICK CONNECTOR RELEASE	Used for removing FUEL HOSE (42075AG690). NOTE: FUEL HOSE (42075AG690) is used for checking the fuel pressure.
 ST42075AG690	42075AG690	FUEL HOSE	Used for inspecting the fuel pressure. NOTE: This is the SUBARU genuine part.
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for setting of each function and trouble-shooting for electrical system. NOTE: For detailed operation procedures of Subaru Select Monitor III, refer to “PC application help for Subaru Select Monitor”.

2. GENERAL TOOL

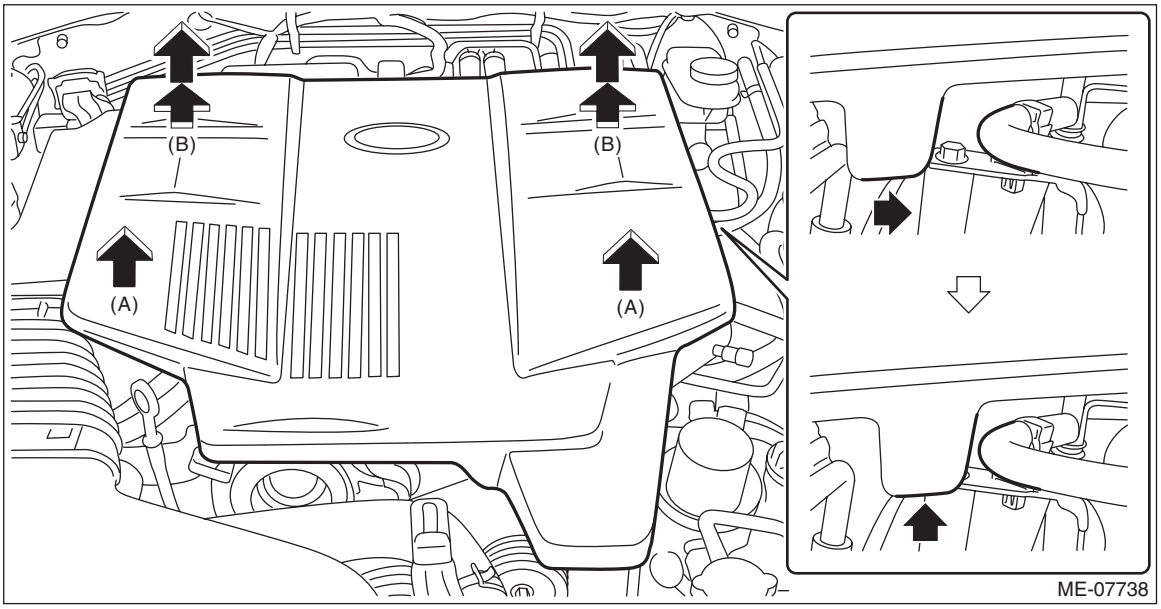
TOOL NAME	REMARKS
Compression gauge	Used for measuring compression.
Vacuum gauge	Used for measuring intake manifold vacuum.
Oil pressure gauge	Used for measuring engine oil pressure.
Fuel pressure gauge	Used for measuring fuel pressure.
Piston ring compressor	Used for installing the piston into the cylinder block.
Thickness gauge	Used for various inspections.
Angle gauge	Used for angle tightening.

2. Compression

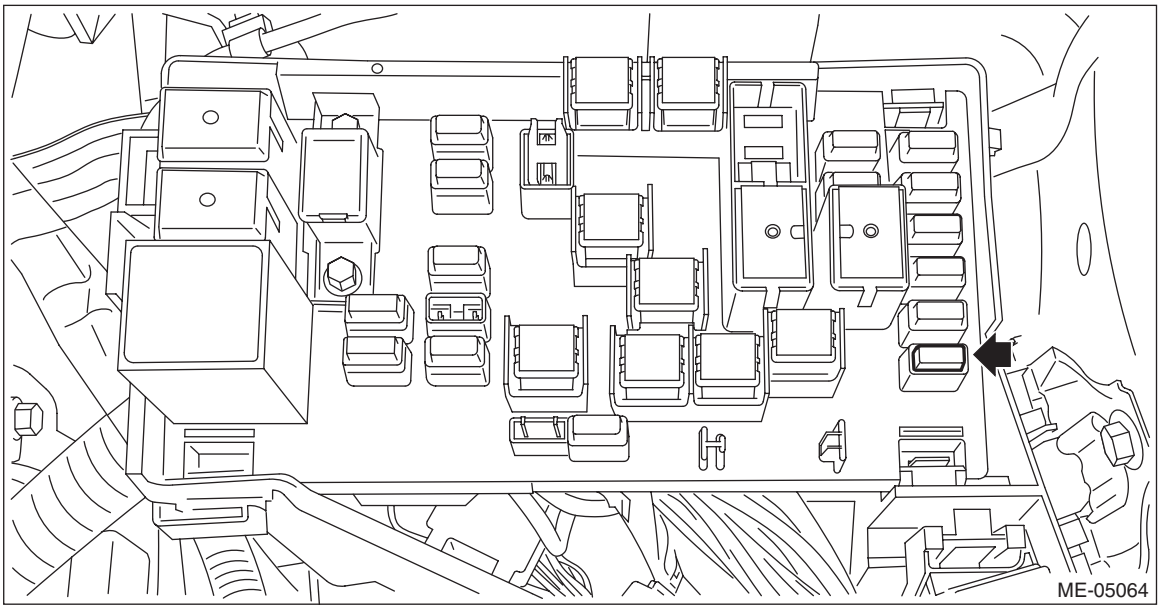
A: INSPECTION

CAUTION:
After warming-up, engine becomes very hot. Be careful not to burn yourself during measurement.
1) Turn the ignition switch to OFF.
2) Remove the collector cover. (HEV model)
   (1) Carefully pull up the front of collector cover at two positions (A).
   (2) Carefully pull up the rear of collector cover at two positions (B) while moving it backward.

NOTE:
Be careful not to contact the fuel delivery tube when moving the collector cover rearward.



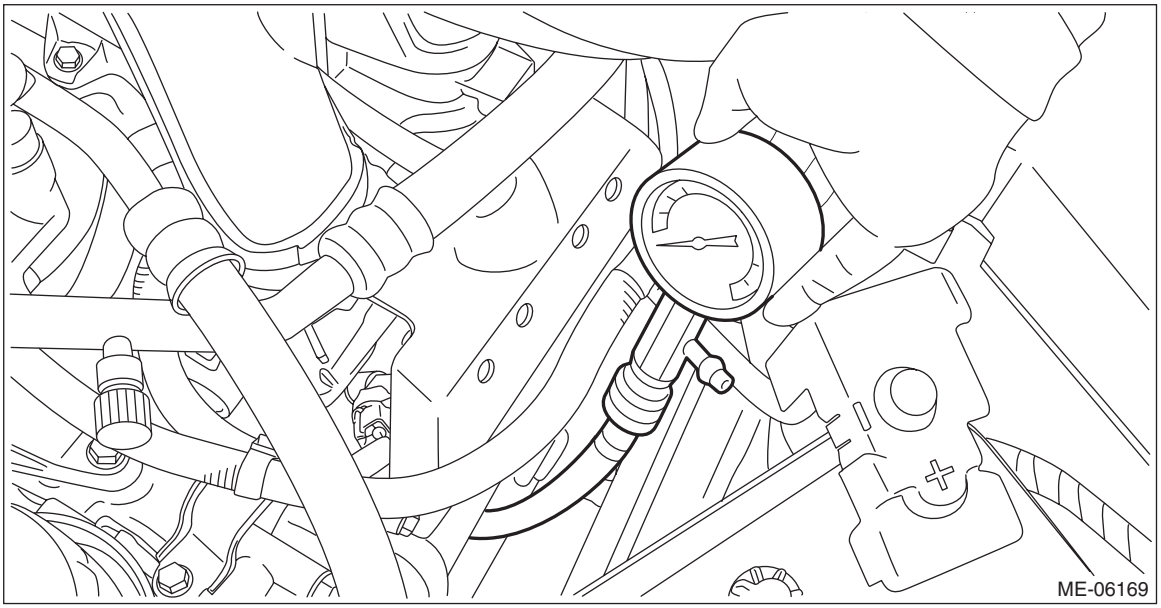
3) After warming-up the engine, turn the ignition switch to OFF.
4) Make sure that the battery (12 volt auxiliary battery) is fully charged.
5) Check the starter motor for satisfactory performance and operation.
6) Remove the fuse of fuel pump from main fuse box.



7) Start the engine and run it until it stalls.
8) After the engine stalls, crank it for five more seconds.

9) Turn the ignition switch to OFF.
10) Remove all spark plugs. <Ref. to IG(H4DO(w/o HEV))-4, REMOVAL, Spark Plug.>
11) Install the compression gauge to the spark plug hole.

NOTE:
When using a screw-in type compression gauge, the screw should be less than 25 mm (0.98 in) long.



12) Install the 12 volt engine restart battery. (HEV model) <Ref. to SC(H4DO(HEV))-42, 12 VOLT ENGINE RESTART BATTERY, INSTALLATION, Battery.>
13) Connect the battery ground terminal. <Ref. to NT-5, BATTERY, NOTE, Note.>
14) Turn the ignition switch to ON.
15) Depress the accelerator pedal to full throttle.
16) Crank the engine by starter motor and read the value when the needle of the compression gauge becomes stable.

NOTE:
- Perform at least two measurements per cylinder, and make sure that the values are correct.
- If the compression pressure is out of standard, check or adjust the pistons, valves and cylinders.

Compression (fully open throttle):
Standard
1,050 — 1,400 kPa (11 — 14 kg/cm^2, 152 — 203 psi)
Difference between cylinders
100 kPa (1 kg/cm^2, 14 psi), or less

17) After inspection, install the related parts in the reverse order of removal.

3. Idle Speed

A: INSPECTION

1) Before checking the idle speed, check the following item:
   (1) Check the air cleaner element is free from clogging, ignition timing is correct, spark plugs are in good condition, and hoses are connected properly.
   (2) Check the malfunction indicator light does not illuminate.
2) Warm up the engine.
3) Read the engine idle speed using Subaru Select Monitor. <Ref. to EN(H4DO w/o HEV)(diag)-37, DISPLAY ENGINE CURRENT DATA, OPERATION, Subaru Select Monitor.> <Ref. to EN(H4DO HEV)(diag)-36, DISPLAY CURRENT ENGINE DATA, OPERATION, Subaru Select Monitor.>

NOTE:
- Idle speed cannot be adjusted manually, because the idle speed is automatically adjusted.
- If idle speed is out of standard, refer to the General Diagnosis Table under “Engine Control System”. <Ref. to EN(H4DO w/o HEV)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(H4DO HEV)(diag)-2, Basic Diagnostic Procedure.>

   (1) Check the idle speed when no-loaded. (Headlight, blower fan, rear defroster, radiator fan, A/C and etc. are OFF)

Idle speed (No load, and for CVT model, select lever in “P” or “N” range, for MT model, gear shift lever in neutral position.):

Standard

650±100 r/min

   (2) Check the idle speed when loaded. (Turn the A/C switch to ON and operate the compressor for at least one minute before measurement.)

Idle speed (A/C on, and for CVT model, select lever in “P” or “N” range, for MT model, gear shift lever in neutral position.):

Standard

800 — 900±50 r/min

4. Ignition Timing

A: INSPECTION

CAUTION:
After warming-up, engine becomes very hot. Be careful not to burn yourself at measurement.

1) Before checking the ignition timing, check the following item:
   (1) Check the air cleaner element is free from clogging, spark plugs are in good condition, and hoses are connected properly.
   (2) Check the malfunction indicator light does not illuminate.
2) Warm up the engine.
3) Read the ignition timing using Subaru Select Monitor. <Ref. to EN(H4DO w/o HEV)(diag)-37, DISPLAY ENGINE CURRENT DATA, OPERATION, Subaru Select Monitor.> <Ref. to EN(H4DO HEV)(diag)-36, DISPLAY CURRENT ENGINE DATA, OPERATION, Subaru Select Monitor.>

NOTE:
If ignition timing is out of standard, check the ignition control system. Refer to “Engine Control System”. <Ref. to EN(H4DO w/o HEV)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(H4DO HEV)(diag)-2, Basic Diagnostic Procedure.>

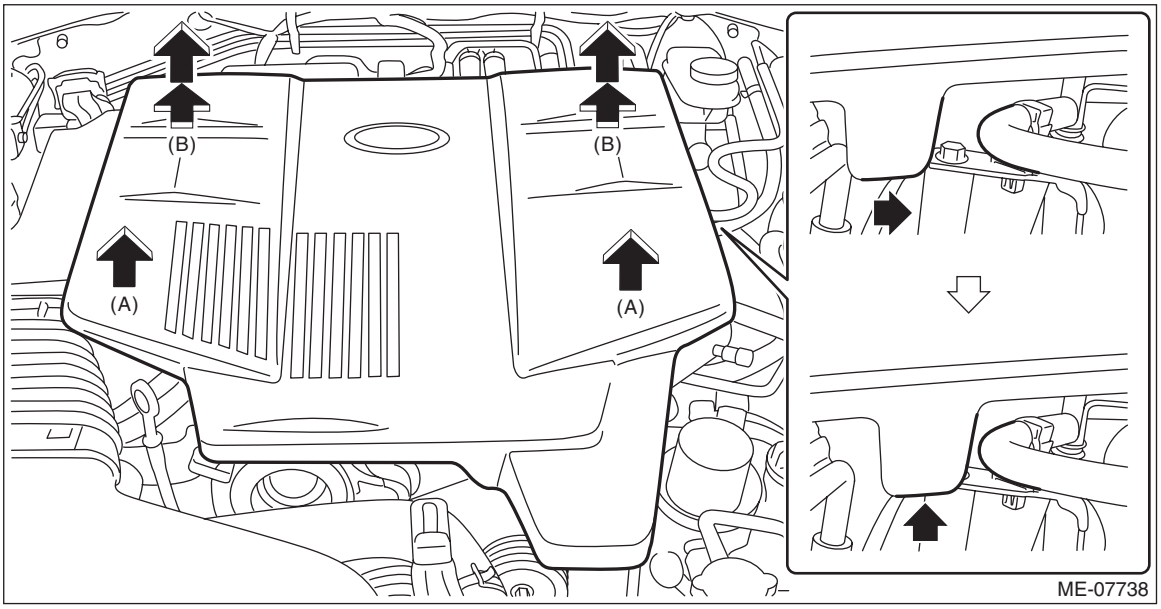
Ignition timing [BTDC/{r/min}]:
Standard
16°±10°/650 (gasoline engine CVT model)
12°±10°/650 (gasoline engine MT model)
10°±10°/650 (HEV model)

5. Intake Manifold Vacuum

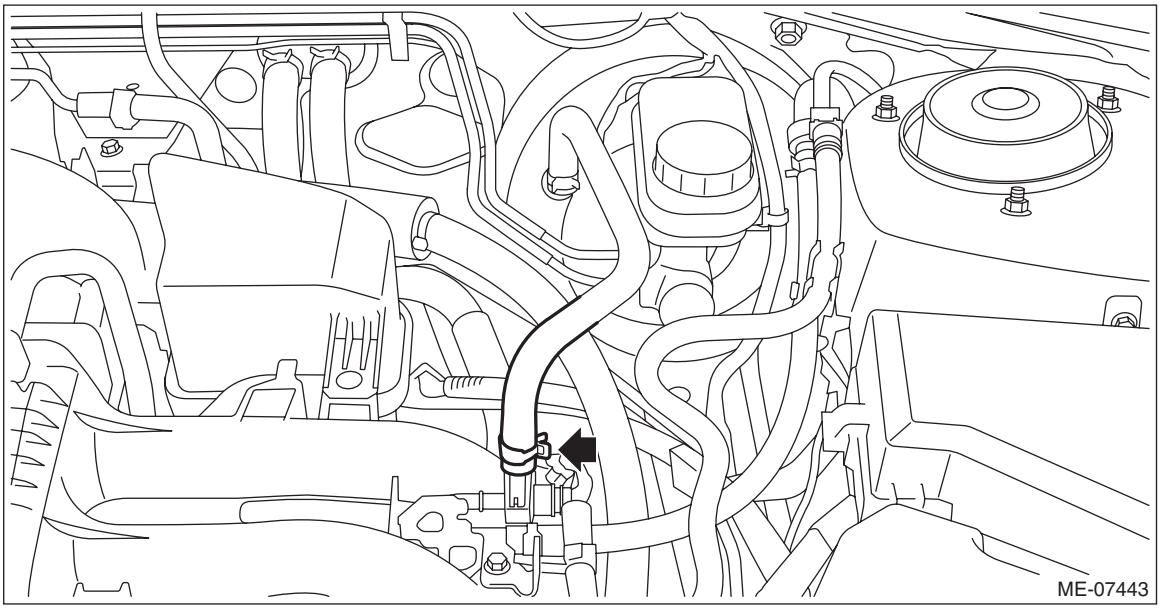
A: INSPECTION

1) Turn the ignition switch to OFF.
2) Remove the collector cover. (HEV model)
   (1) Carefully pull up the front of collector cover at two positions (A).
   (2) Carefully pull up the rear of collector cover at two positions (B) while moving it backward.

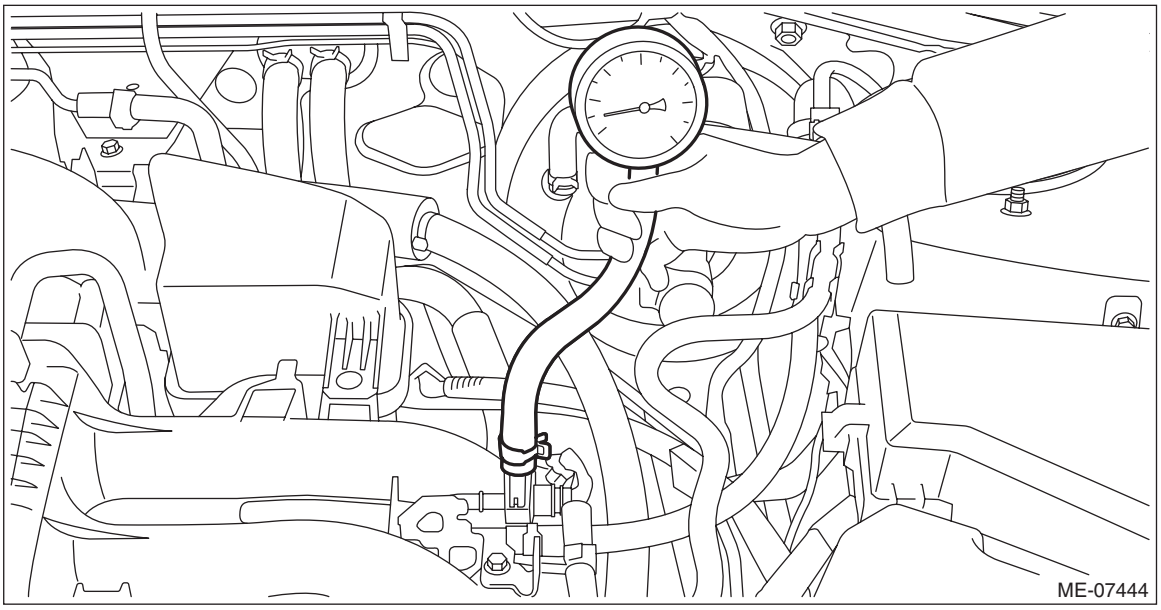
NOTE:
Be careful not to contact the fuel delivery tube when moving the collector cover rearward.



3) Warm up the engine.
4) Install the vacuum gauge. (Gasoline engine model)
   (1) Remove the brake booster vacuum hose from the intake manifold.



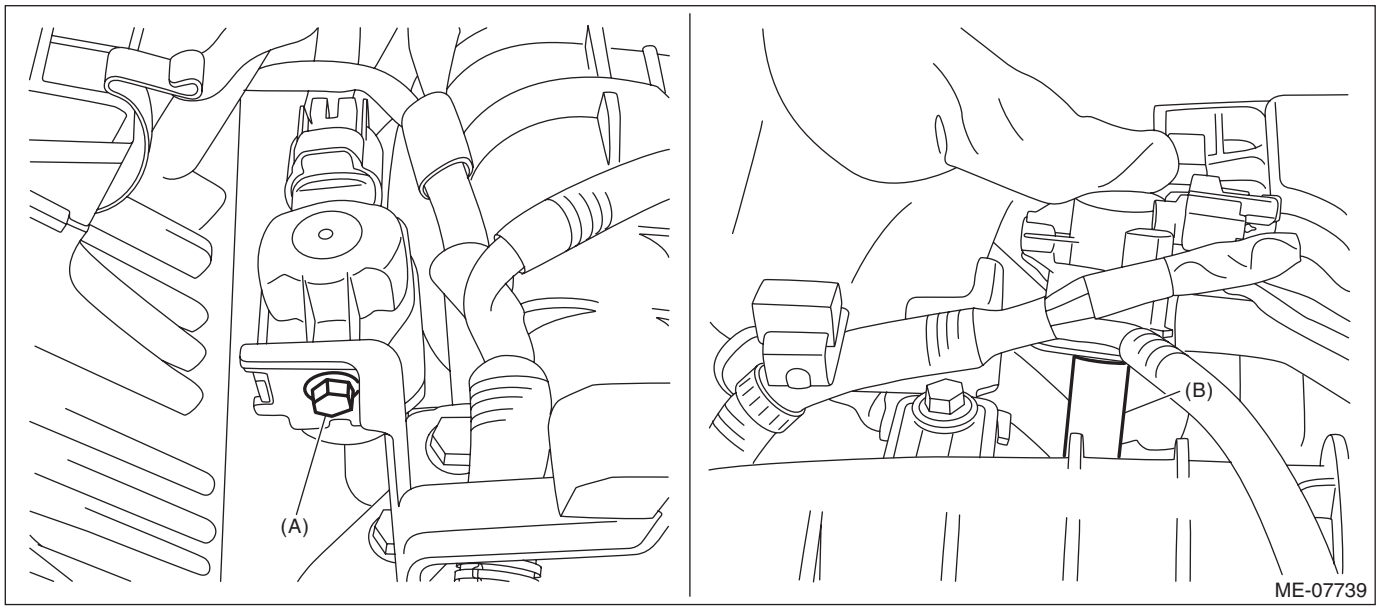
(2) Connect the vacuum gauge to the intake manifold.



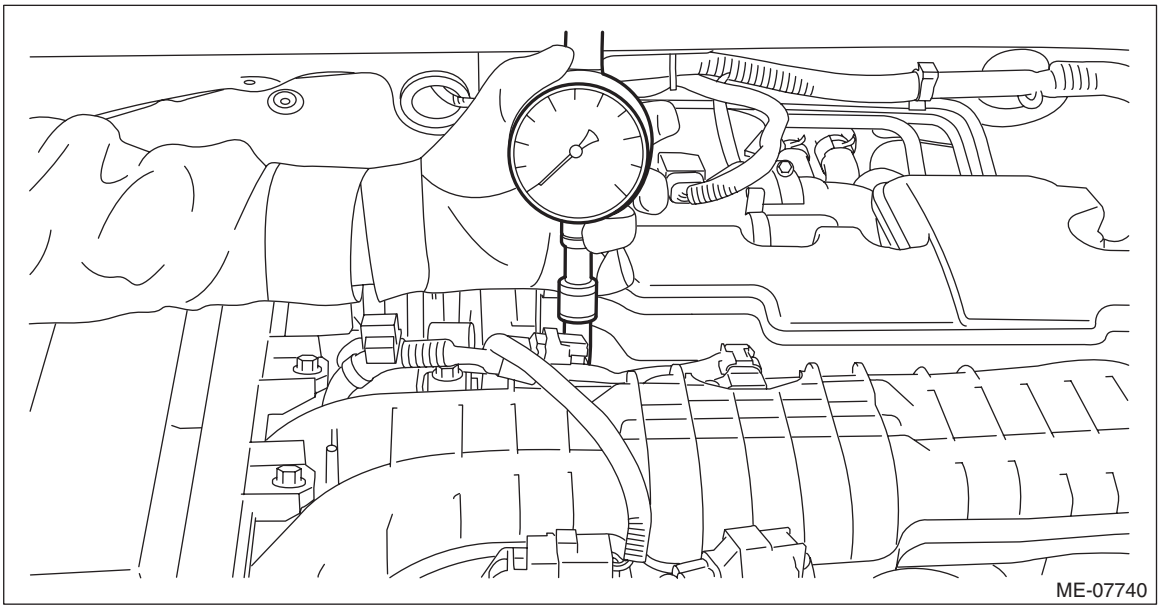
5) Install the vacuum gauge. (HEV model)

(1) Remove the nut (A) which secures purge control solenoid valve to the purge control solenoid valve bracket, and disconnect the vacuum hose (B) from the purge control solenoid valve.

NOTE:
Hold the purge control solenoid valve unit by hand to prevent it from rotating together.



(2) Connect the vacuum gauge to the vacuum hose.



6) Keep the engine at idle speed and read the vacuum gauge indication.

NOTE:
Condition of engine inside can be diagnosed by observing the behavior of the vacuum gauge needle as described in table below.

Intake manifold vacuum (at idling, A/C OFF):
Standard
–60.0 kPa (–450 mmHg, –17.72 inHg) or more

Diagnosis of engine condition by inspection of intake manifold vacuum	
Vacuum gauge needle behavior	Possible engine condition
1. Needle is steady but lower than standard value. This tendency becomes more evident as engine temperature rises.	Leakage around intake manifold gasket, disconnection or damage of vacuum hose
2. Needle intermittently drops to position lower than standard value.	Leakage around cylinder
3. Needle drops suddenly and intermittently from standard value.	Sticky valve
4. When engine speed is gradually increased, needle begins to vibrate rapidly at certain speed, and then vibration increases as engine speed increases.	Weak or broken valve springs
5. Needle vibrates above and below standard value in narrow range.	Defective ignition system

7) After inspection, install the related parts in the reverse order of removal.

NOTE:
When installing the purge control solenoid valve, hold the purge control solenoid valve unit by hand to prevent it from rotating together. (HEV model)

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

6. Engine Oil Pressure

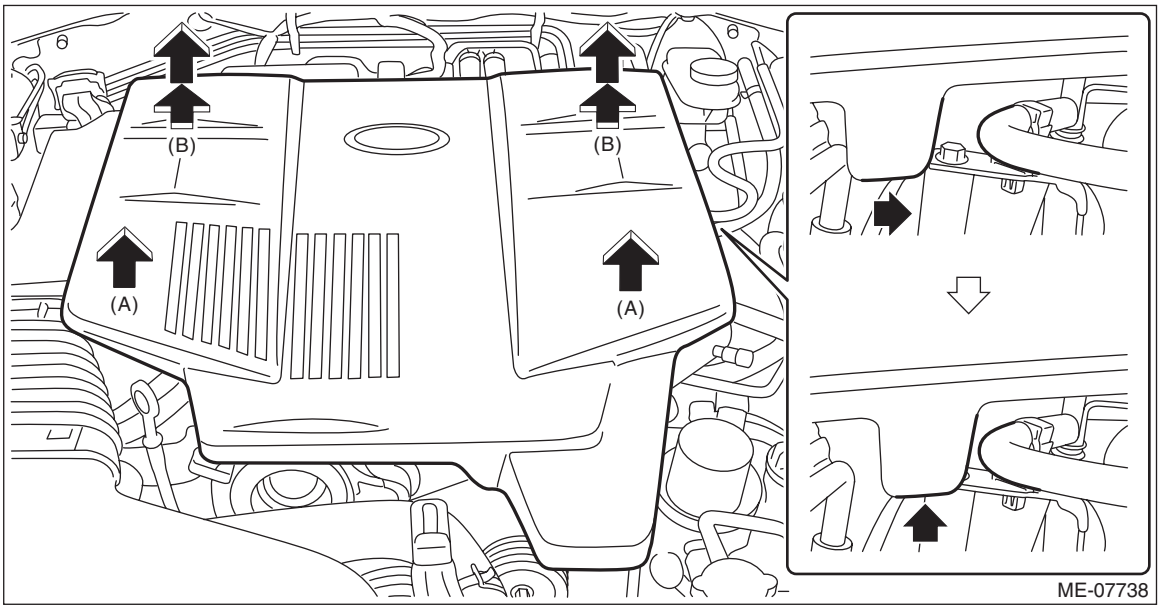
A: INSPECTION

1) Disconnect the ground cable from battery. <Ref. to NT-5, BATTERY, NOTE, Note.>

NOTE:
For the 12 volt engine restart battery of HEV model, disconnect the ground terminal from 12V engine restart battery sensor.

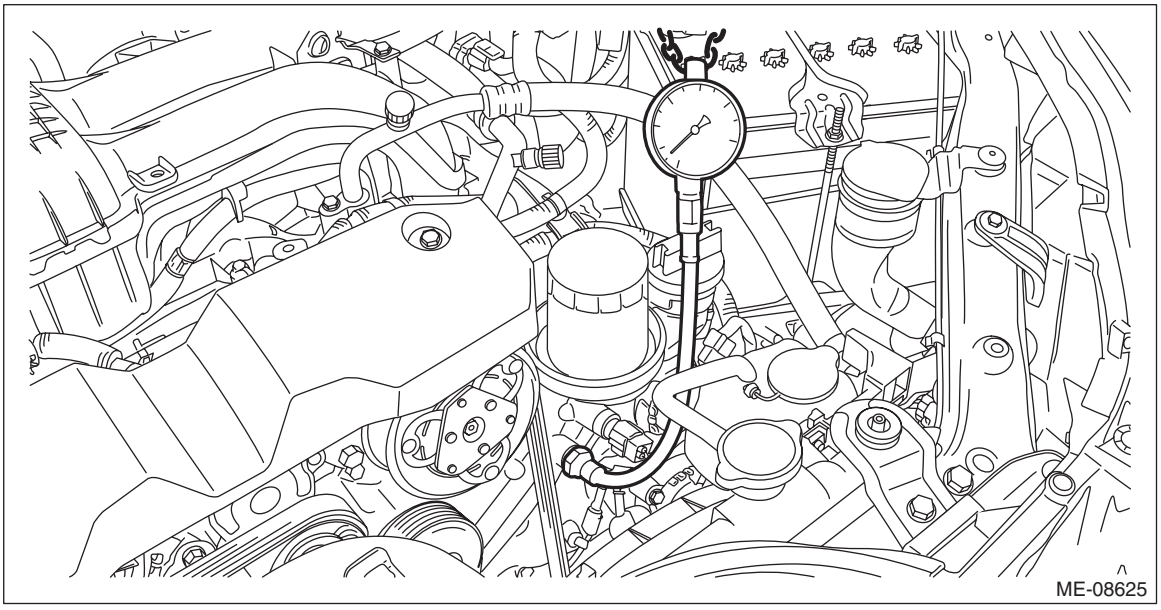
2) Remove the collector cover. (HEV model)
   (1) Carefully pull up the front of collector cover at two positions (A).
   (2) Carefully pull up the rear of collector cover at two positions (B) while moving it backward.

NOTE:
Be careful not to contact the fuel delivery tube when moving the collector cover rearward.

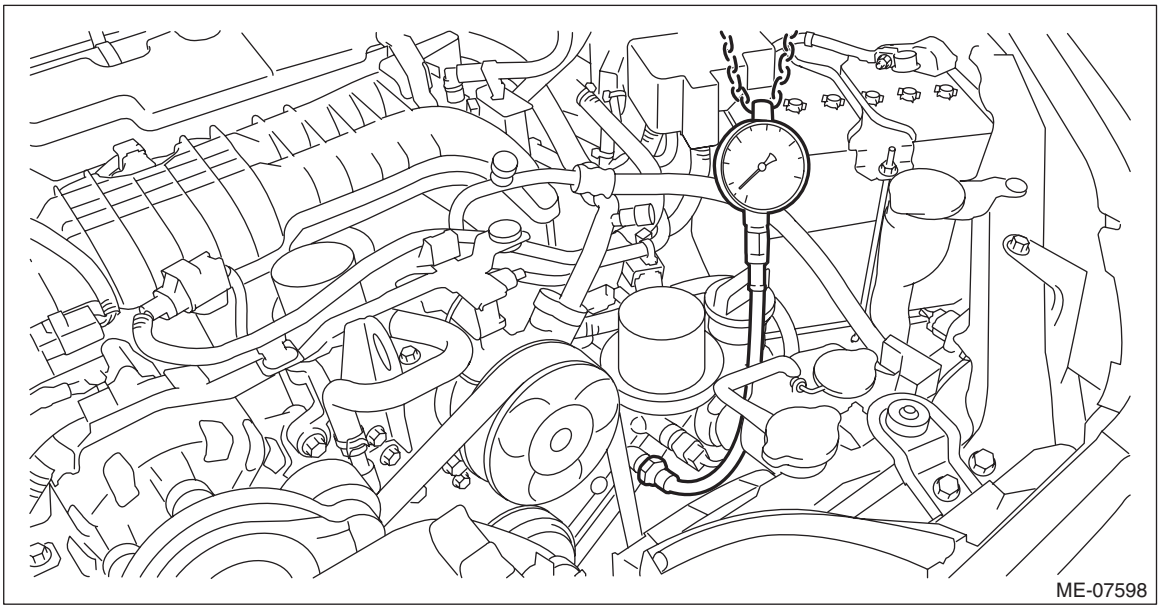


3) Remove the oil pressure switch. <Ref. to LU(H4DO(w/o HEV))-25, REMOVAL, Oil Pressure Switch.>

4) Install the oil pressure gauge to the chain cover.
- Gasoline engine model



- HEV model



5) Connect the battery ground terminal. <Ref. to NT-5, BATTERY, NOTE, Note.>
6) Start the engine, and check the oil pressure.

NOTE:
- Standard value is based on an engine oil temperature of 80°C (176°F).
- If the oil pressure is out of specification, check oil pump, oil filter and lubrication line. <Ref. to LU(H4DO(w/o HEV))-74, INSPECTION, Engine Lubrication System Trouble in General.>
- If the oil pressure warning light is ON and oil pressure is within standard, check the oil pressure switch. <Ref. to LU(H4DO(w/o HEV))-74, INSPECTION, Engine Lubrication System Trouble in General.>

Engine oil pressure:
Standard
50 kPa (0.5 kg/cm^2, 7 psi) or more (at 600 r/min)
350 kPa (3.6 kg/cm^2, 51 psi) or more (at 6,000 r/min)

7) After inspection, install the related parts in the reverse order of removal.

7. Fuel Pressure

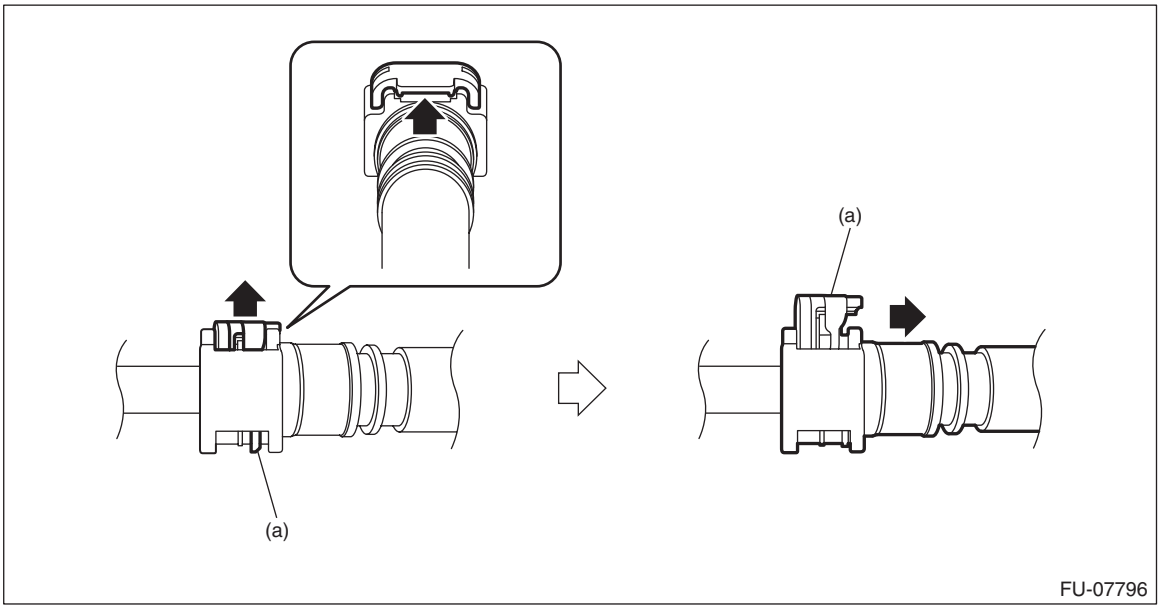
A: INSPECTION

1. GASOLINE ENGINE MODEL

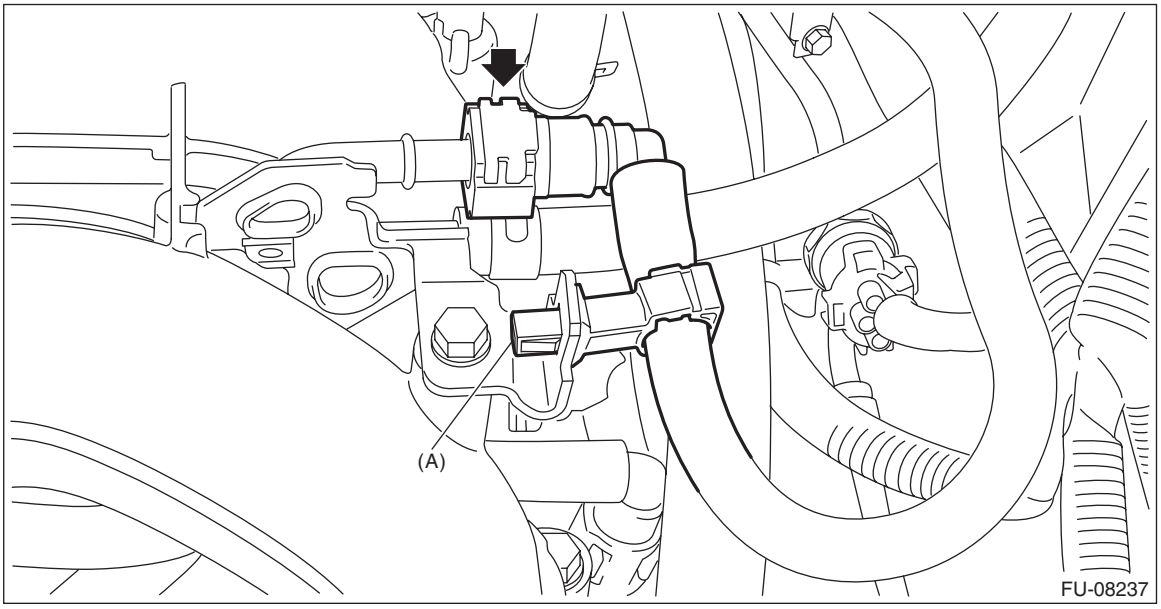
CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from the tubes using a container or cloth.**

1) Release the fuel pressure. <Ref. to FU(H4DO(w/o HEV))-109, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Open the fuel filler lid and remove the fuel filler cap.
3) Disconnect the fuel delivery tube from the fuel delivery pipe, and connect the fuel pressure gauge.
   (1) Disconnect the quick connector on the fuel delivery tube from the fuel pipe assembly, and remove the clip (A) securing the fuel delivery tube to the fuel pipe assembly.

NOTE:
Disconnect the quick connector as shown in the figure.



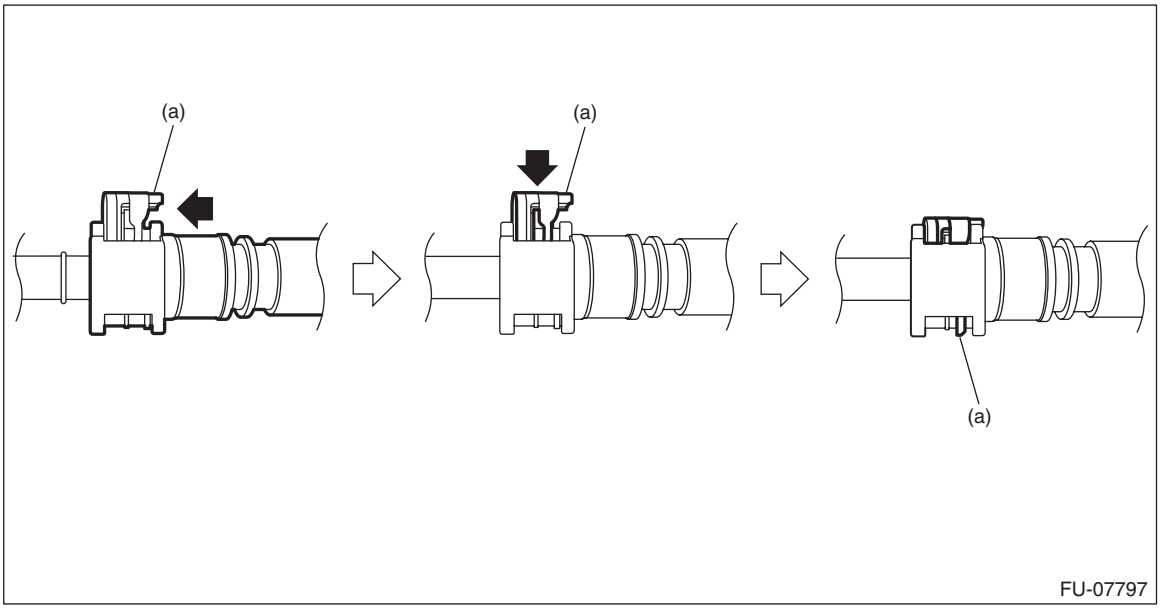
(a) Slider



(2) Connect the fuel pressure gauge with ST1 and ST2.

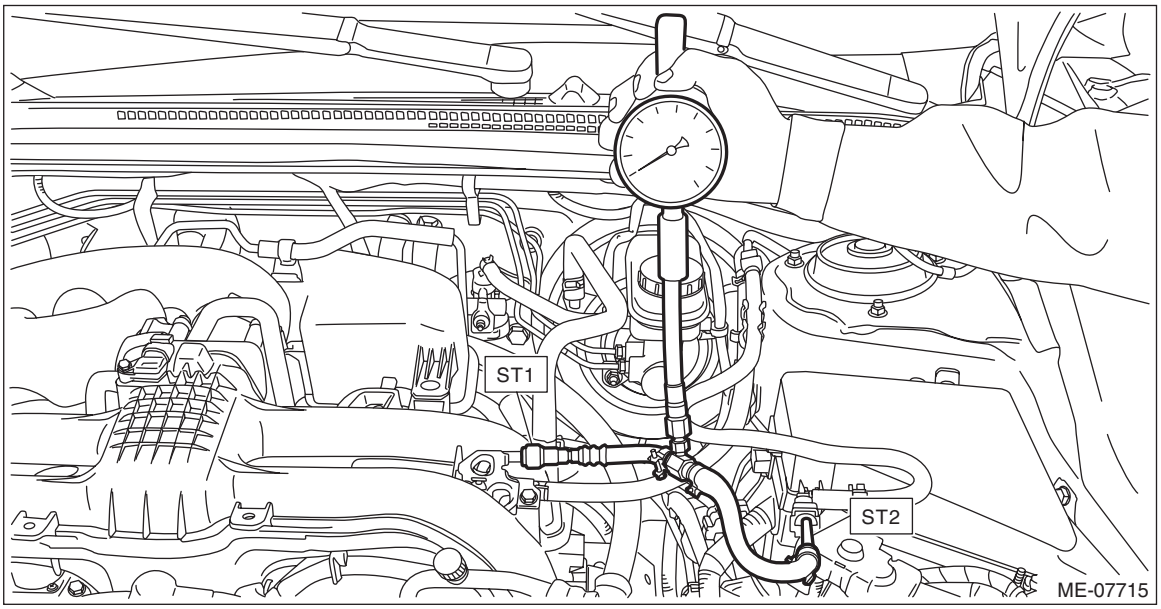
CAUTION:
• Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
• When connecting the quick connector with slider, make sure to insert the ST2 all the way in before locking the slider.
• When it is difficult to lock the slider, check that the ST2 is fully inserted.
• Make sure that the quick connector is securely connected.

NOTE:
• ST1 is a SUBARU genuine part.
• When connecting the ST2 to the quick connector on the fuel delivery tube, connect as shown in the figure.



(a) Slider

ST1 42075AG690 FUEL HOSE
ST2 18471AA000 FUEL PIPE ADAPTER



4) Start the engine.

5) Check the fuel pressure after warming up the engine.

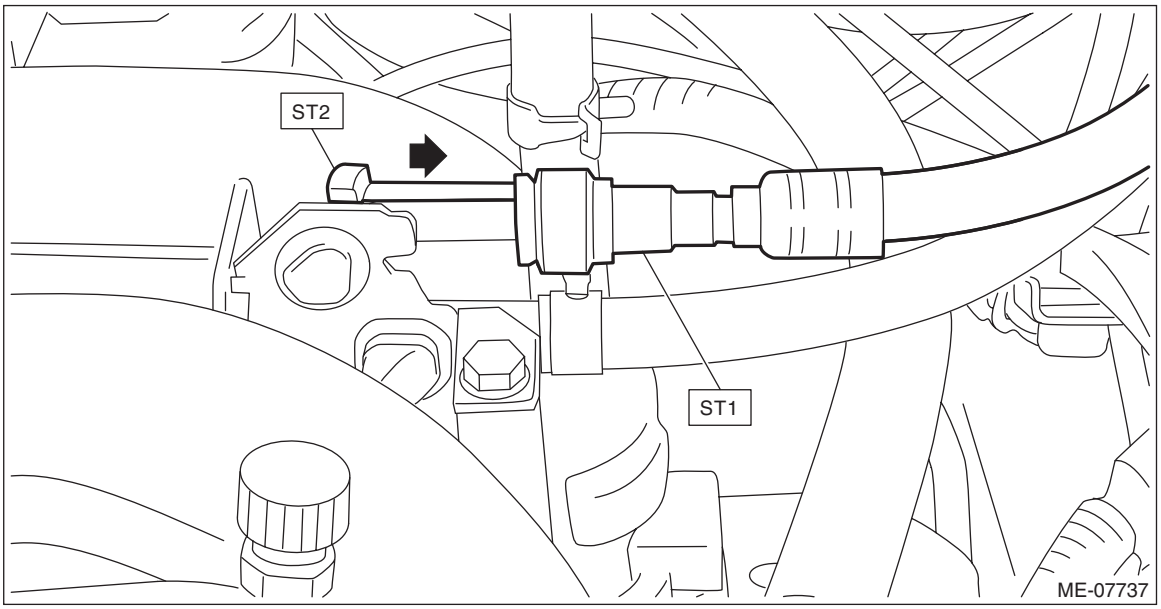
NOTE:
• The fuel pressure gauge registers 10 to 20 kPa (0.1 to 0.2 kg/cm^2, 1 to 3 psi) higher than standard values during high-altitude operations.
• Check or replace the fuel pump and fuel delivery line if the fuel pressure is out of the standard.

Fuel pressure:
Standard
340 — 400 kPa (3.5 — 4.1 kg/cm^2, 49 — 58 psi)

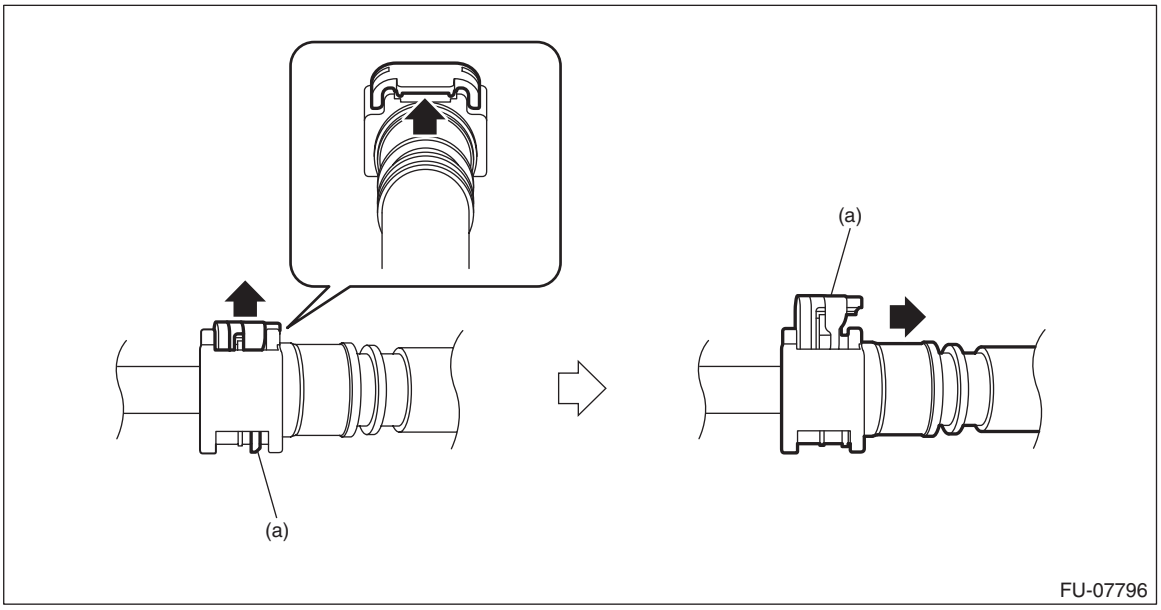
6) After inspection, install the related parts in the reverse order of removal.

CAUTION:
• Before removing the fuel pressure gauge, release the fuel pressure.
• Be careful not to spill fuel.
• Catch the fuel from hoses and tubes using a container or cloth.
• Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
• When connecting the quick connector with slider, make sure to insert the pipe all the way in before locking the slider.
• When it is difficult to lock the slider, check that the pipe is fully inserted.
• Make sure that the quick connector is securely connected.

NOTE:
• When disconnecting the ST1, install the ST2 to the fuel pipe assembly, and press the ST2 in the direction of arrow to disconnect the quick connector on the ST1.
ST1 42075AG690 FUEL HOSE
ST2 42099AE000 QUICK CONNECTOR RELEASE

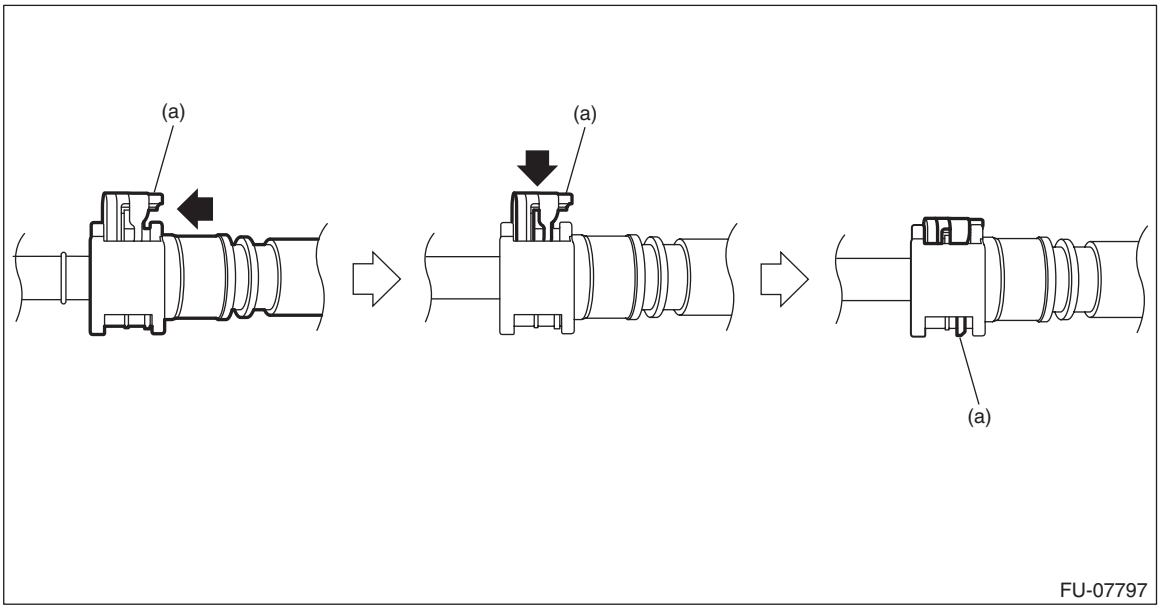


- Disconnect the quick connector on the fuel delivery tube as shown in the figure.



(a) Slider

- Connect the quick connector on the fuel delivery tube as shown in the figure.



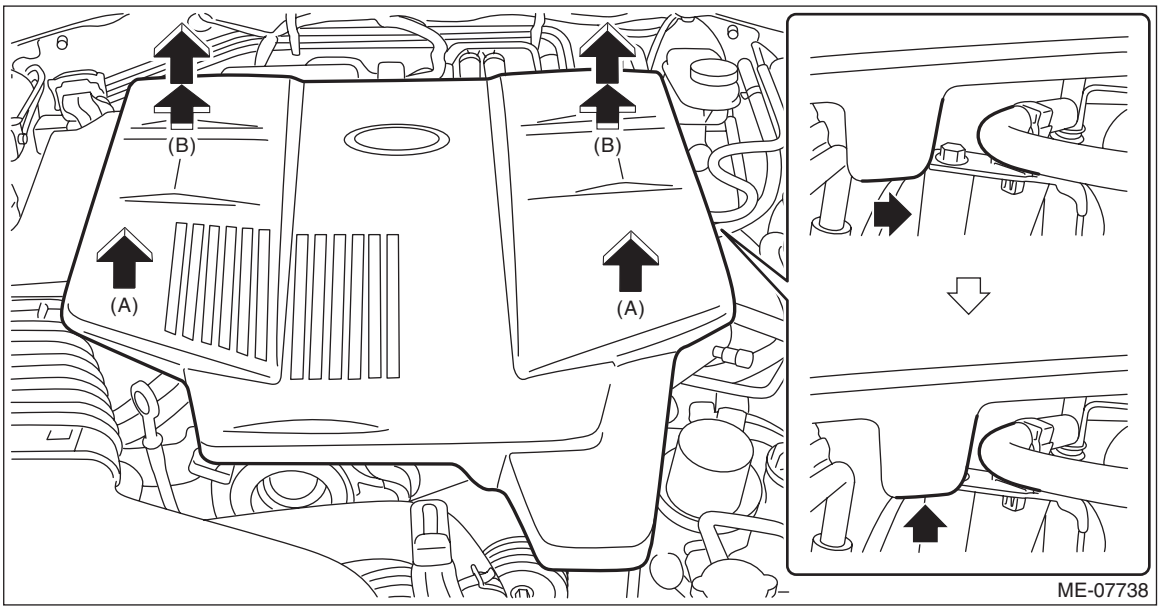
(a) Slider

2. HEV MODEL

CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from the tubes using a container or cloth.**

1) Turn the ignition switch to OFF.
2) Remove the collector cover.
   (1) Carefully pull up the front of collector cover at two positions (A).
   (2) Carefully pull up the rear of collector cover at two positions (B) while moving it backward.

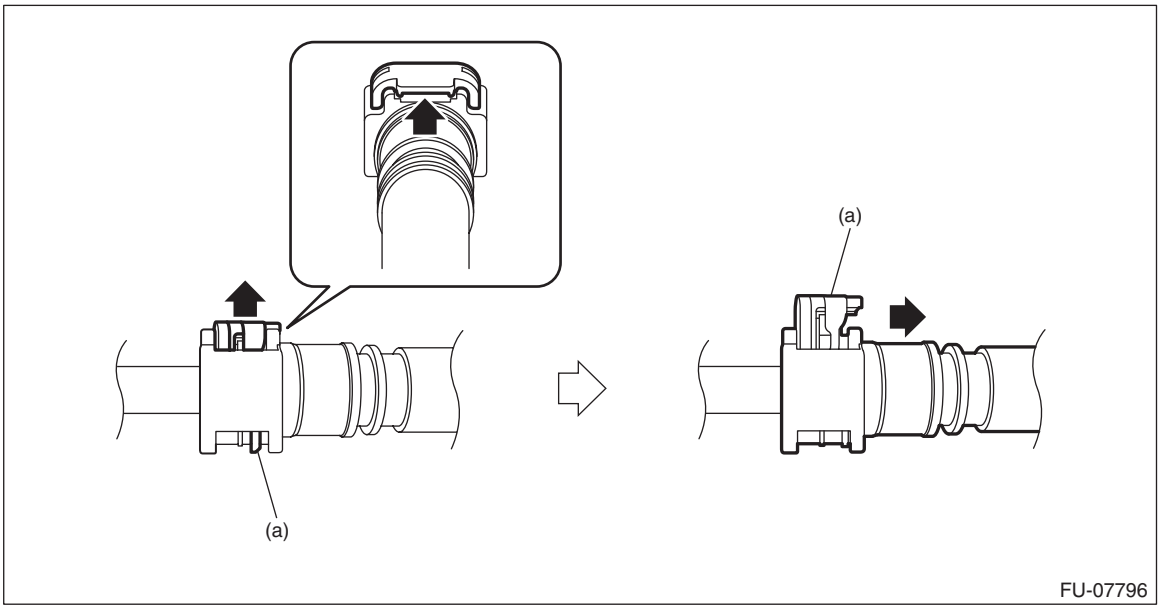
NOTE:
Be careful not to contact the fuel delivery tube when moving the collector cover rearward.



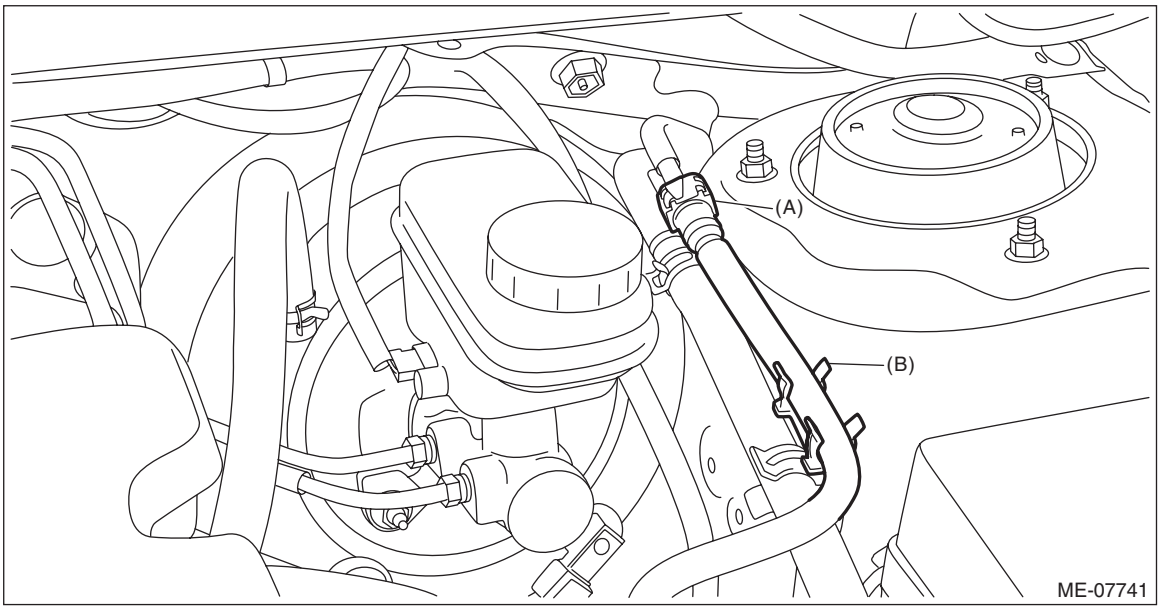
3) Release the fuel pressure. <Ref. to FU(H4DO(HEV))-98, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
4) Open the fuel filler lid and remove the fuel filler cap.

5) Disconnect the fuel delivery tube from the fuel pipe assembly, and connect the fuel pressure gauge.
(1) Disconnect the quick connector (A) of the fuel delivery tube from the fuel pipe assembly, and remove the fuel delivery tube from the hose clamp (B).

NOTE:
Disconnect the quick connector as shown in the figure.



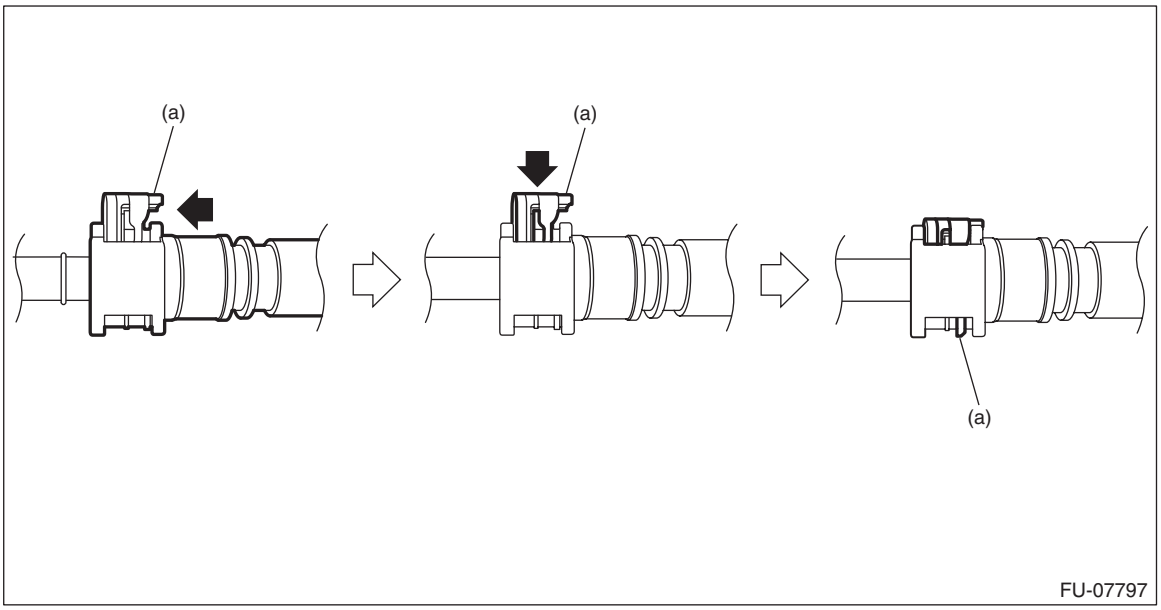
(a) Slider



(2) Connect the fuel pressure gauge with ST1 and ST2.

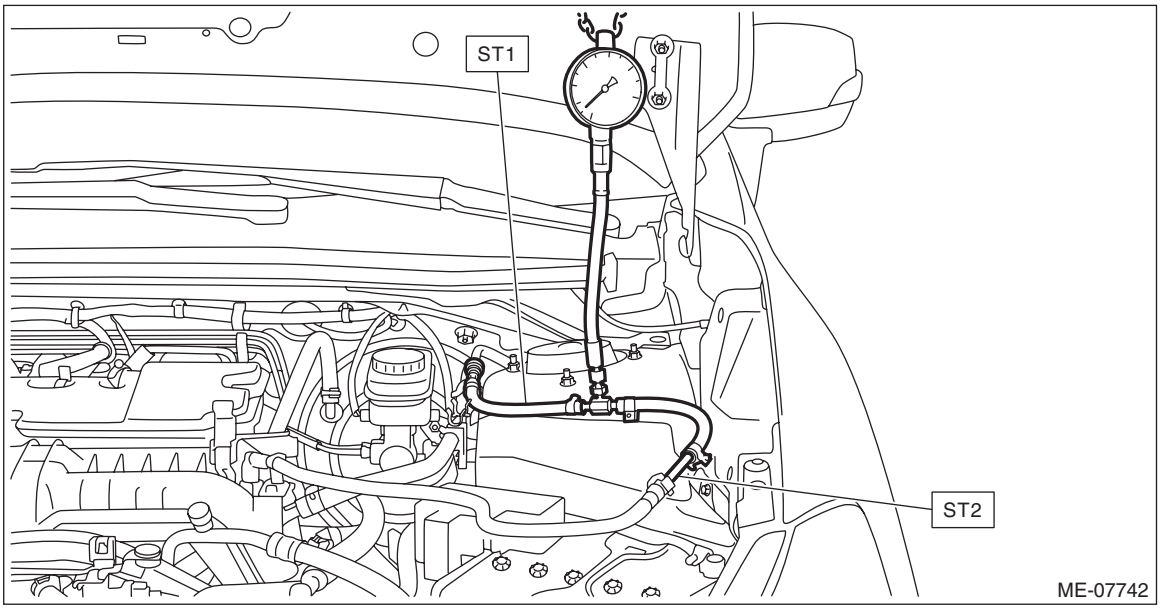
CAUTION:
• Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
• When connecting the quick connector with slider, make sure to insert the ST2 all the way in before locking the slider.
• When it is difficult to lock the slider, check that the ST2 is fully inserted.
• Make sure that the quick connector is securely connected.

NOTE:
- ST1 is a SUBARU genuine part.
- When connecting the ST2 to the quick connector on the fuel delivery tube, connect as shown in the figure.



(a) Slider

ST1 42075AG690 FUEL HOSE
ST2 18471AA000 FUEL PIPE ADAPTER



6) Start the engine.
7) Check the fuel pressure after warming up the engine.

NOTE:
- The fuel pressure gauge registers 10 to 20 kPa (0.1 to 0.2 kg/cm^2, 1 to 3 psi) higher than standard values during high-altitude operations.
- Check or replace the fuel pump and fuel delivery line if the fuel pressure is out of the standard.

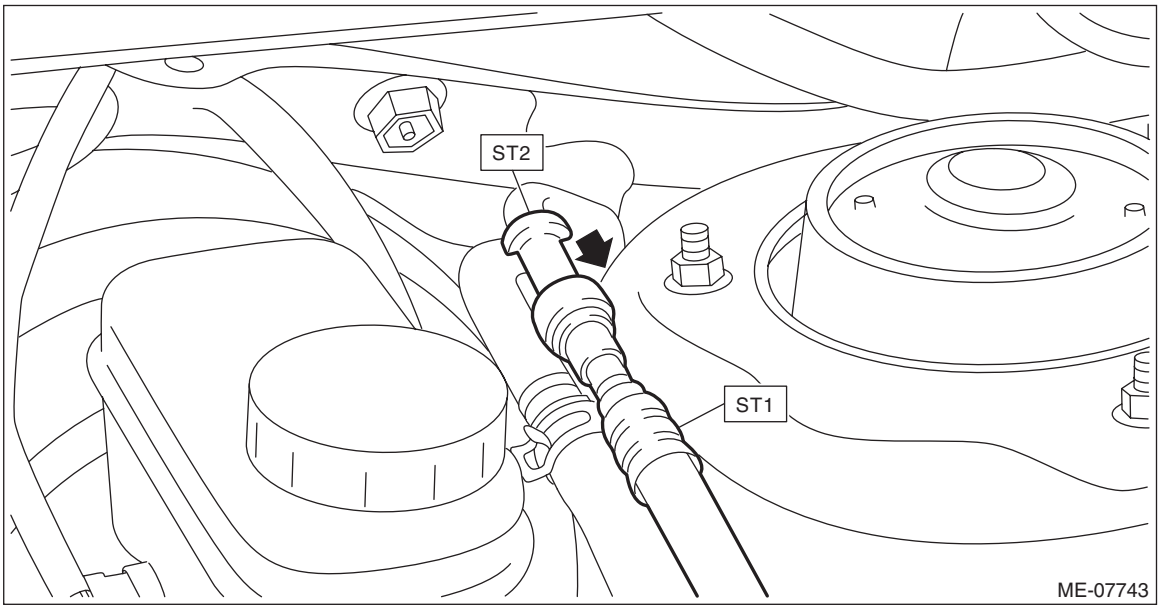
Fuel pressure:
Standard
340 — 400 kPa (3.5 — 4.1 kg/cm^2, 49 — 58 psi)

8) After inspection, install the related parts in the reverse order of removal.

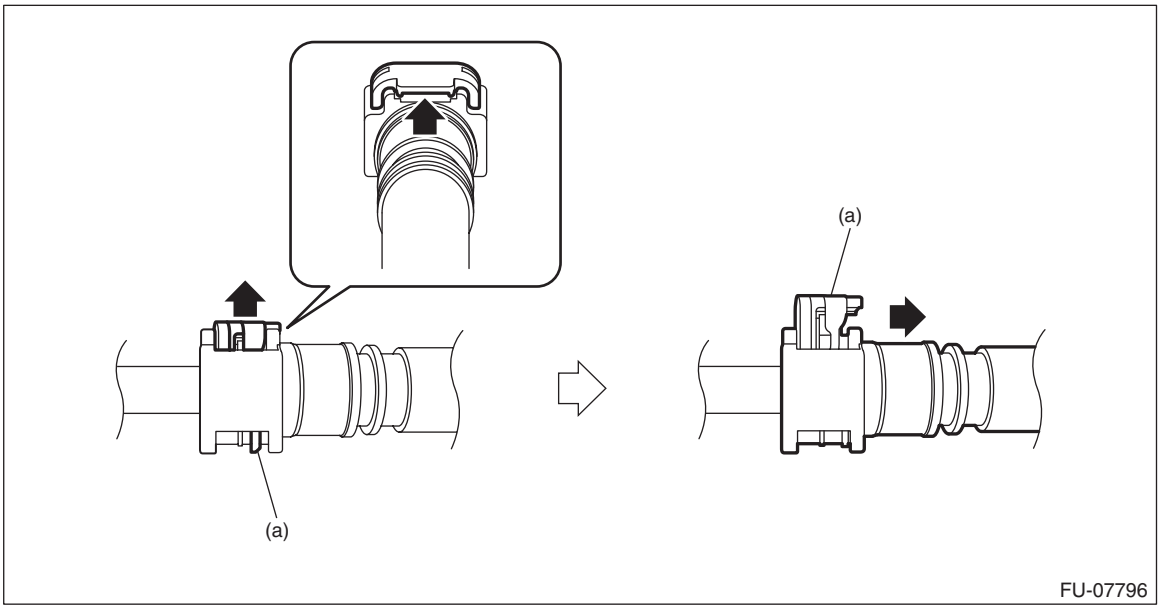
CAUTION:
- **Before removing the fuel pressure gauge, release the fuel pressure.**
- **Be careful not to spill fuel.**
- **Catch the fuel from hoses and tubes using a container or cloth.**
- **Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.**
- **When connecting the quick connector with slider, make sure to insert the pipe all the way in before locking the slider.**
- **When it is difficult to lock the slider, check that the pipe is fully inserted.**
- **Make sure that the quick connector is securely connected.**

NOTE:
- When disconnecting the ST1, install the ST2 to the fuel pipe assembly, and press the ST2 in the direction of arrow to disconnect the quick connector on the ST1.

ST1 42075AG690 FUEL HOSE
ST2 42099AE000 QUICK CONNECTOR RELEASE

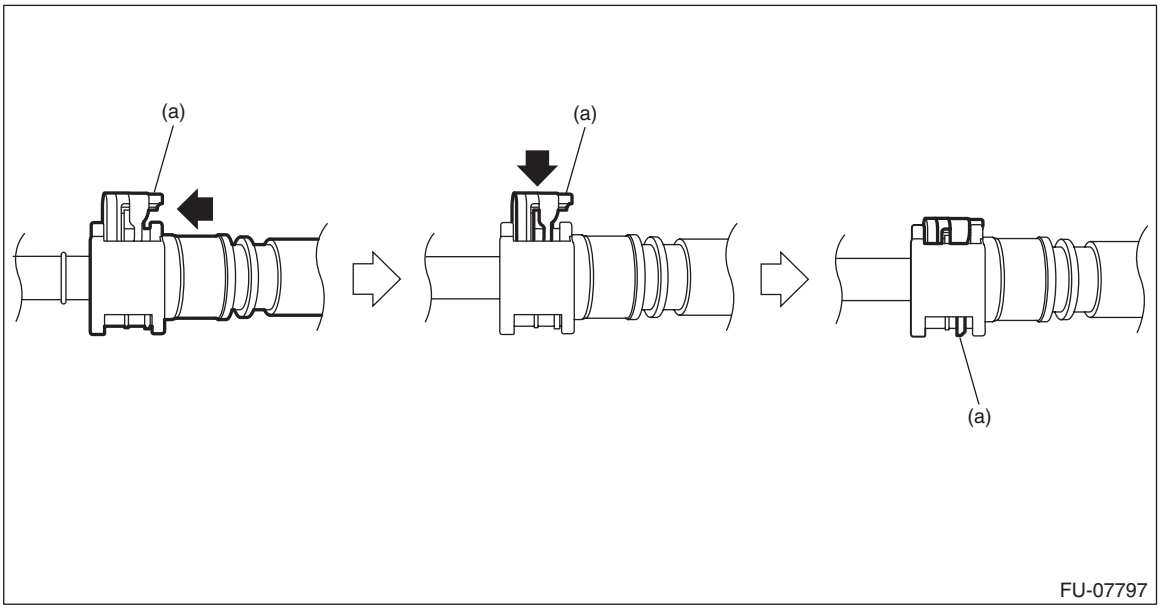


- Disconnect the quick connector on the fuel delivery tube as shown in the figure.



(a) Slider

- Connect the quick connector on the fuel delivery tube as shown in the figure.



(a) Slider

8. Cam Clearance

A: INSPECTION

1. WHEN TIMING CHAIN ASSEMBLY IS NOT REMOVED

CAUTION:
When working on the vehicle, if engine oil is spilt onto the exhaust pipe, wipe it off with cloth to avoid emission of smoke or causing a fire.

NOTE:
- Inspection of cam clearance should be performed while engine is cold.
- If the engine is removed from vehicle, performing the steps 1) to 3) is not necessary.

1) Disconnect the ground cable from battery. <Ref. to NT-5, BATTERY, NOTE, Note.>

NOTE:
For the 12 volt engine restart battery of HEV model, disconnect the ground terminal from 12V engine restart battery sensor.

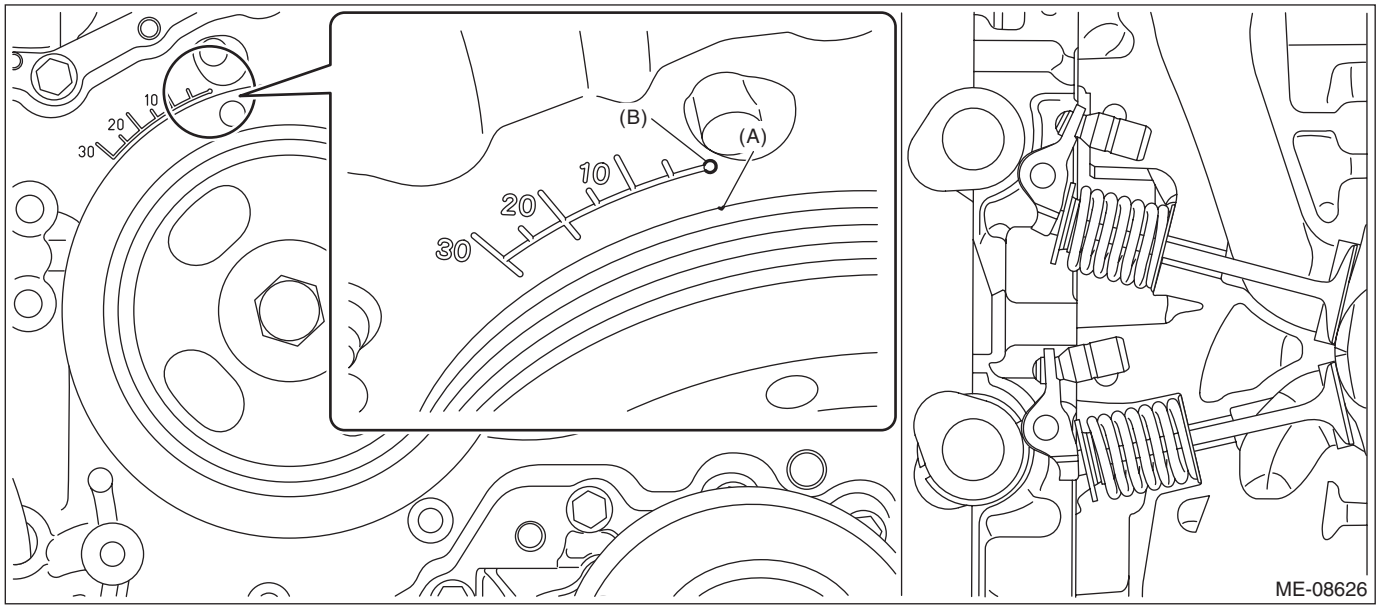
2) Remove the V-belts. (Gasoline engine model) <Ref. to ME(H4DO(w/o HEV))-122, GASOLINE ENGINE MODEL, REMOVAL, V-belt.>
3) Remove the air intake duct. (HEV model) <Ref. to IN(H4DO(HEV))-15, REMOVAL, Air Intake Duct.>
4) When inspecting #1 and #3 cylinders
   (1) Remove the rocker cover RH. <Ref. to ME(H4DO(w/o HEV))-202, ROCKER COVER RH, REMOVAL, Rocker Cover.>

NOTE:
When working on the vehicle, place a suitable container under the vehicle.

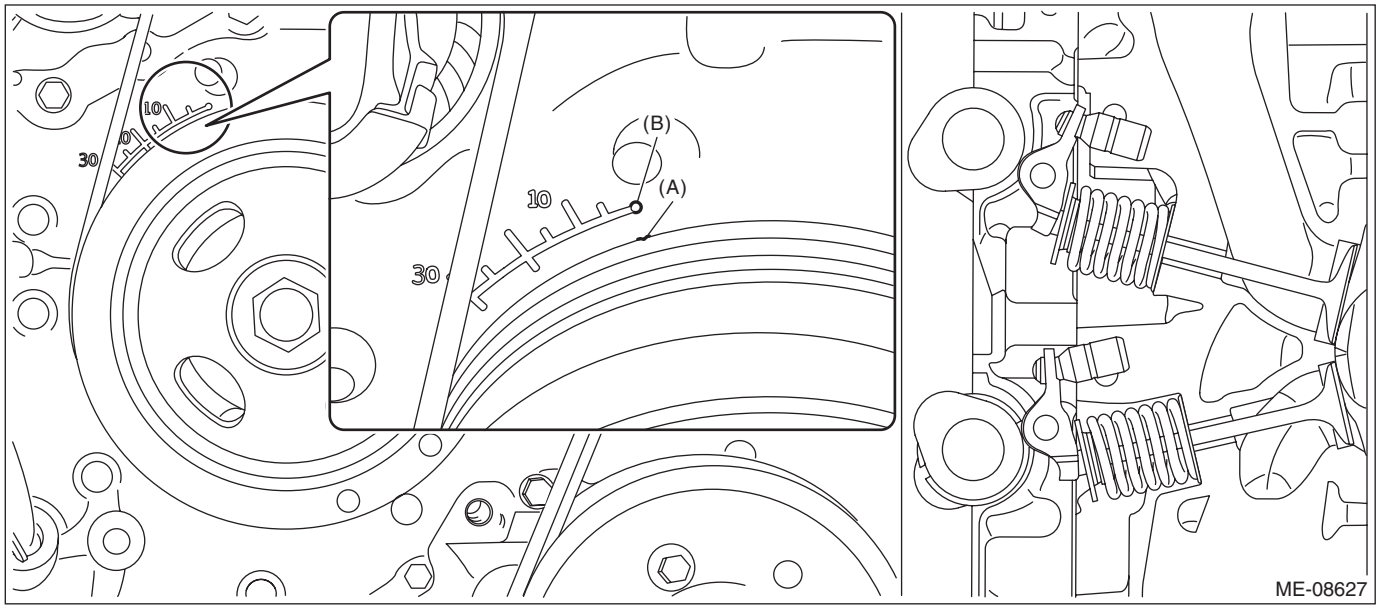
   (2) Set #1 cylinder piston to top dead center of compression stroke by rotating the crank pulley clockwise using the socket wrench.

NOTE:
When the timing mark (A) on crank pulley is aligned to the 0° in timing gauge (B) on chain cover as shown in the figure, the #1 cylinder piston is located at TDC of compression stroke if the intake camshaft and exhaust camshaft does not depress the #1 cylinder intake side roller rocker arm (intake valve) and exhaust side roller rocker arm (exhaust valve). If roller rocker arm (valve) is depressed, turn the crank pulley by 360° in order to make #1 cylinder piston at TDC of compression stroke.

- Gasoline engine model



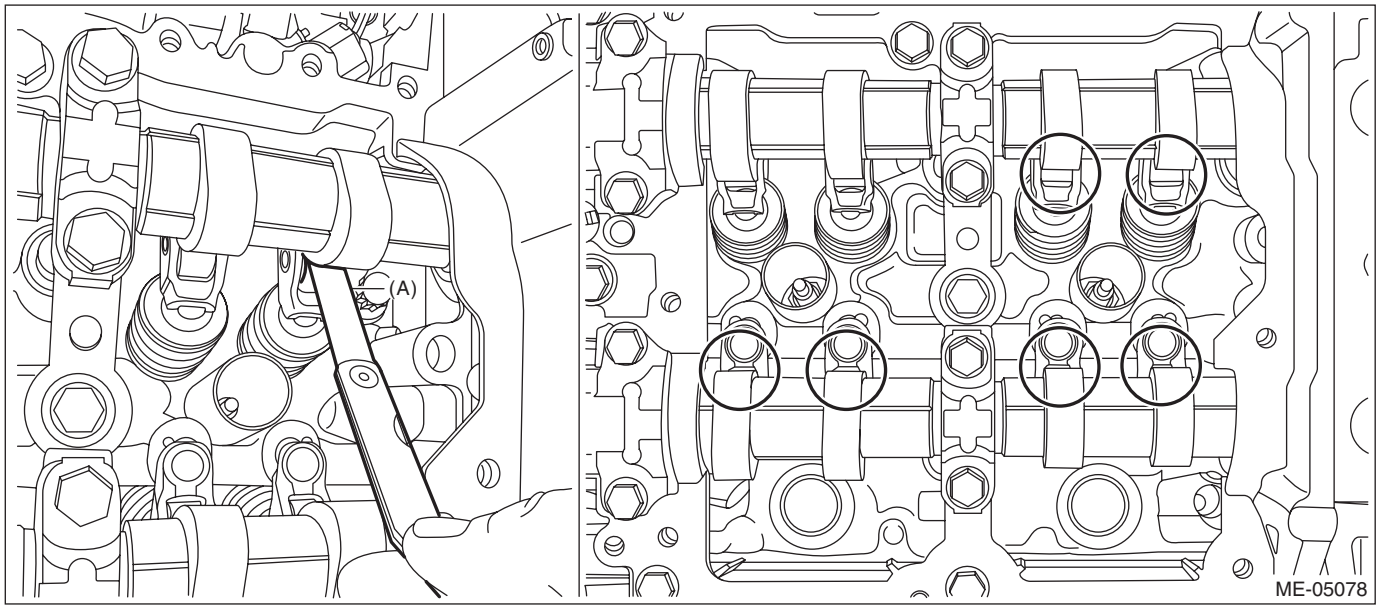
- HEV model



(3) Check the cam clearance for #1 cylinder intake, #1 cylinder exhaust and #3 cylinder exhaust.

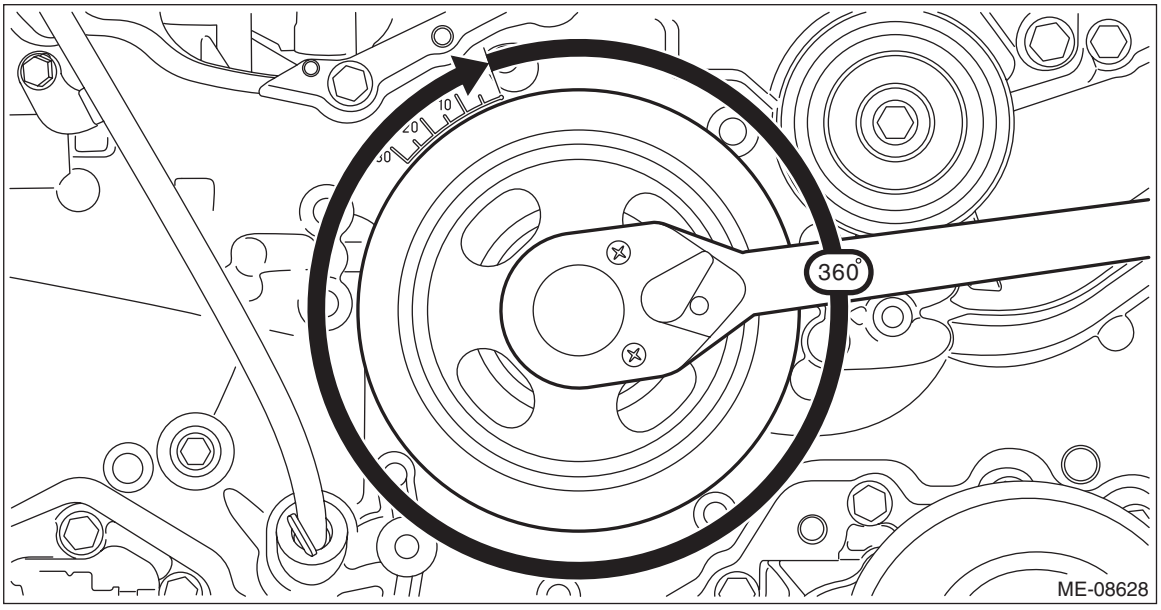
NOTE:
- Measure the roller surface of cam base circle and roller rocker arm using thickness gauge (A).
- If the measured value is out of standard, take notes of the value in order to adjust the cam clearance later on.

Cam clearance:
Intake
Standard
$0.13^{+0.02}_{-0.03}$ mm ($0.0051^{+0.0008}_{-0.0012}$ in)
Exhaust
Standard
0.22±0.02 mm (0.0087±0.0008 in)

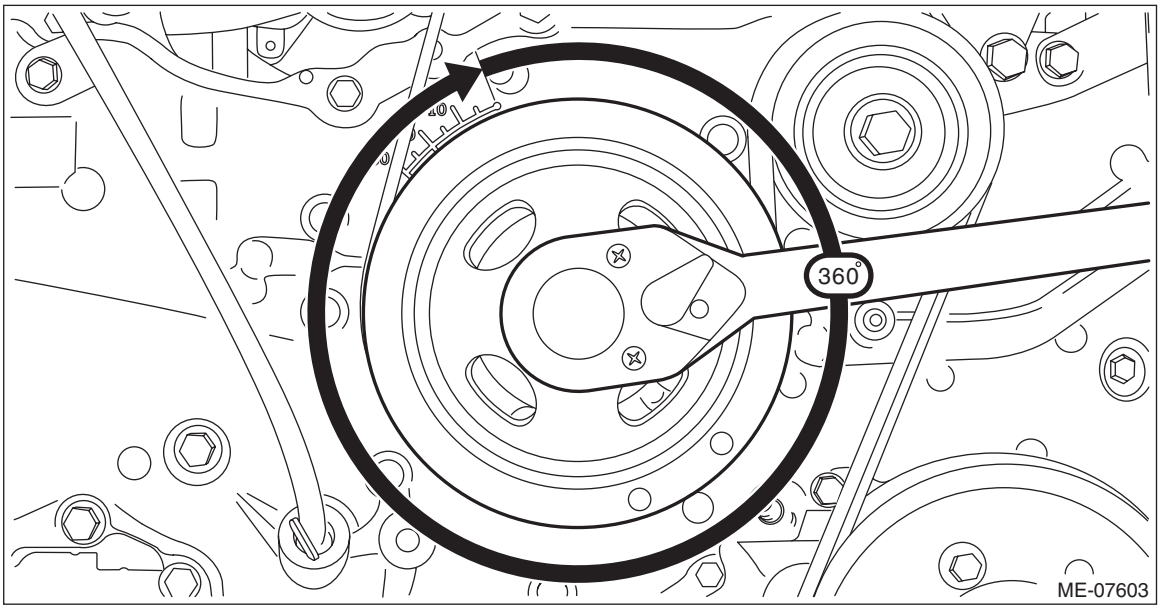


(4) Turn the crank pulley by 360°.

- Gasoline engine model



- HEV model

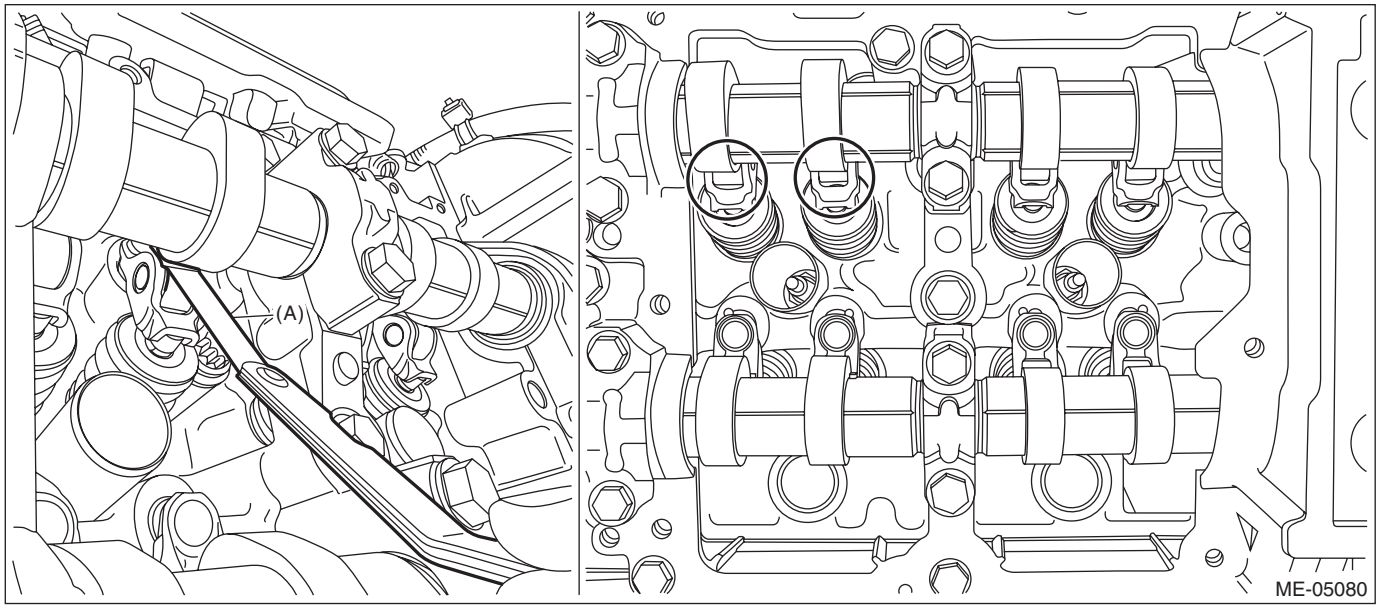


(5) Check the clearance of #3 cylinder intake.

NOTE:

- Measure the roller surface of cam base circle and roller rocker arm using thickness gauge (A).
- If the measured value is out of standard, take notes of the value in order to adjust the cam clearance later on.

Cam clearance:
Standard
$0.13^{+0.02}_{-0.03}$ mm ($0.0051^{+0.0008}_{-0.0012}$ in)

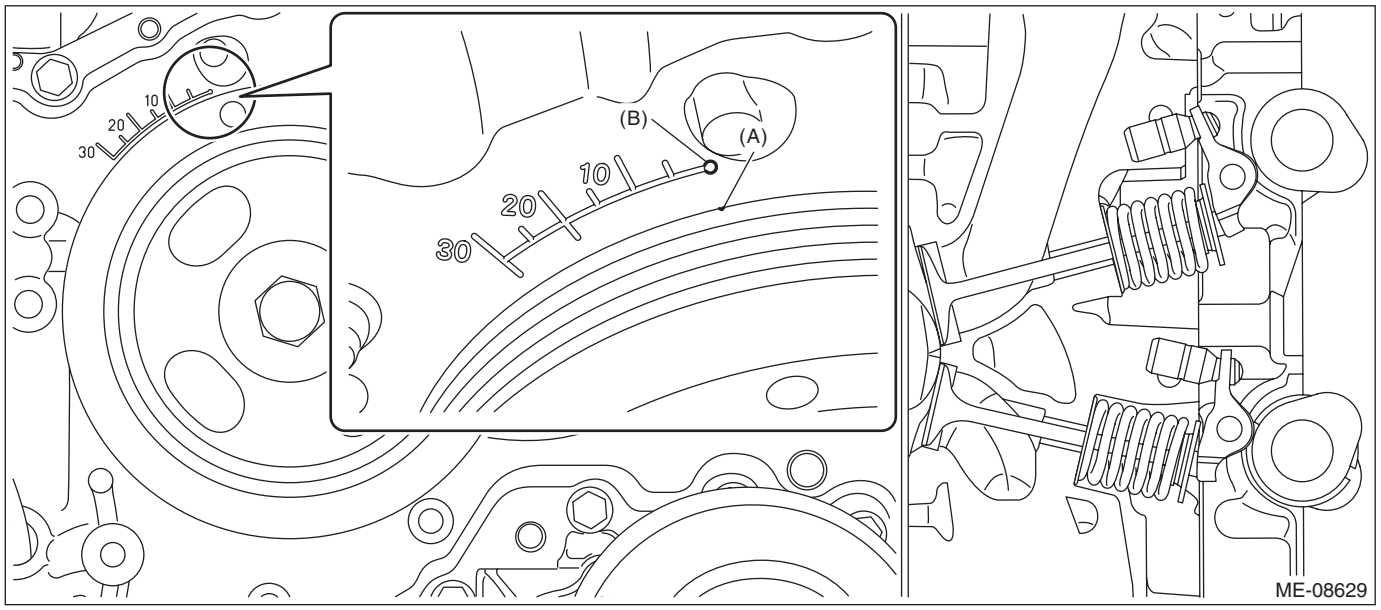


5) When inspecting #2 and #4 cylinders
(1) Remove the rocker cover LH. <Ref. to ME(H4DO(w/o HEV))-206, ROCKER COVER LH, REMOVAL, Rocker Cover.>

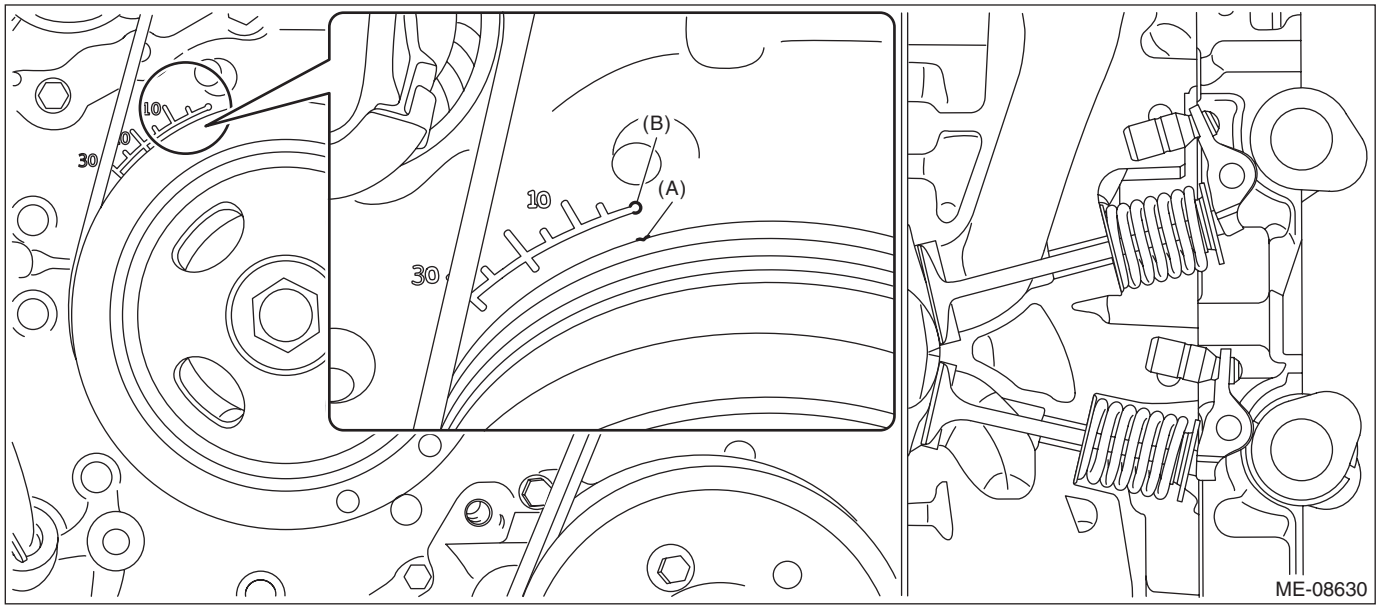
NOTE:
When working on the vehicle, place a suitable container under the vehicle.
(2) Set #2 cylinder piston to top dead center of compression stroke by rotating the crank pulley clockwise using the socket wrench.

NOTE:
When the timing mark (A) on crank pulley is aligned to the 0° in timing gauge (B) on chain cover as shown in the figure, the #2 cylinder piston is located at TDC of compression stroke if the intake camshaft and exhaust camshaft does not depress the #2 cylinder intake side roller rocker arm (intake valve) and exhaust side roller rocker arm (exhaust valve). If roller rocker arm (valve) is depressed, turn the crank pulley by 360° in order to make #2 cylinder piston at TDC of compression stroke.

- Gasoline engine model



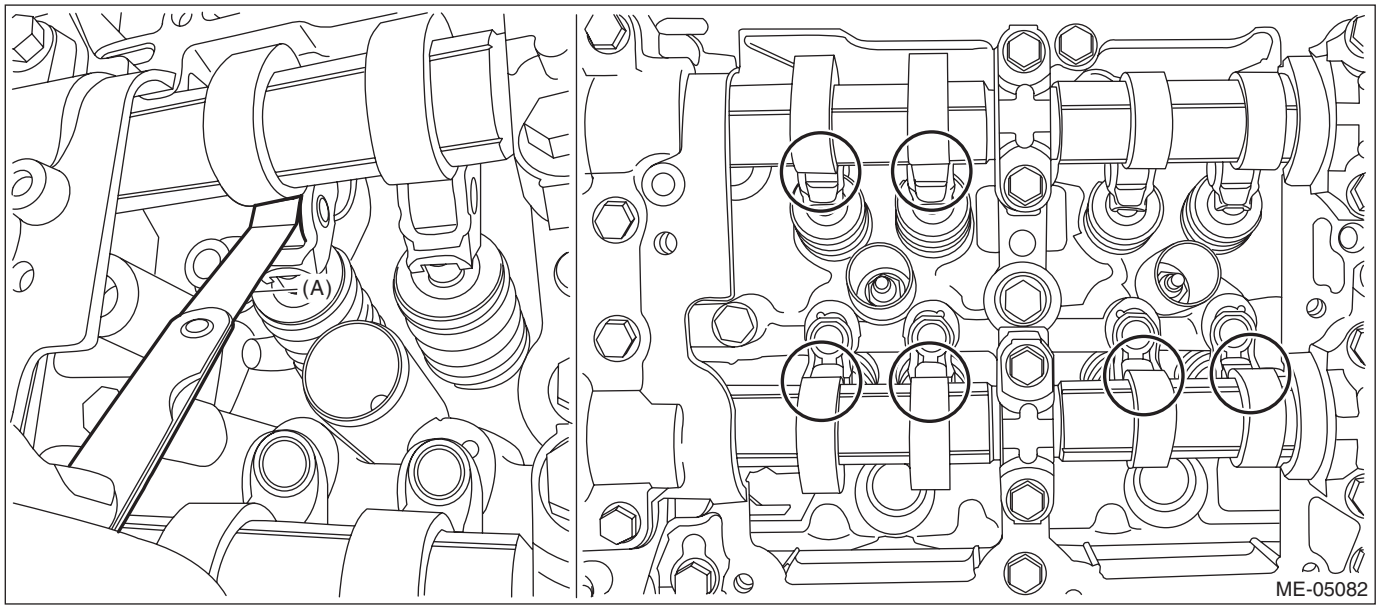
- HEV model



(3) Check the cam clearance for #2 cylinder intake, #2 cylinder exhaust and #4 cylinder exhaust.

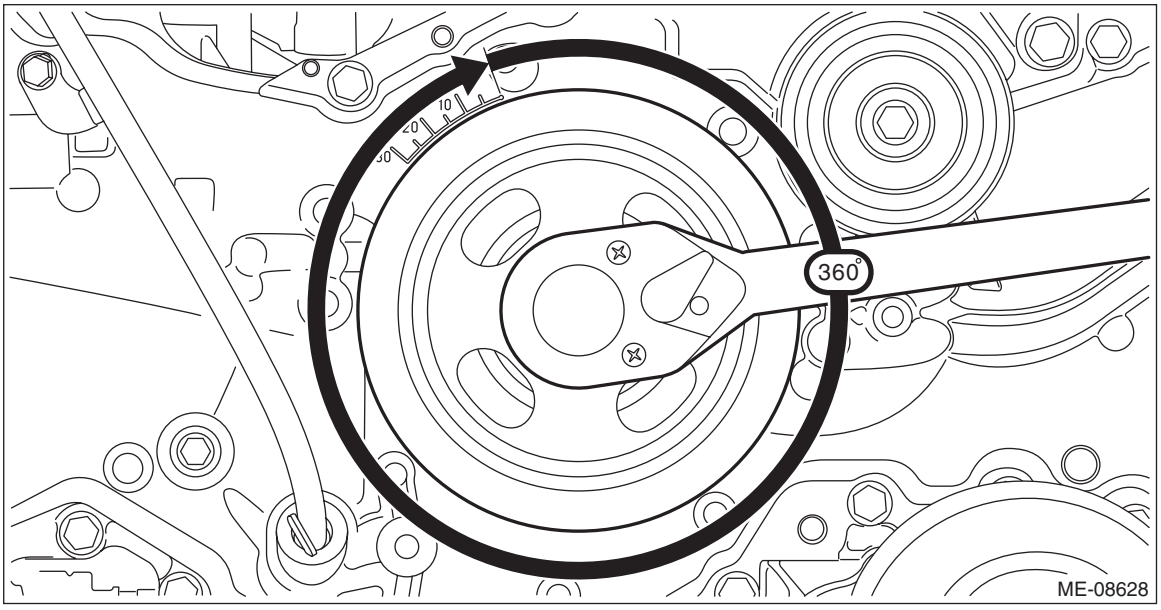
NOTE:
- Measure the roller surface of cam base circle and roller rocker arm using thickness gauge (A).
- If the measured value is out of standard, take notes of the value in order to adjust the cam clearance later on.

Cam clearance:
Intake
Standard
$0.13^{+0.02}_{-0.03}$ mm ($0.0051^{+0.0008}_{-0.0012}$ in)
Exhaust
Standard
0.22±0.02 mm (0.0087±0.0008 in)

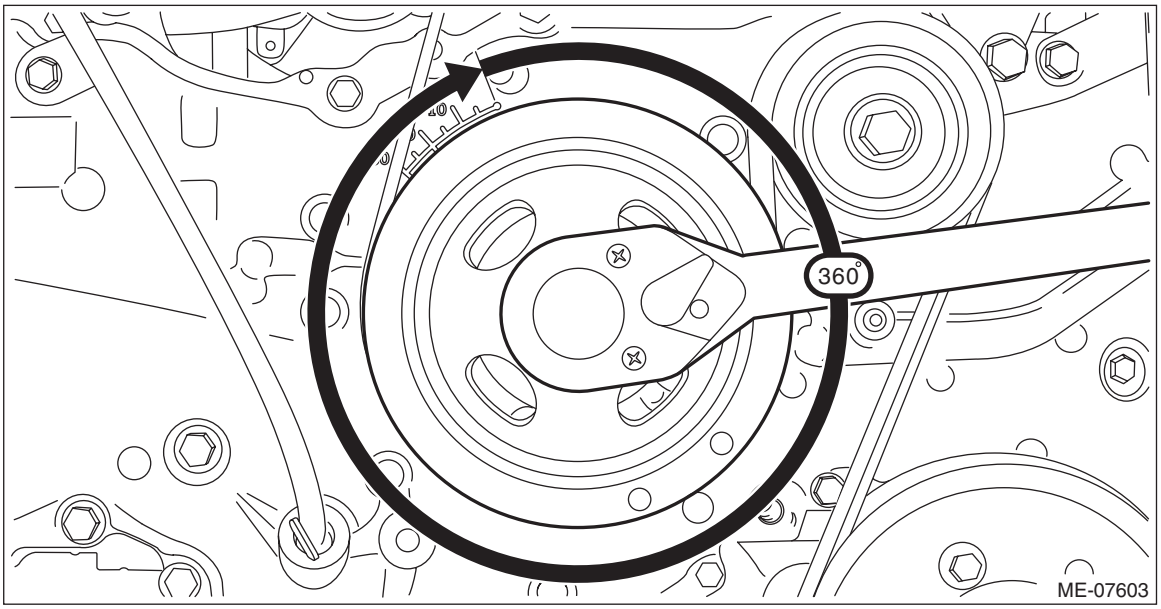


(4) Turn the crank pulley by 360°.

- Gasoline engine model



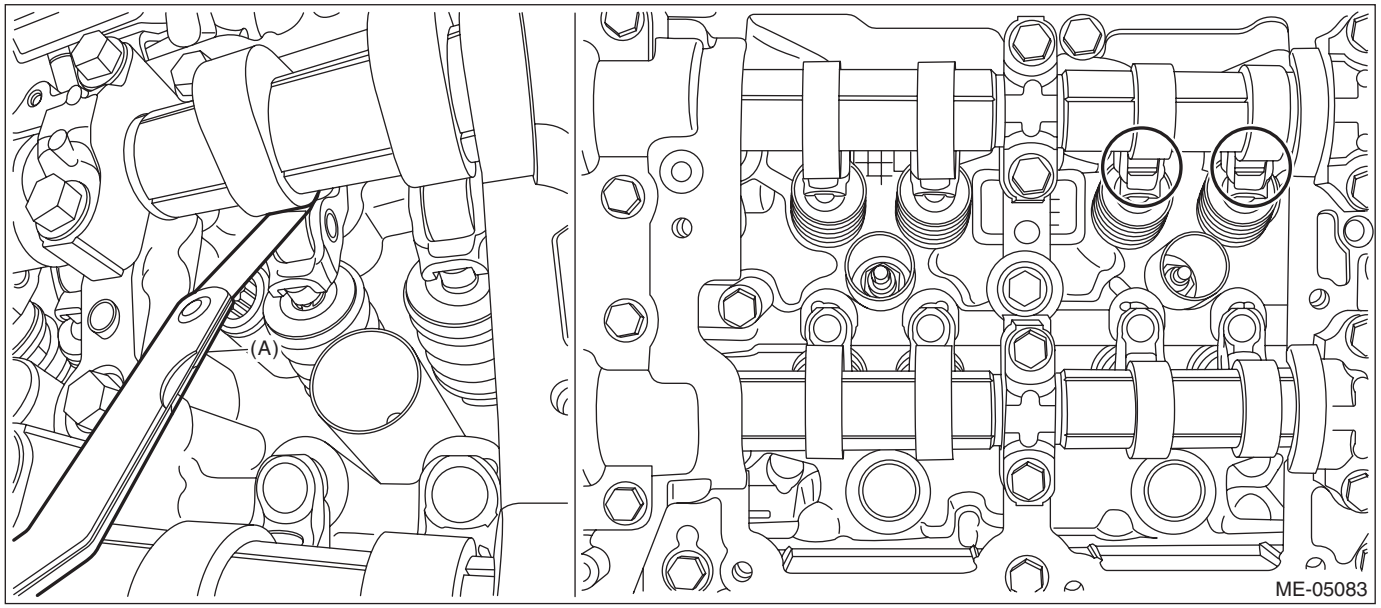
- HEV model



(5) Check the clearance of #4 cylinder intake.

NOTE:
- Measure the roller surface of cam base circle and roller rocker arm using thickness gauge (A).
- If the measured value is out of standard, take notes of the value in order to adjust the cam clearance later on.

Cam clearance:
Standard
$0.13^{+0.02}_{-0.03}$ mm ($0.0051^{+0.0008}_{-0.0012}$ in)



6) If necessary, adjust the cam clearance. <Ref. to ME(H4DO(w/o HEV))-52, ADJUSTMENT, Cam Clearance.>
7) After inspection, install the related parts in the reverse order of removal.

2. WHEN TIMING CHAIN ASSEMBLY IS REMOVED

NOTE:
Inspection of cam clearance should be performed while engine is cold.

1) When inspecting #1 and #3 cylinders
   (1) Remove the rocker cover RH. <Ref. to ME(H4DO(w/o HEV))-202, ROCKER COVER RH, REMOVAL, Rocker Cover.>

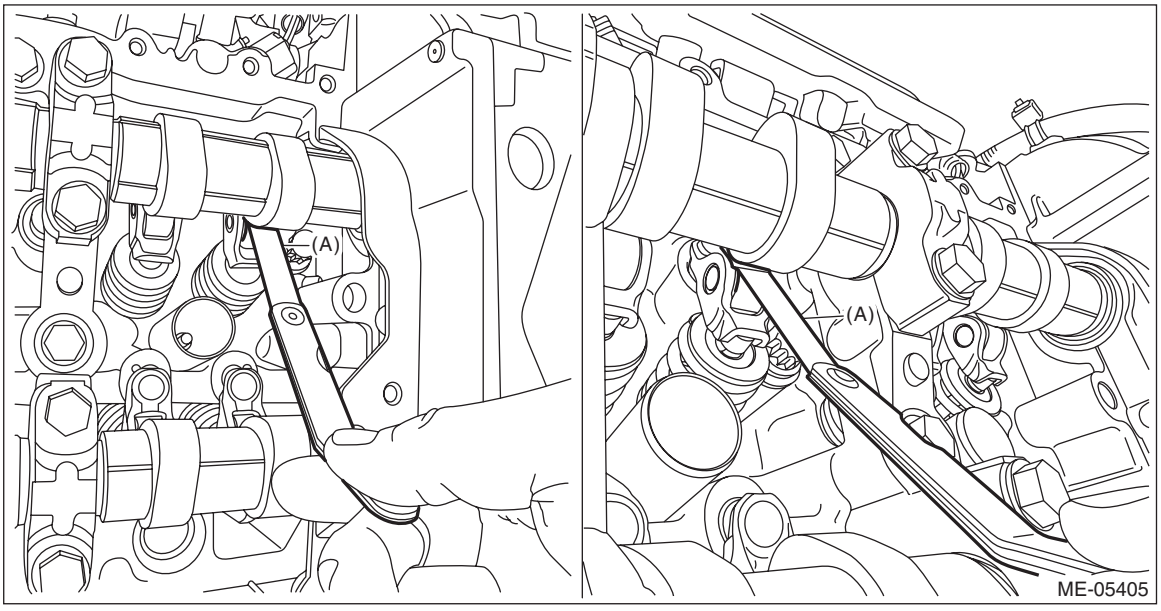
NOTE:
When working on the vehicle, place a suitable container under the vehicle.

   (2) Check the #1 and #3 cylinder cam clearance.

CAUTION:
Intake and exhaust camshafts can be independently rotated with the timing chain removed. When the intake valve and exhaust valve lift at the same time, the valve heads contact each other and valve stem may bend. Do not turn it to the outside of range of zero lift (cam base circle position) (in range where it can be turned lightly by hand).

NOTE:
- For cam clearance inspection, adjust the cam base circle position so that the thickness gauge (A) can be inserted easily by hand turning the camshaft (cam sprocket) to be measured.
- Measure the roller surface of cam base circle and roller rocker arm using thickness gauge (A).
- If the measured value is out of standard, take notes of the value in order to adjust the cam clearance later on.

Cam clearance:
Intake
Standard
$0.13^{+0.02}_{-0.03}$ mm ($0.0051^{+0.0008}_{-0.0012}$ in)
Exhaust
Standard
0.22±0.02 mm (0.0087±0.0008 in)



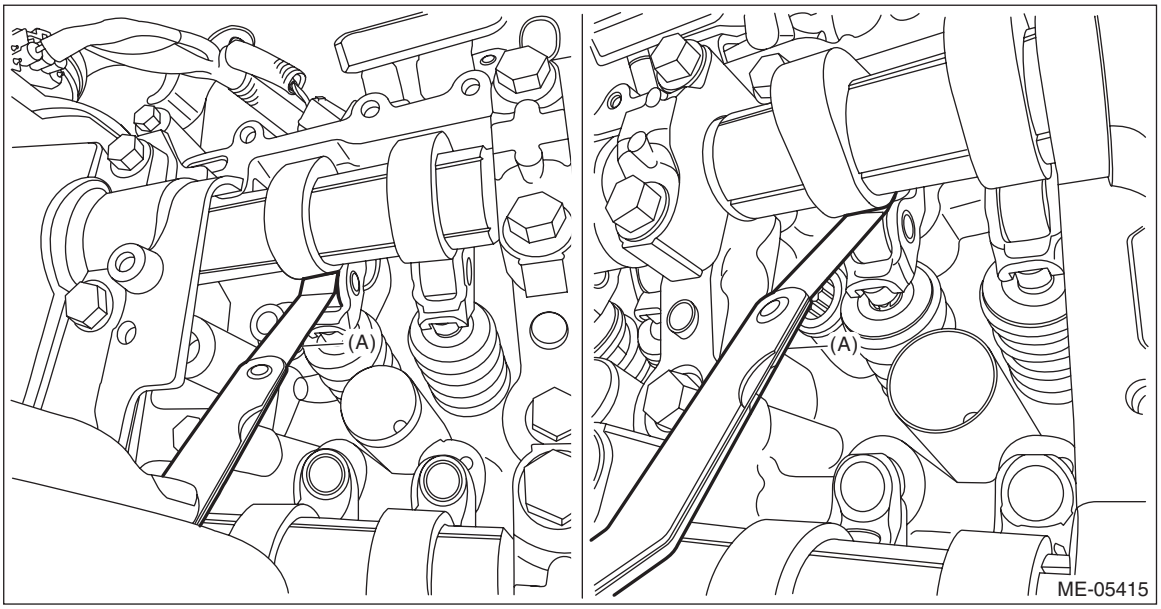
2) When inspecting #2 and #4 cylinders
(1) Remove the rocker cover LH. <Ref. to ME(H4DO(w/o HEV))-206, ROCKER COVER LH, REMOVAL, Rocker Cover.>

NOTE:
When working on the vehicle, place a suitable container under the vehicle.
(2) Check the #2 and #4 cylinder cam clearance.

CAUTION:
Intake and exhaust camshafts can be independently rotated with the timing chain removed. When the intake valve and exhaust valve lift at the same time, the valve heads contact each other and valve stem may bend. Do not turn it to the outside of range of zero lift (cam base circle position) (in range where it can be turned lightly by hand).

NOTE:
• For cam clearance inspection, adjust the cam base circle position so that the thickness gauge (A) can be inserted easily by hand turning the camshaft (cam sprocket) to be measured.
• Measure the roller surface of cam base circle and roller rocker arm using thickness gauge (A).
• If the measured value is out of standard, take notes of the value in order to adjust the cam clearance later on.

Cam clearance:
Intake
Standard
$0.13^{+0.02}_{-0.03}$ mm ($0.0051^{+0.0008}_{-0.0012}$ in)
Exhaust
Standard
0.22±0.02 mm (0.0087±0.0008 in)



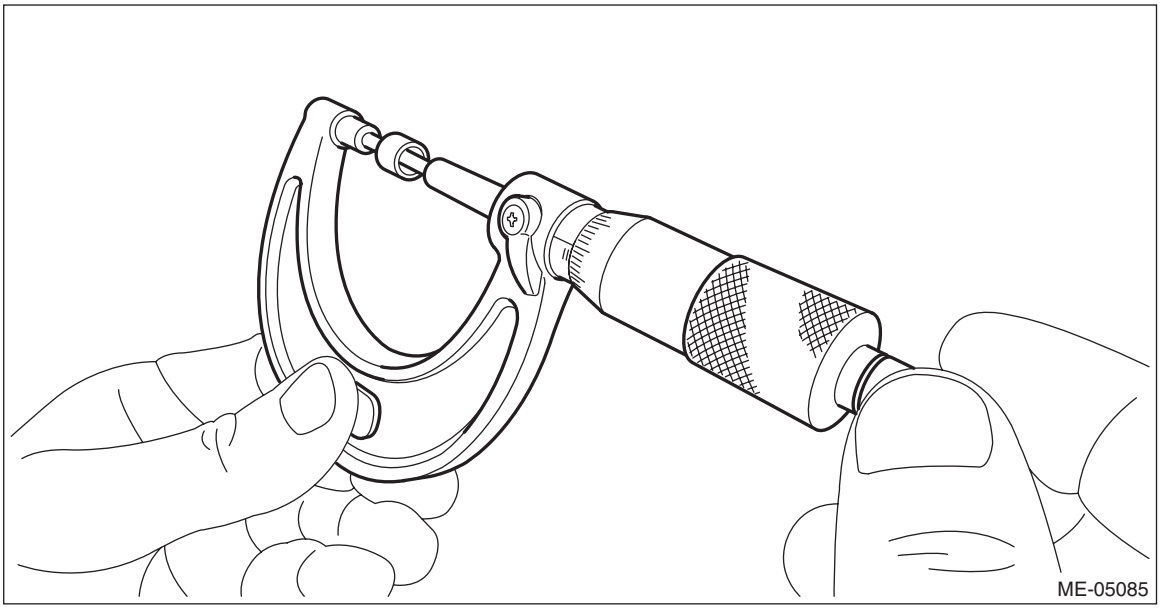
3) If necessary, adjust the cam clearance. <Ref. to ME(H4DO(w/o HEV))-52, ADJUSTMENT, Cam Clearance.>
4) After inspection, install the related parts in the reverse order of removal.

B: ADJUSTMENT

1) Remove the engine from the vehicle. <Ref. to ME(H4DO(w/o HEV))-55, REMOVAL, Engine Assembly.>
2) Remove the chain cover. <Ref. to ME(H4DO(w/o HEV))-149, REMOVAL, Chain Cover.>
3) When adjusting #1 and #3 cylinders
(1) Remove the timing chain RH. <Ref. to ME(H4DO(w/o HEV))-169, TIMING CHAIN RH, REMOVAL, Timing Chain Assembly.>
(2) Remove the cam carrier RH. <Ref. to ME(H4DO(w/o HEV))-220, CAM CARRIER RH, REMOVAL, Cam Carrier.>

(3) Measure the thickness of valve shim using micrometer.

NOTE:
Measurement should be performed at a temperature of 20°C (68°F).



(4) Select a valve shim of suitable thickness using the measured cam clearance and valve shim thickness.

NOTE:
Use a new valve shim.

Intake side: S = T + 1.69 × (V – 0.13 mm (0.0051 in)) Exhaust side: S = T + 1.87 × (V – 0.22 mm (0.0087 in))
S: Valve shim thickness required V: Measured cam clearance T: Current valve shim thickness

(5) Install the cam carrier RH. <Ref. to ME(H4DO(w/o HEV))-230, CAM CARRIER RH, INSTALLATION, Cam Carrier.>

(6) Check all the cam clearance of RH side at this time. If the cam clearance is not within the standard value, repeat the procedure over again from step 2).

NOTE:
When the removing/installing of cam carrier RH has been performed, cam clearance may be outside the standard value. Checking of all cam clearance of RH side is necessary. Refer to INSPECTION of “Cam Clearance” for the cam clearance inspection. <Ref. to ME(H4DO(w/o HEV))-51, WHEN TIMING CHAIN ASSEMBLY IS REMOVED, INSPECTION, Cam Clearance.>

Cam clearance:

Intake

Standard

$0.13^{+0.02}_{-0.03}$ mm ($0.0051^{+0.0008}_{-0.0012}$ in)

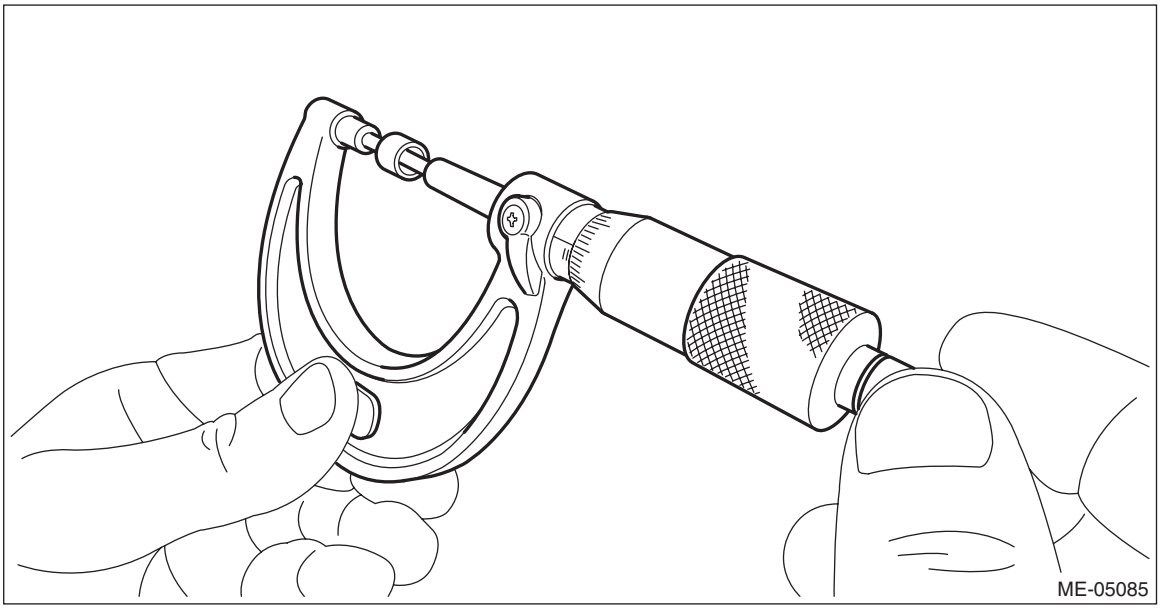
Exhaust

Standard

0.22±0.02 mm (0.0087±0.0008 in)

4) When adjusting #2 and #4 cylinders
(1) Remove the timing chain LH. <Ref. to ME(H4DO(w/o HEV))-171, TIMING CHAIN LH, REMOVAL, Timing Chain Assembly.>
(2) Remove the cam carrier LH. <Ref. to ME(H4DO(w/o HEV))-225, CAM CARRIER LH, REMOVAL, Cam Carrier.>
(3) Measure the thickness of valve shim using micrometer.

NOTE:
Measurement should be performed at a temperature of 20°C (68°F).



(4) Select a valve shim of suitable thickness using the measured cam clearance and valve shim thickness.

NOTE:
Use a new valve shim.

Intake side: S = T + 1.69 × (V – 0.13 mm (0.0051 in)) Exhaust side: S = T + 1.87 × (V – 0.22 mm (0.0087 in))
S: Valve shim thickness required V: Measured cam clearance T: Current valve shim thickness

(5) Install the cam carrier LH. <Ref. to ME(H4DO(w/o HEV))-240, CAM CARRIER LH, INSTALLATION, Cam Carrier.>
(6) Check all the cam clearance of LH side at this time. If the cam clearance is not within the standard value, repeat the procedure over again from step 2).

NOTE:
When the removing/installing of cam carrier LH has been performed, cam clearance may be outside the standard value. Checking of all cam clearance of LH side is necessary. Refer to INSPECTION of “Cam Clearance” for the cam clearance inspection. <Ref. to ME(H4DO(w/o HEV))-51, WHEN TIMING CHAIN ASSEMBLY IS REMOVED, INSPECTION, Cam Clearance.>

Cam clearance:
Intake
Standard
$0.13^{+0.02}_{-0.03}$ mm ($0.0051^{+0.0008}_{-0.0012}$ in)
Exhaust
Standard
0.22±0.02 mm (0.0087±0.0008 in)

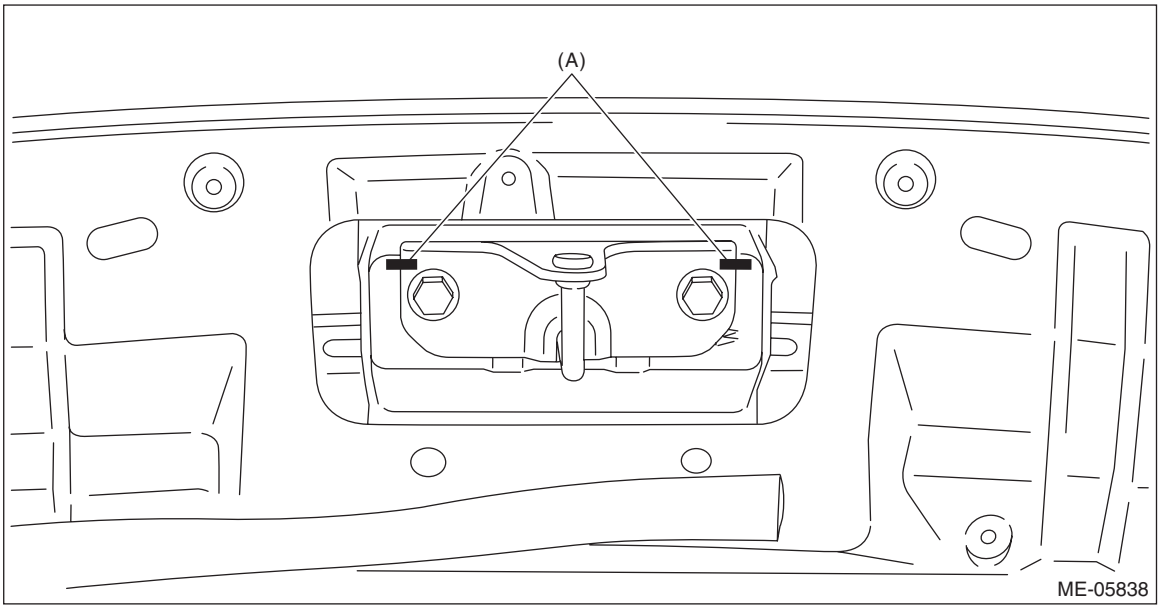
5) After adjustment, install the related parts in the reverse order of removal.

9. Engine Assembly

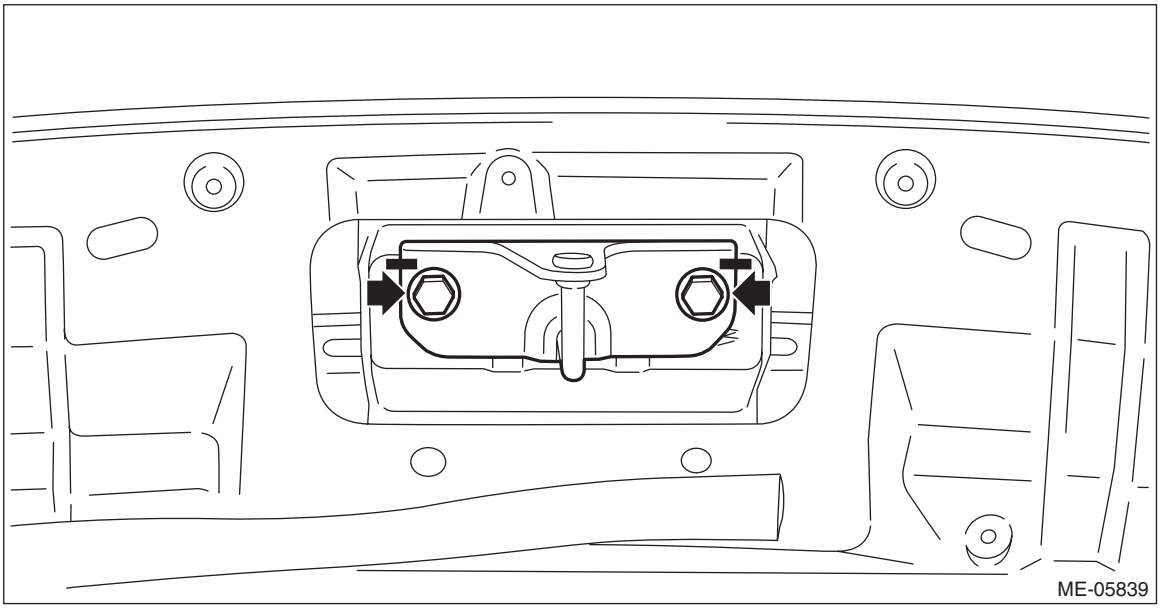
A: REMOVAL

1. GASOLINE ENGINE MODEL

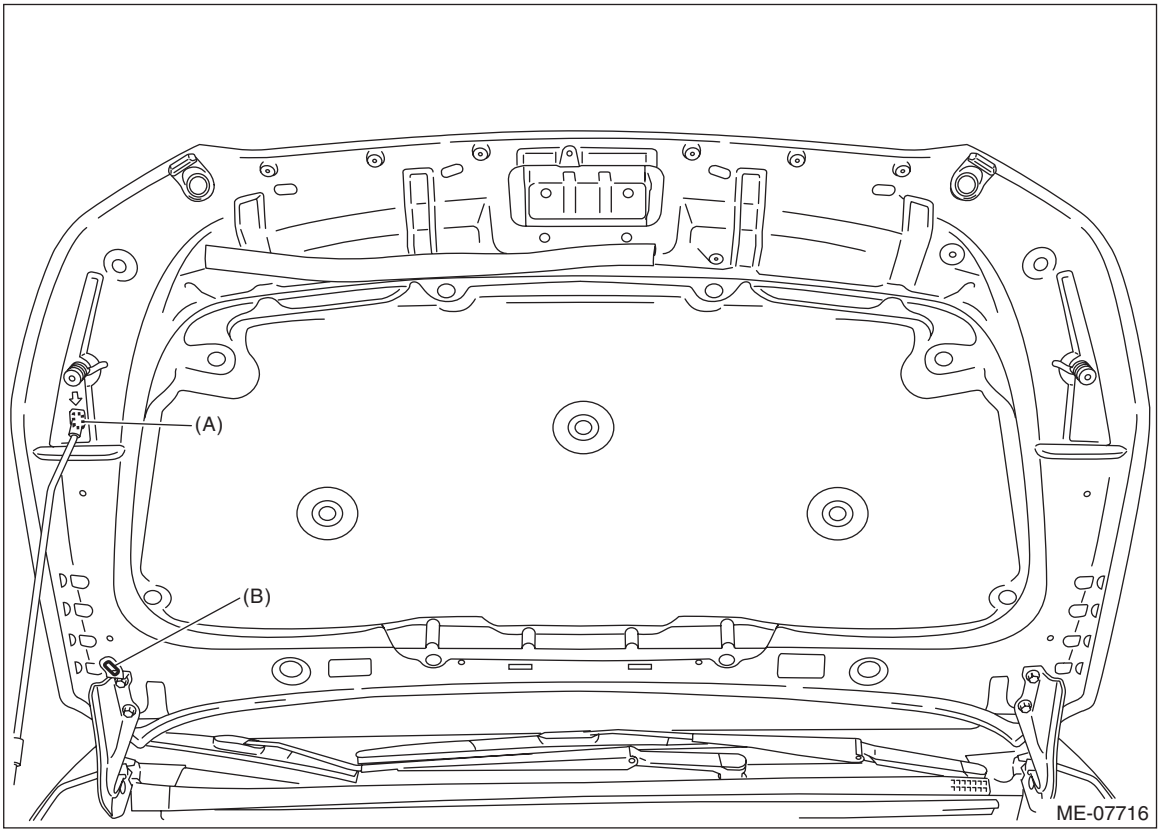
1) Open the front hood, and make alignment marks (A) on both the front hood and the front hood striker by using a marker pen.



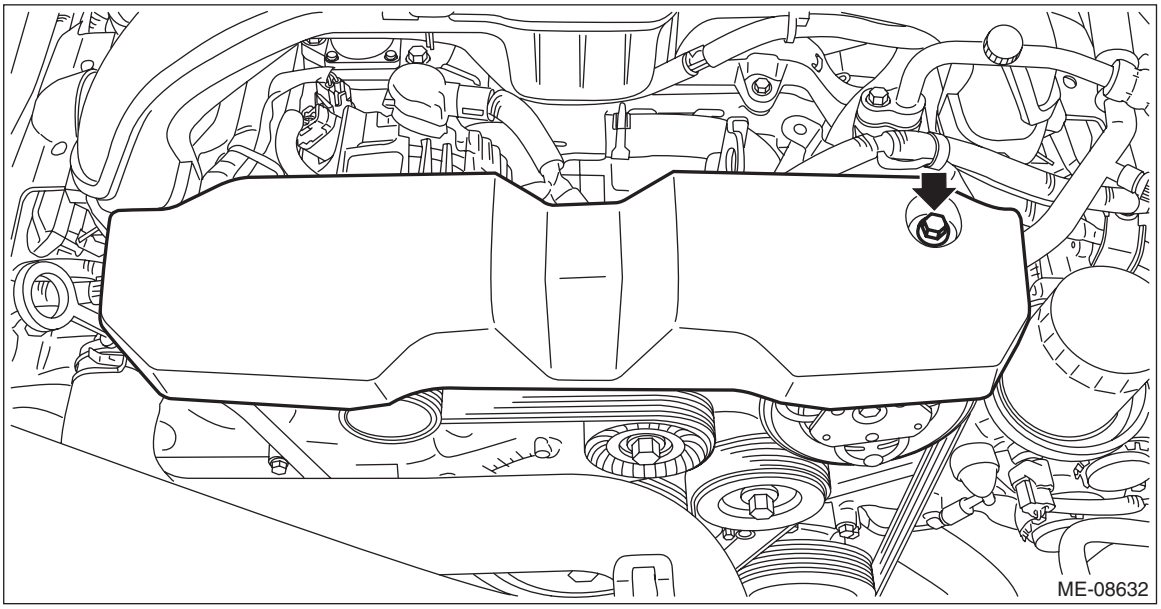
2) Remove the front hood striker from the front hood.



3) Change the front hood stay position from (A) to (B), and completely open the front hood.

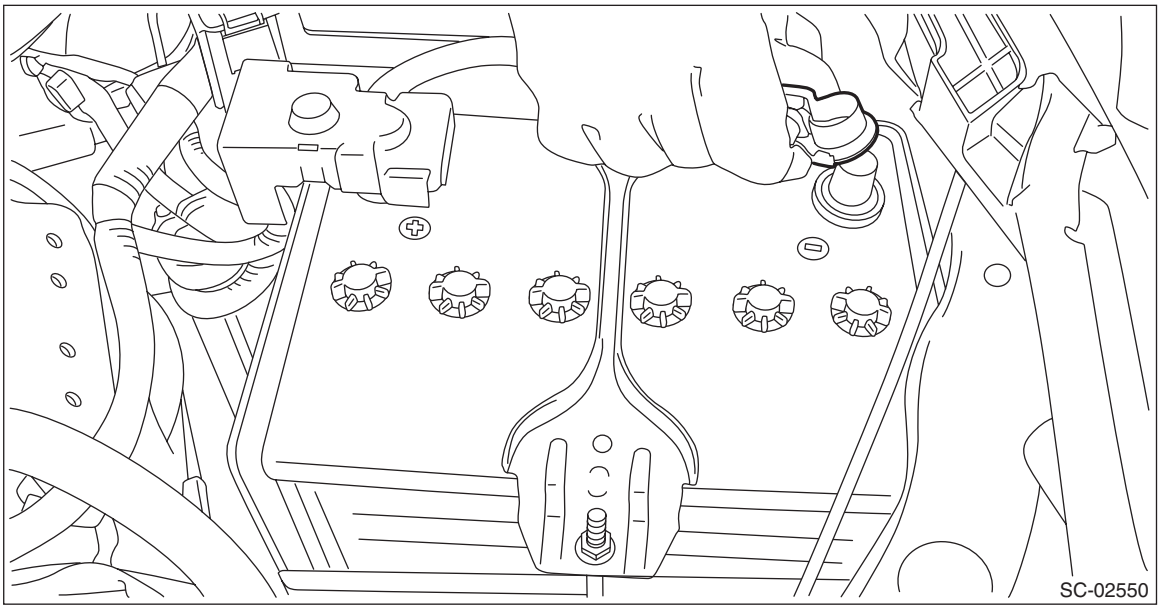


4) Remove the V-belt covers.

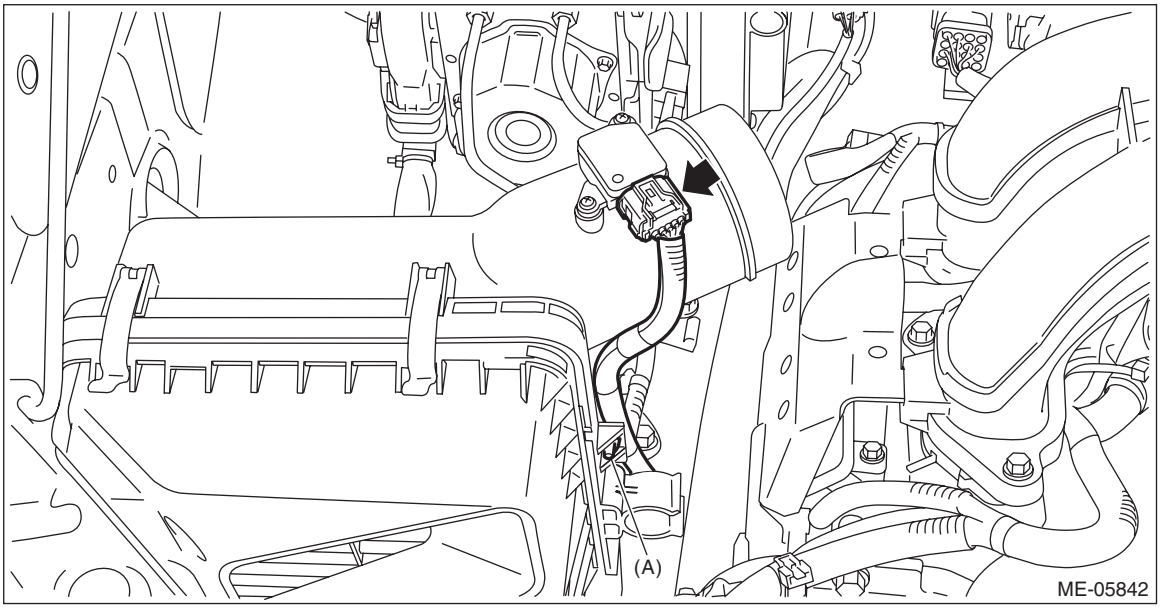


5) Collect the refrigerant from A/C system. <Ref. to AC-28, Refrigerant Recovery Procedure.>
6) Release the fuel pressure. <Ref. to FU(H4DO(w/o HEV))-109, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>

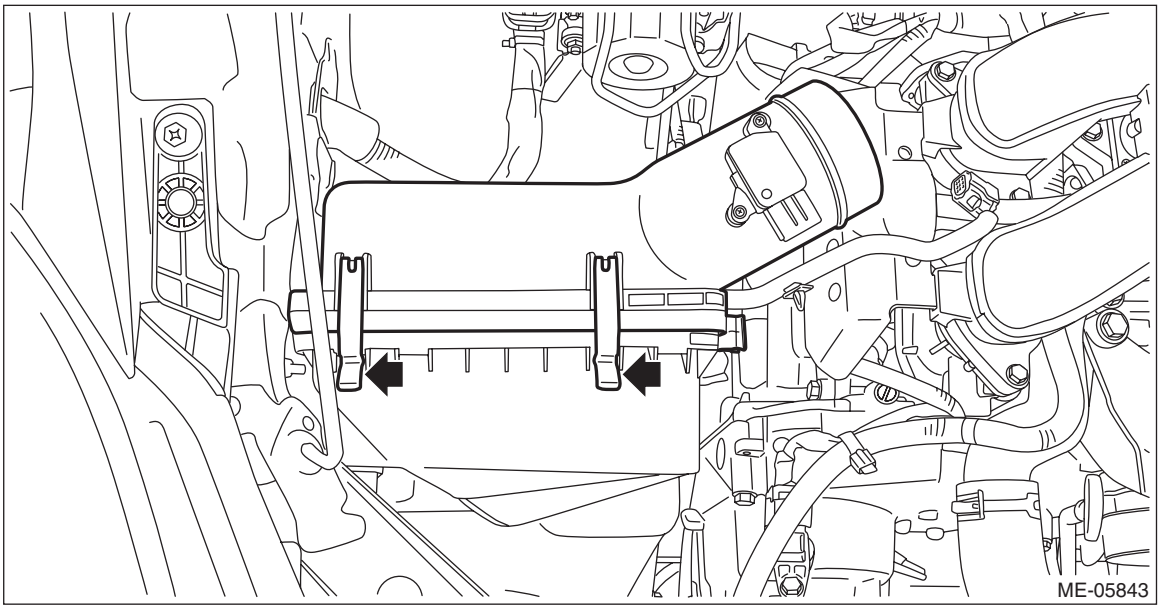
7) Disconnect the ground cable from battery.



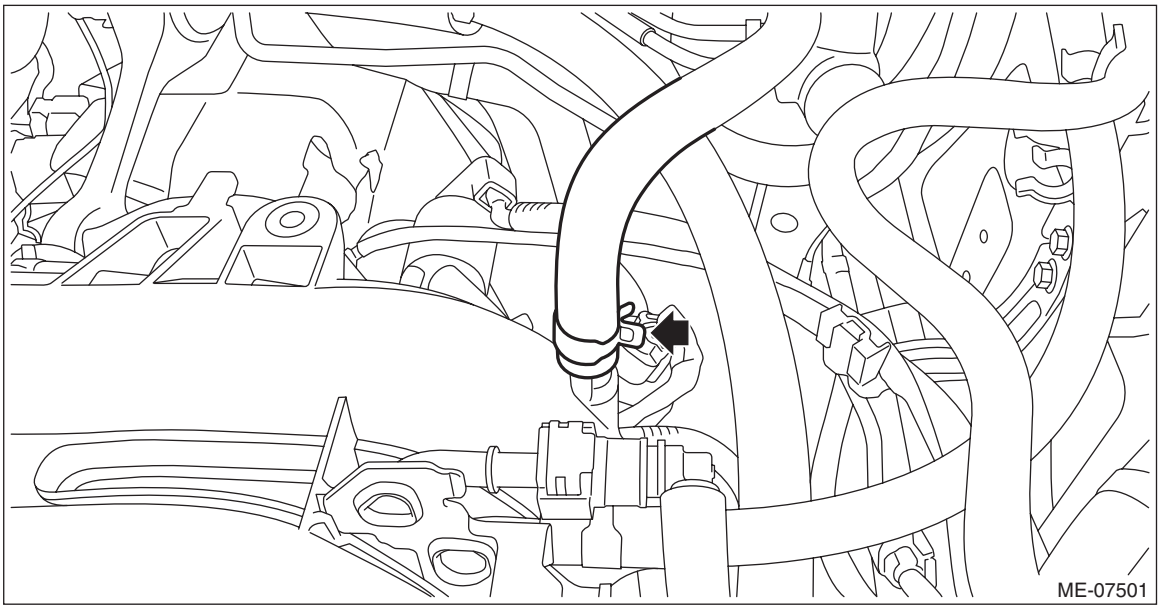
8) Remove the air intake duct. <Ref. to IN(H4DO(w/o HEV))-13, REMOVAL, Air Intake Duct.>
9) Remove the air intake boot. <Ref. to IN(H4DO(w/o HEV))-12, REMOVAL, Air Intake Boot.>
10) Disconnect the connector from the mass air flow and intake air temperature sensor, and remove the clip (A) which holds the mass air flow and intake air temperature sensor harness.



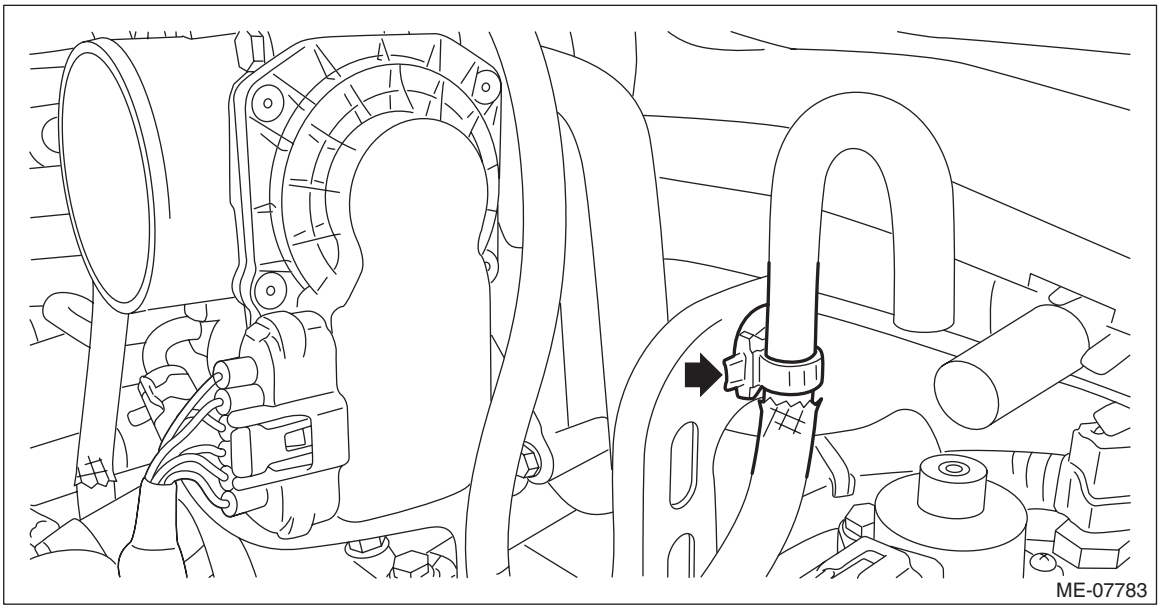
11) Remove the air cleaner case (rear).



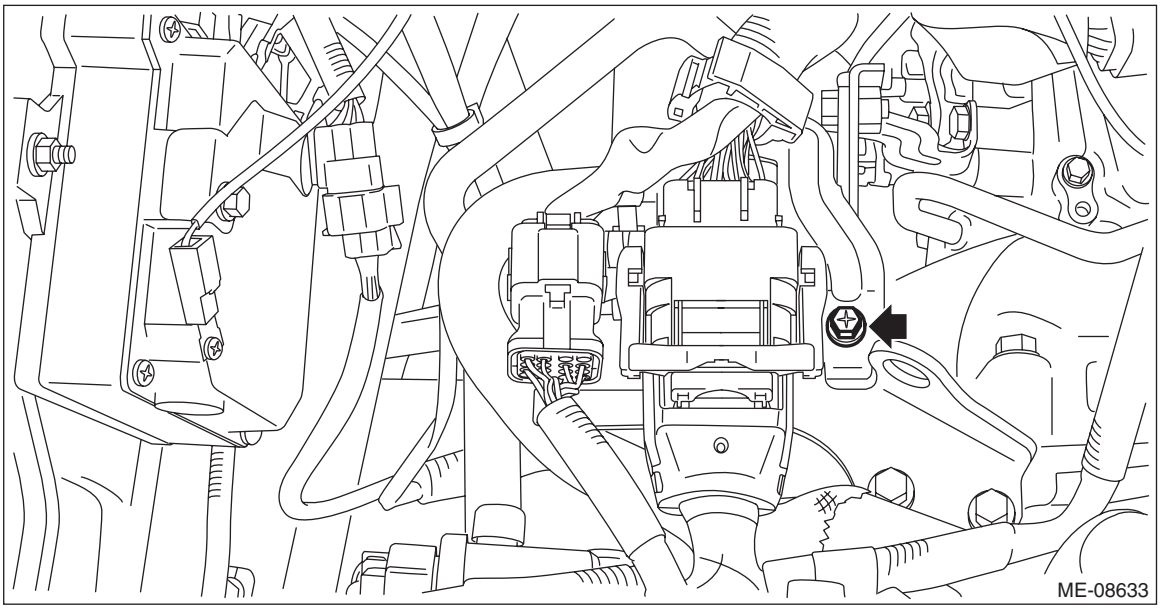
12) Remove the radiator. <Ref. to CO(H4DO(w/o HEV))-78, REMOVAL, Radiator.>
13) Disconnect the brake booster vacuum hose from the intake manifold.



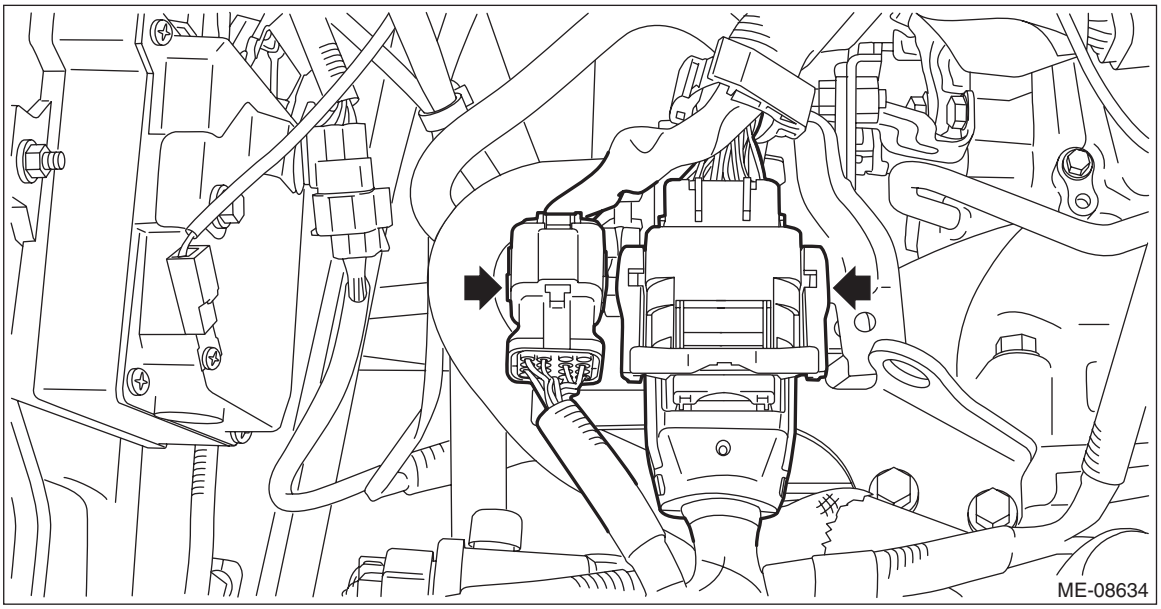
14) Remove the clip holding the air breather hose to the engine rear hanger. (MT model)



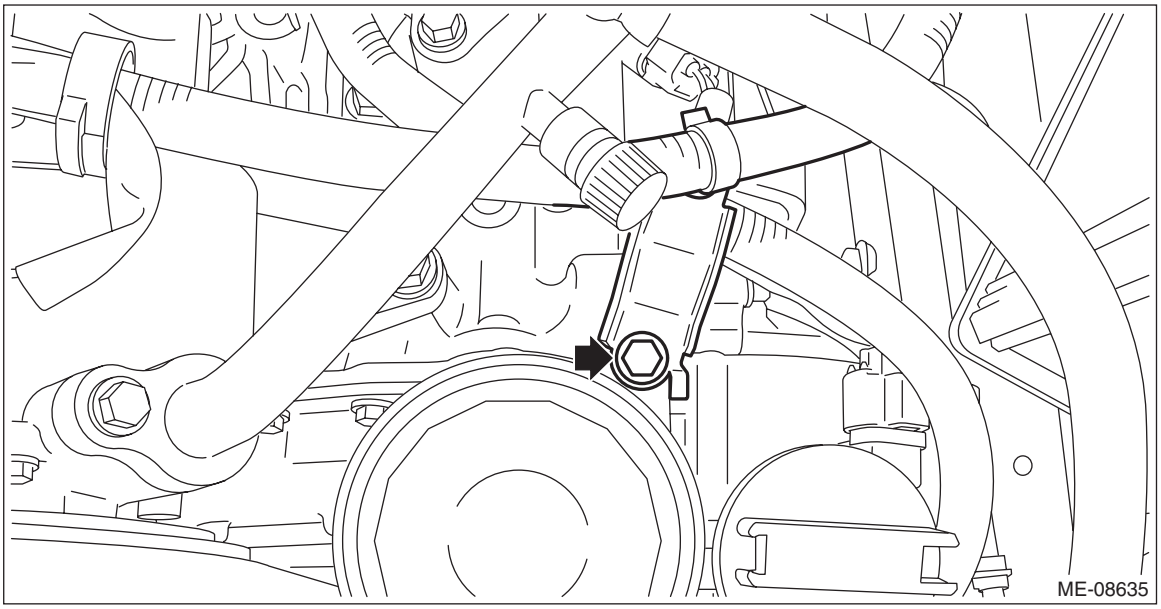
15) Disconnect the engine harness connector.
(1) Remove the bolt securing the bulkhead harness connector bracket.



(2) Disconnect the bulkhead harness connector from the engine harness connector (black) and engine harness connector (brown).

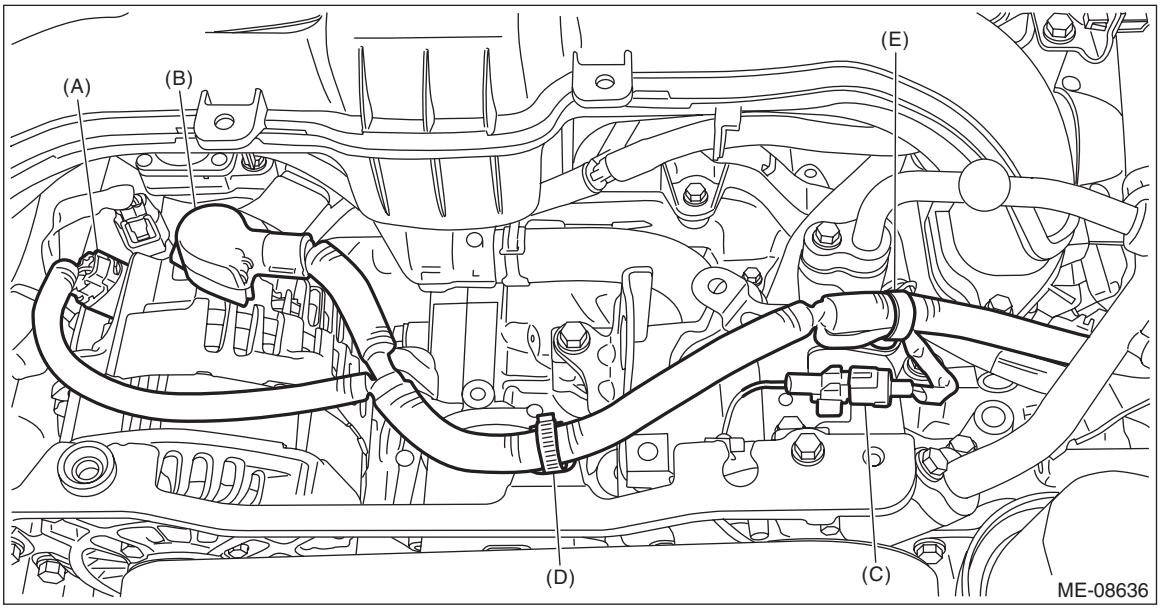


16) Remove the bolts which secure the generator cord stay to the chain cover.

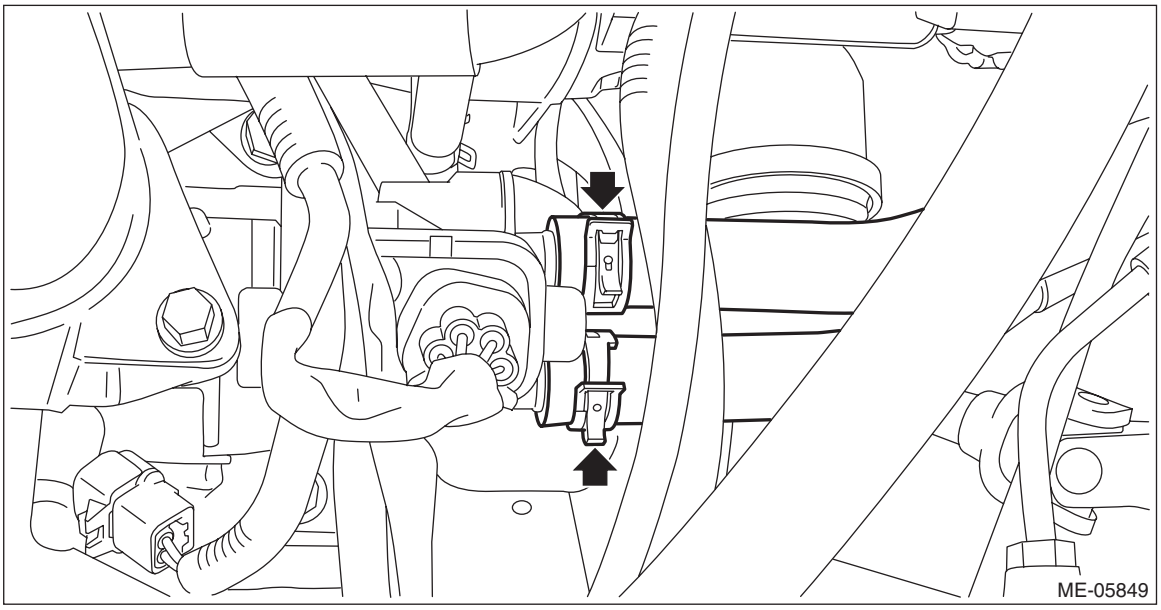


17) Disconnect connector (A) and terminal (B) from the generator, and disconnect connector (C) from A/C compressor.

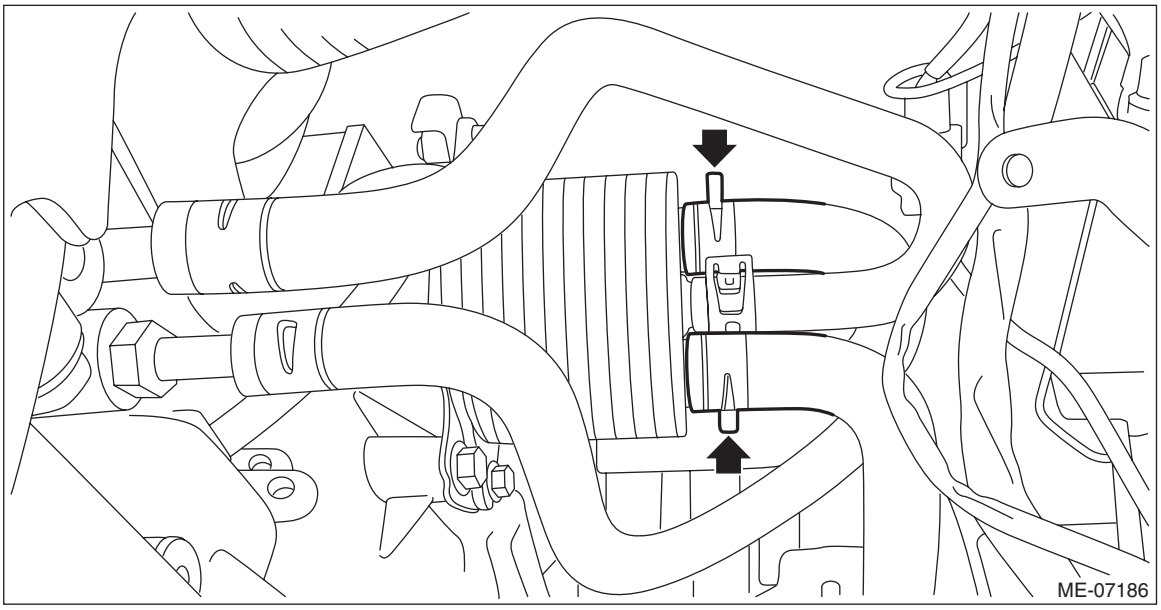
18) Remove the generator cord from the clip (D) and clip (E) and move the generator cord to the left side wheel apron.



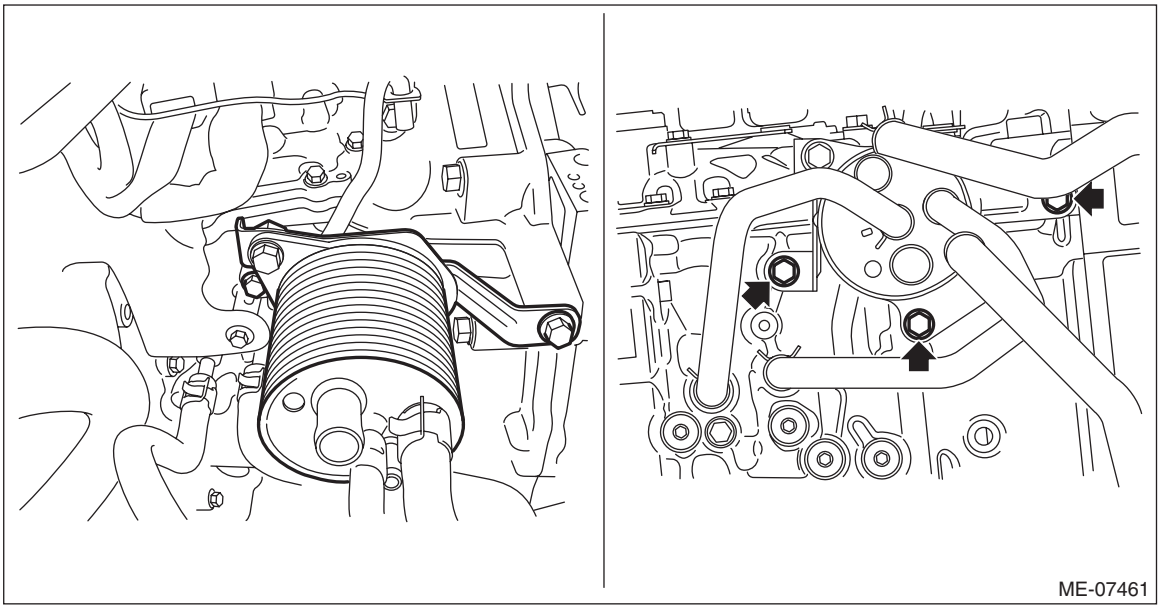
19) Disconnect the A/C pressure hoses from A/C compressor. <Ref. to AC-71, REMOVAL, Hose and Pipe.>
20) Disconnect the heater inlet hose and heater outlet hose.



21) Disconnect the water hose from CVTF cooler (with warmer feature). (CVT model)

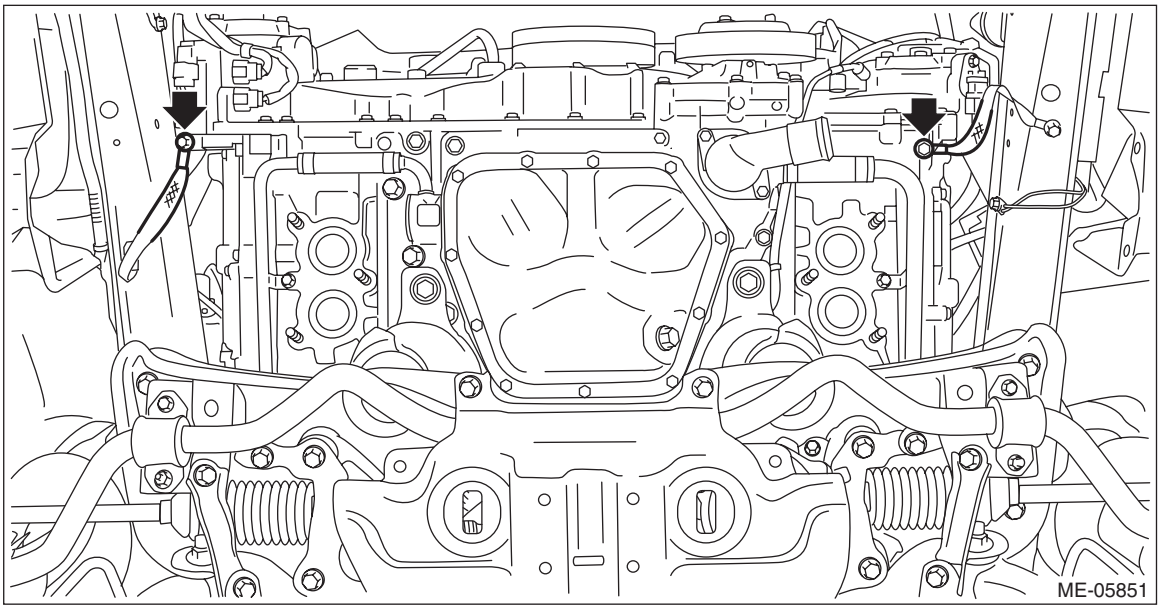


22) Remove the bolt which secures the CVTF cooler (with warmer feature) to the transmission, and move the CVTF cooler (with warmer feature) to the right side of the transmission. (CVT model)



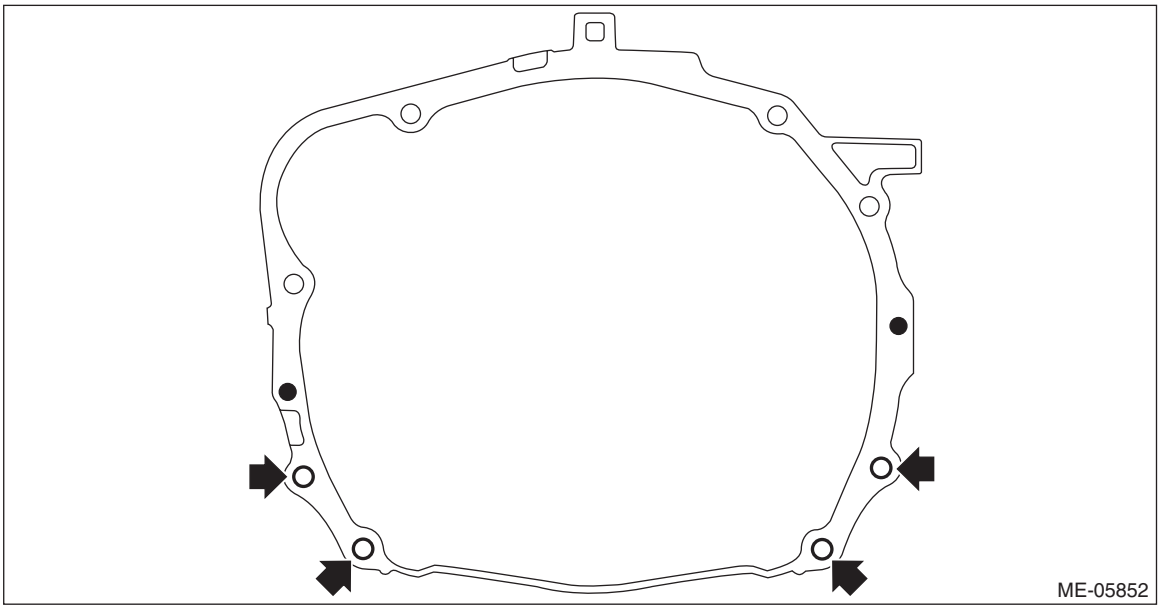
23) Lift up the vehicle.
24) Remove the front exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-6, REMOVAL, Front Exhaust Pipe.>

25) Disconnect the ground cable on the engine side.

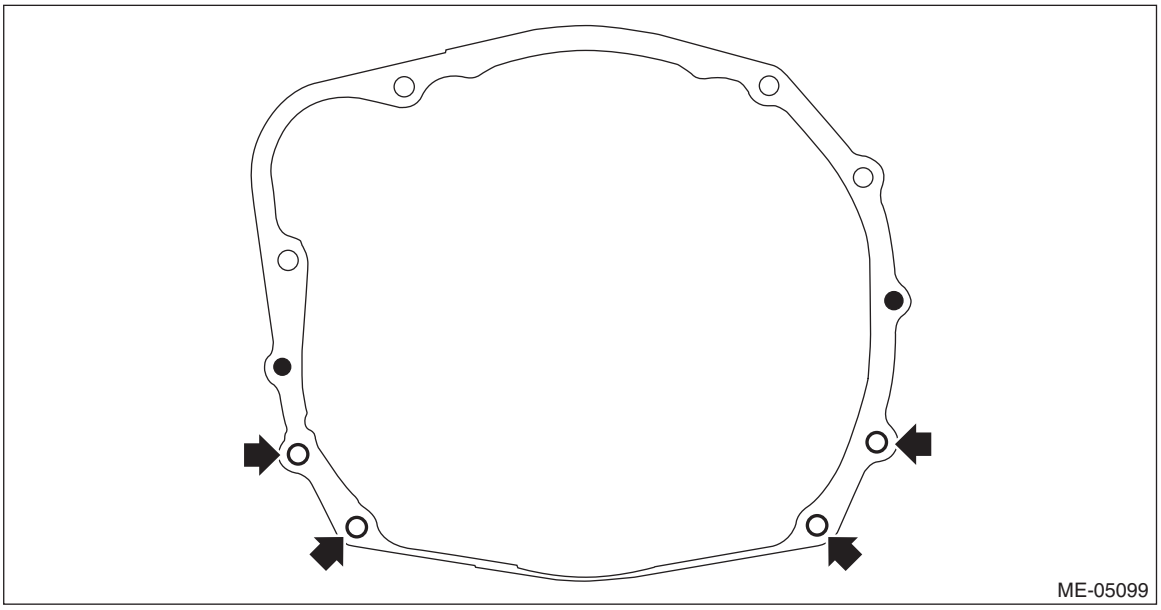


26) Remove the bolts and nuts which hold the lower side of transmission to the engine.

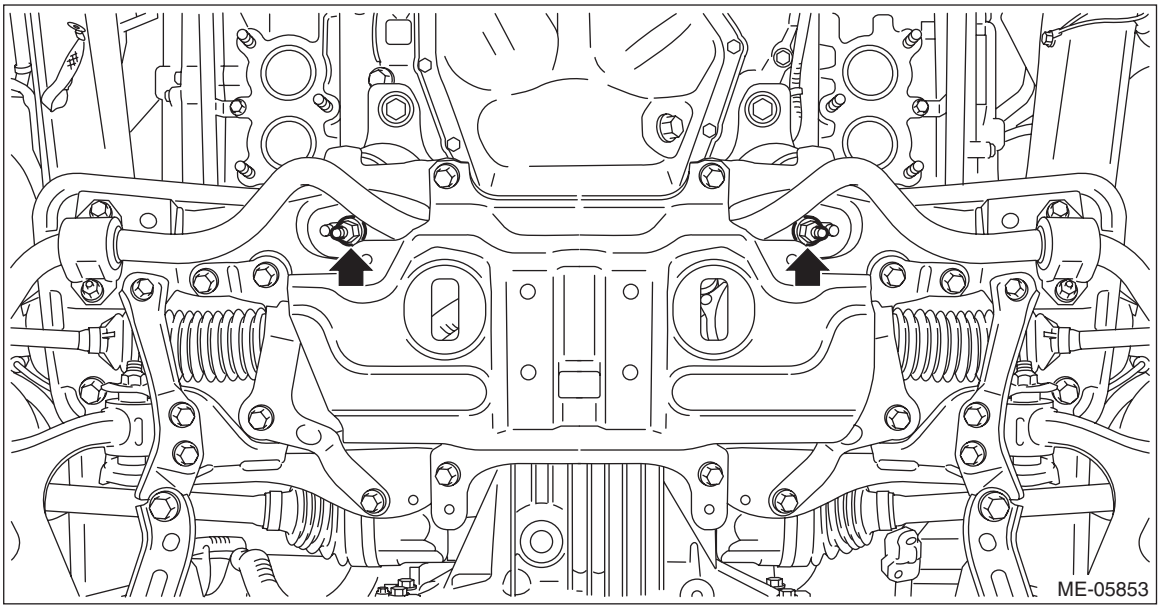
- CVT model



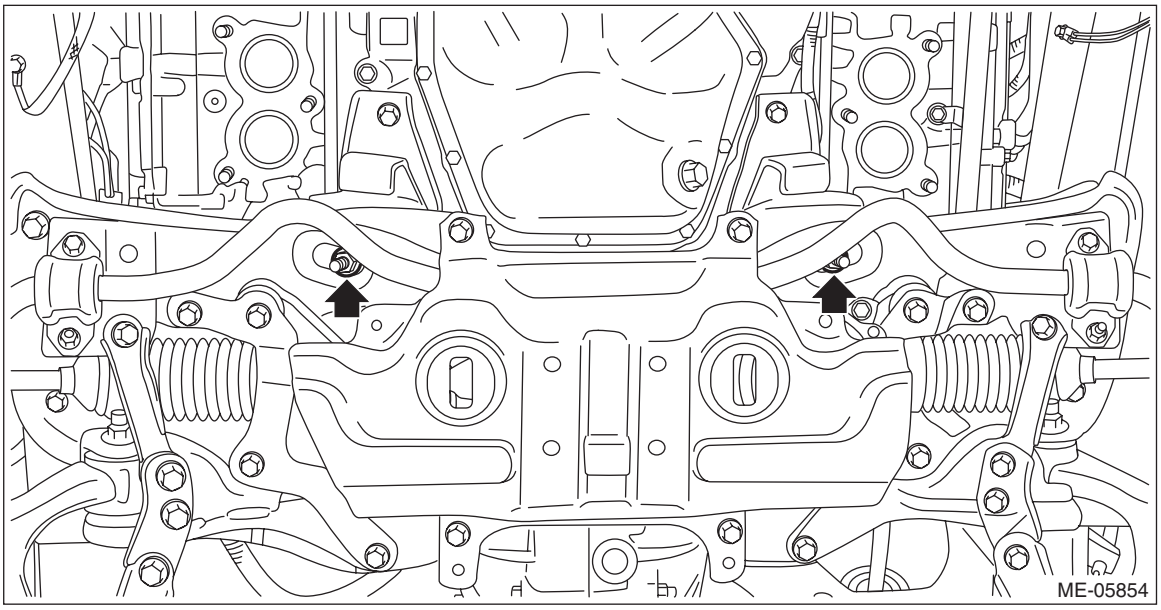
- MT model



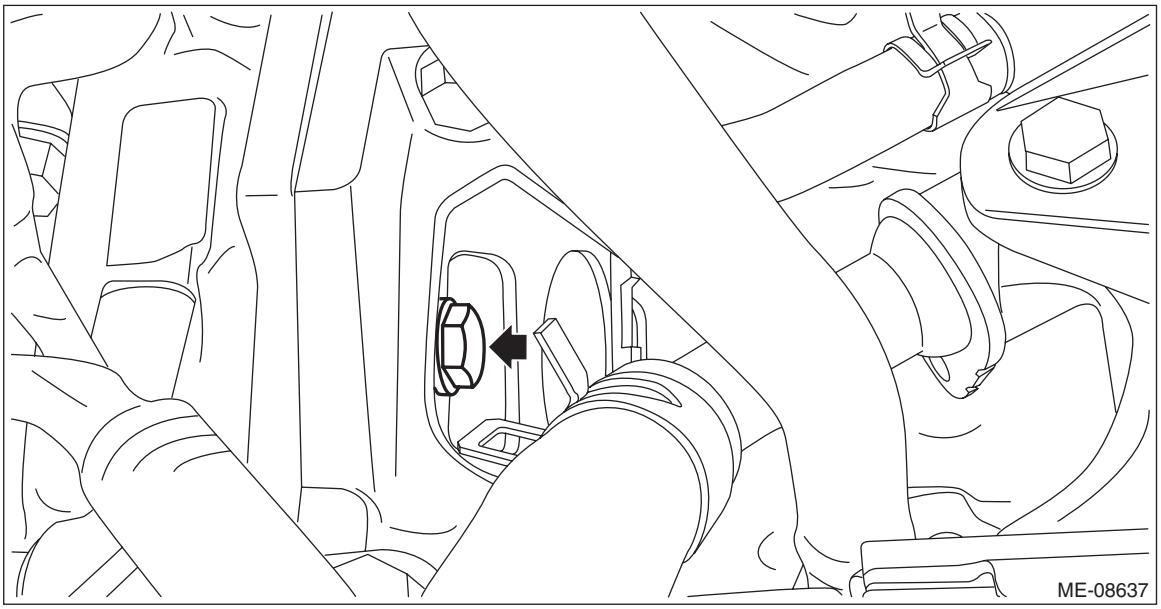
27) Remove the nuts which secure the engine mounting to the front crossmember. (CVT model)



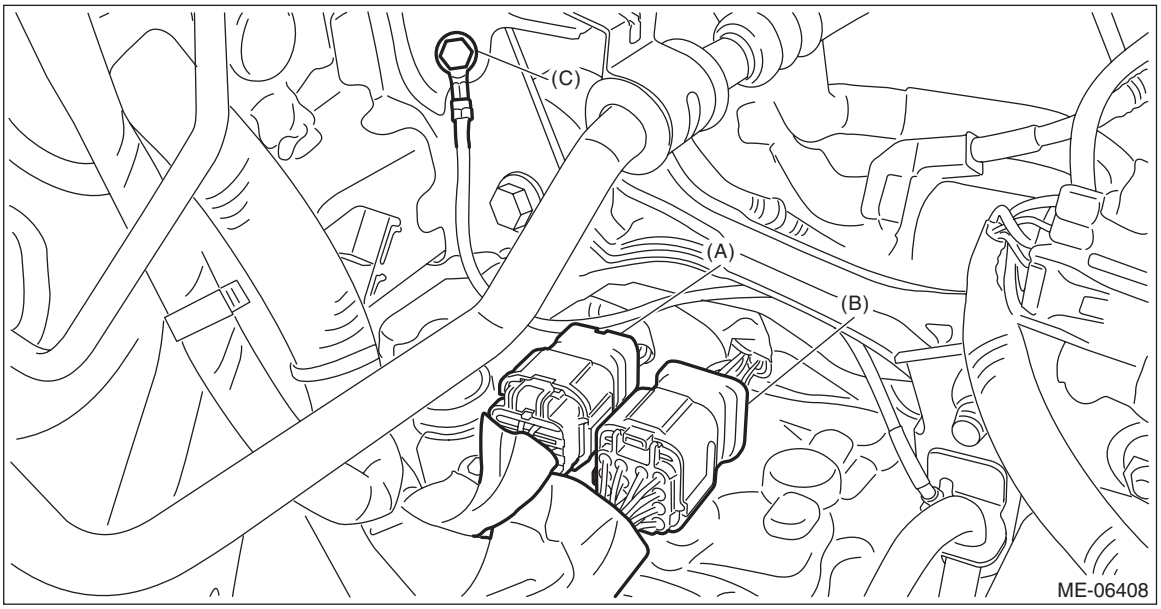
28) Remove the nuts which secure the engine mounting to the front crossmember. (MT model)



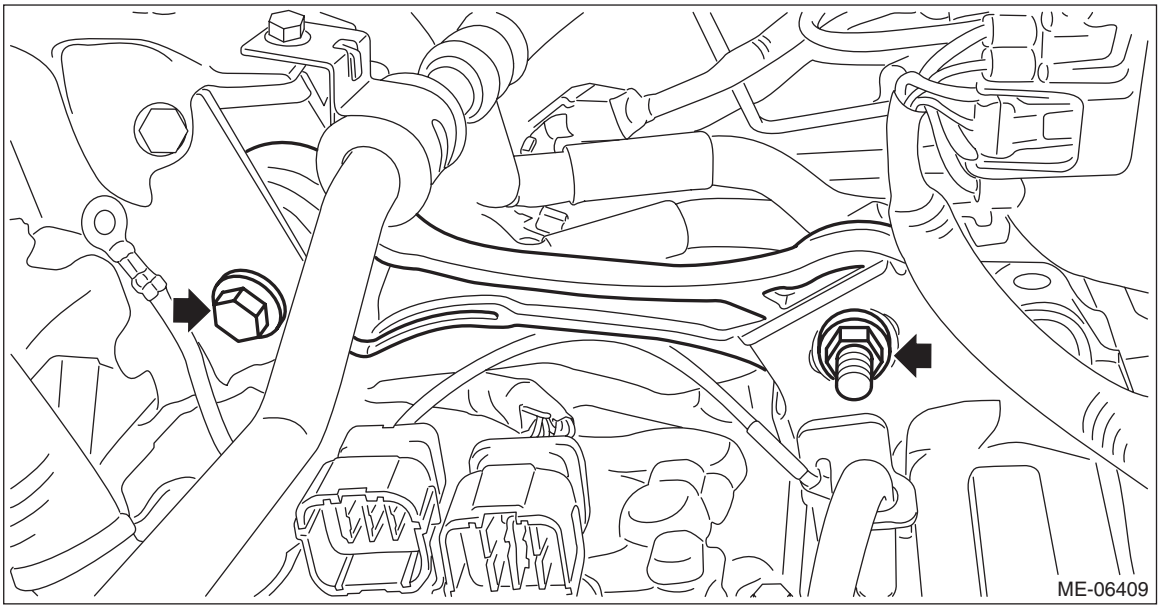
29) Separate the torque converter clutch from the drive plate. (CVT model)
(1) Lower the vehicle.
(2) Remove the throttle body. <Ref. to FU(H4DO(w/o HEV))-14, REMOVAL, Throttle Body.>
(3) Remove the service hole plug.
(4) Insert the wrench into the crank pulley bolt, and rotate the crank pulley to remove the four bolts securing the torque converter clutch to the drive plate.



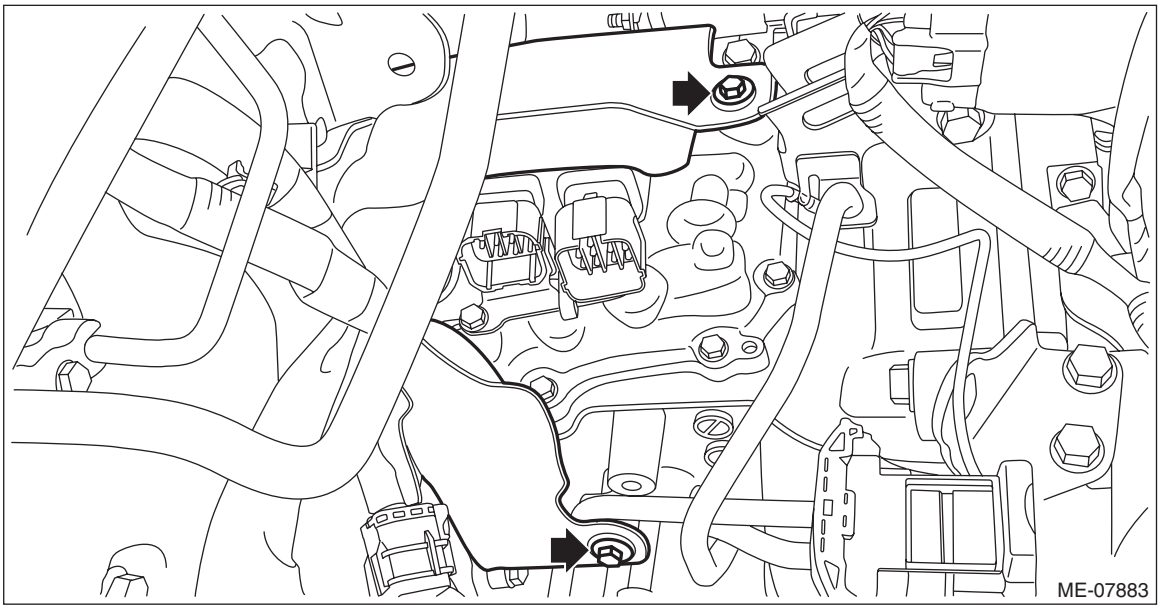
30) Disconnect the bulkhead harness connector from the transmission harness connector (A) and the inhibitor harness connector (B), and disconnect the transmission radio ground terminal (C) from the vehicle body. (CVT model)



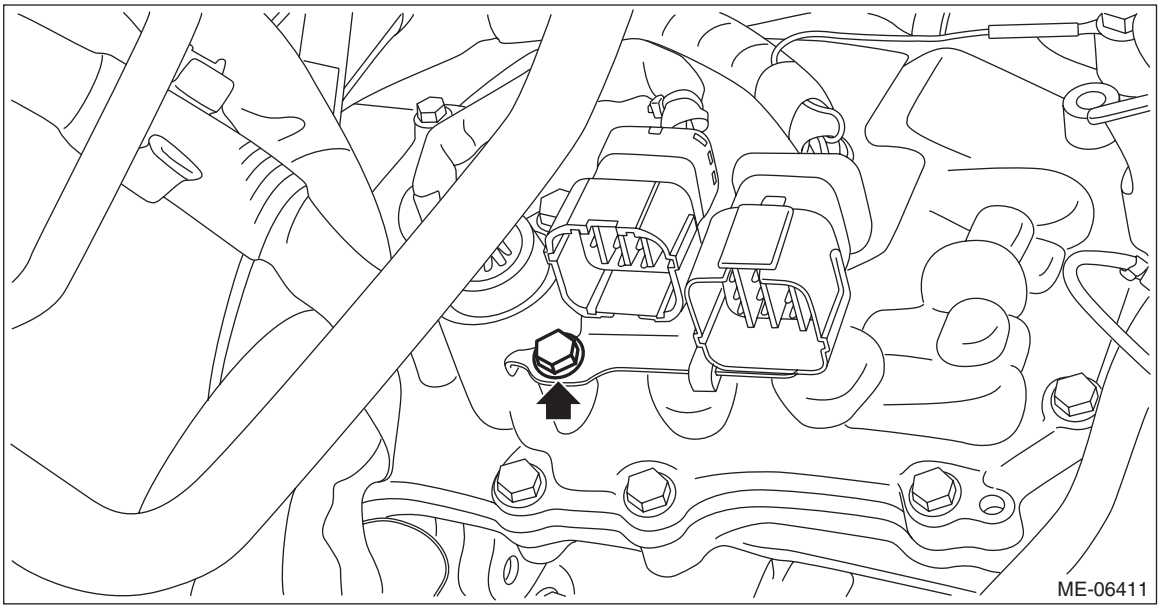
31) Remove the pitching stopper.



32) Remove the transmission case cover. (CVT model)

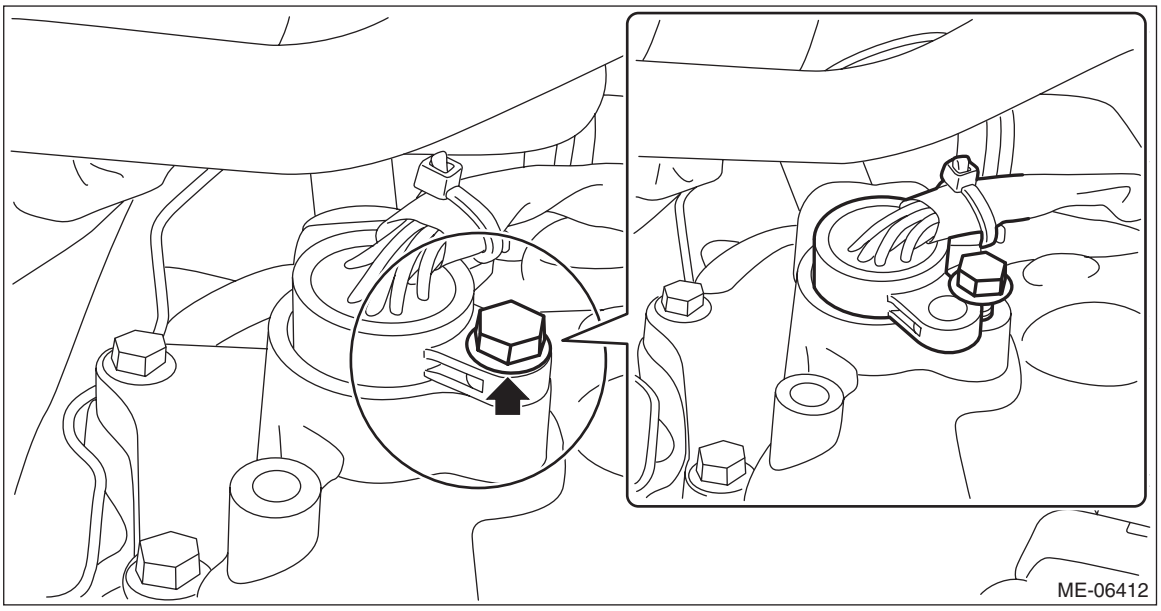


33) Remove the bolt which holds the transmission harness stay. (CVT model)



34) Remove the bolt which holds the transmission harness to the control valve body, and turn the transmission harness clockwise till the bolt hole can be seen as shown in the figure, and tighten the bolt to temporary lock the harness. (CVT model)

NOTE:
This procedure is required to prevent the transmission harness from touching the vehicle body during engine removal/installation.

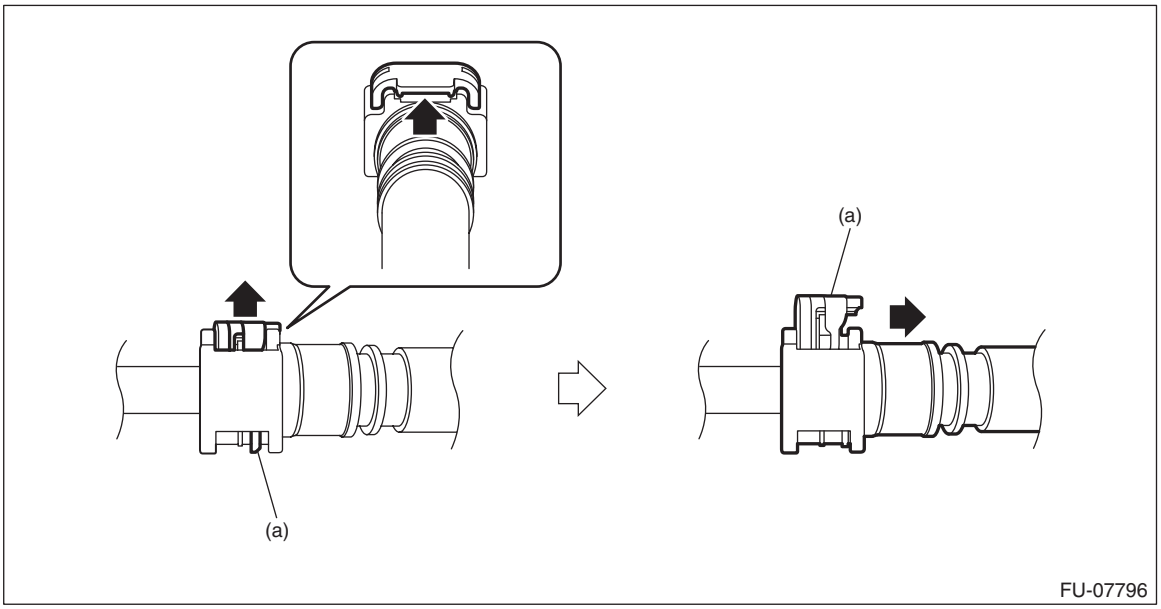


35) Disconnect the fuel delivery tube and evaporation hose.

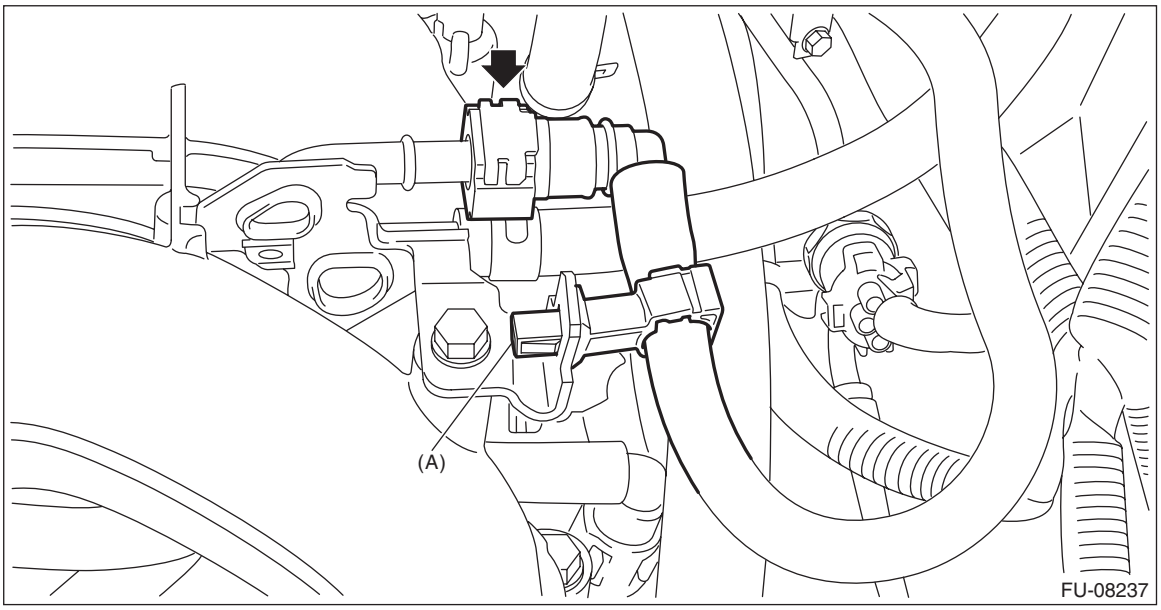
CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from the tubes using a container or cloth.**

(1) Disconnect the quick connector on the fuel delivery tube from the fuel pipe assembly, and remove the clip (A) securing the fuel delivery tube.

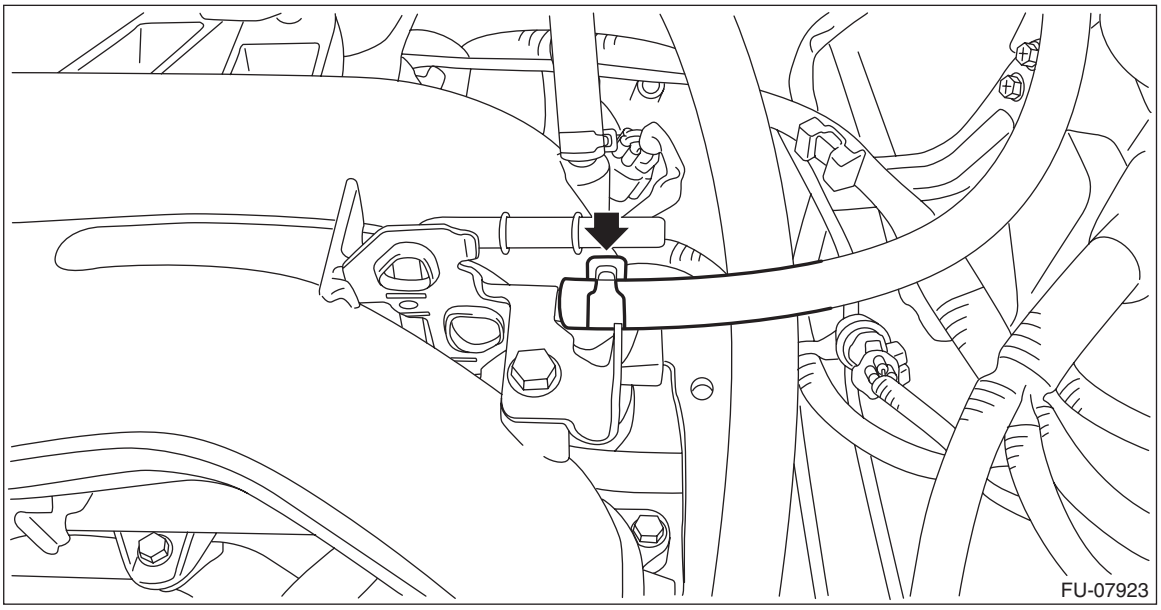
NOTE:
Disconnect the quick connector as shown in the figure.



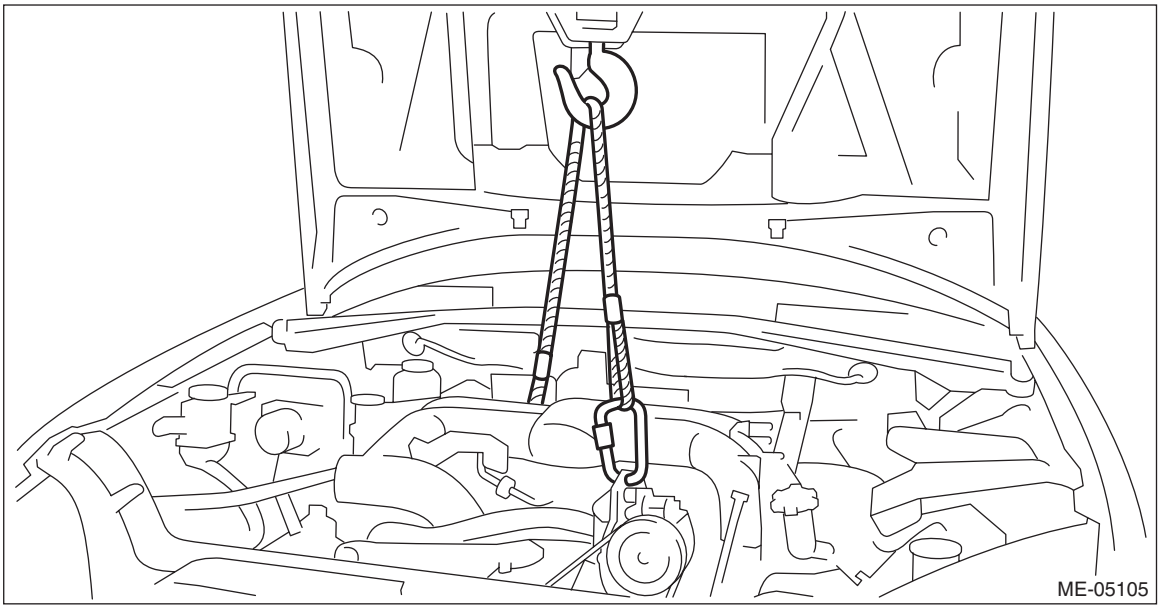
(a) Slider



(2) Disconnect the evaporation hose from the fuel pipe assembly.

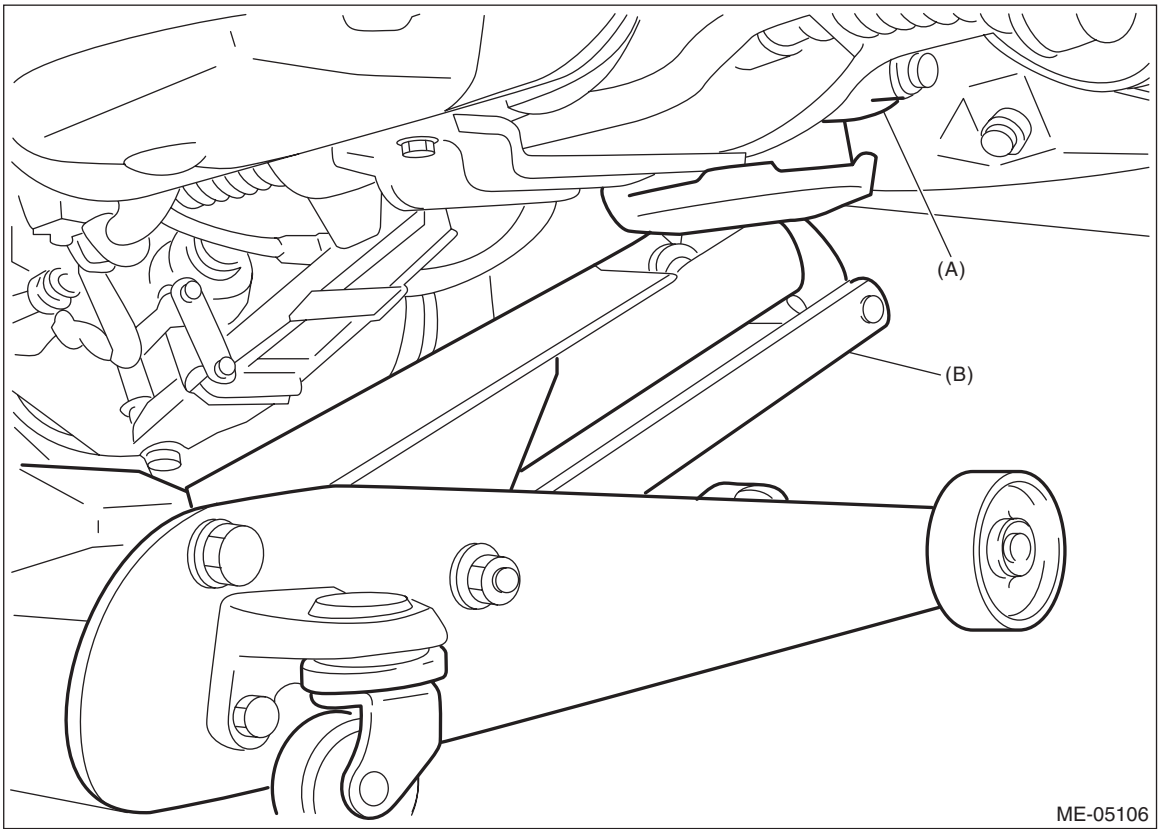


36) Support the engine with a lifting device and wire ropes.



37) Support the transmission with a garage jack.

CAUTION:
Be sure to perform this procedure to prevent the transmission from lowering by its own weight.



(A) Transmission
(B) Garage jack

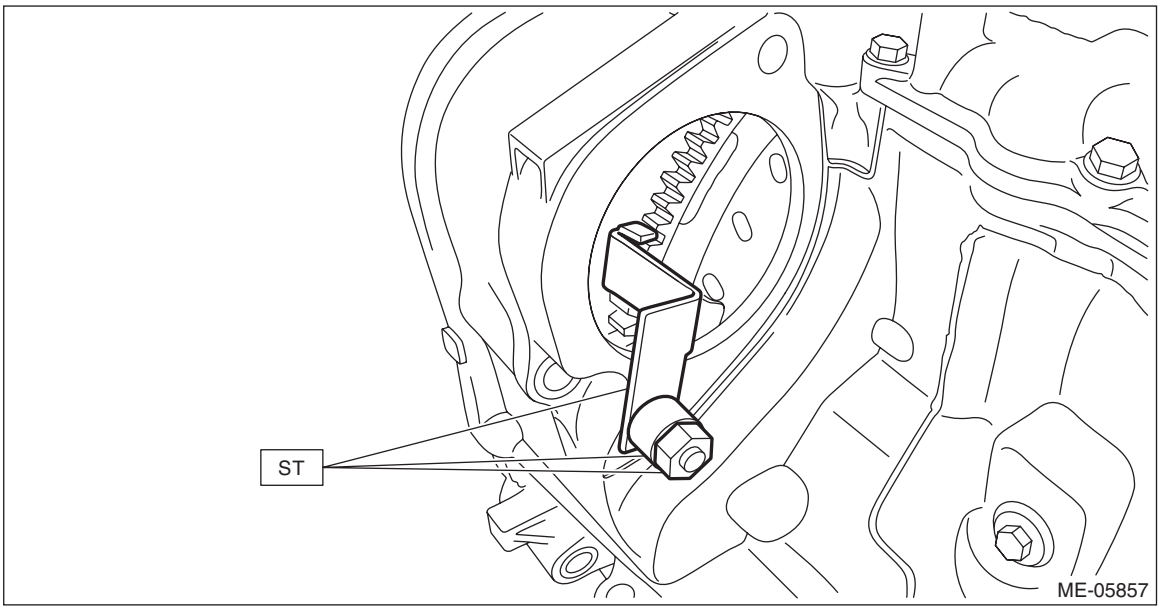
38) Separate the engine and transmission.

CAUTION:
Before removing the engine away from transmission, check to be sure no work has been overlooked.

(1) Remove the starter. <Ref. to SC(H4DO(w/o HEV))-8, REMOVAL, Starter.>

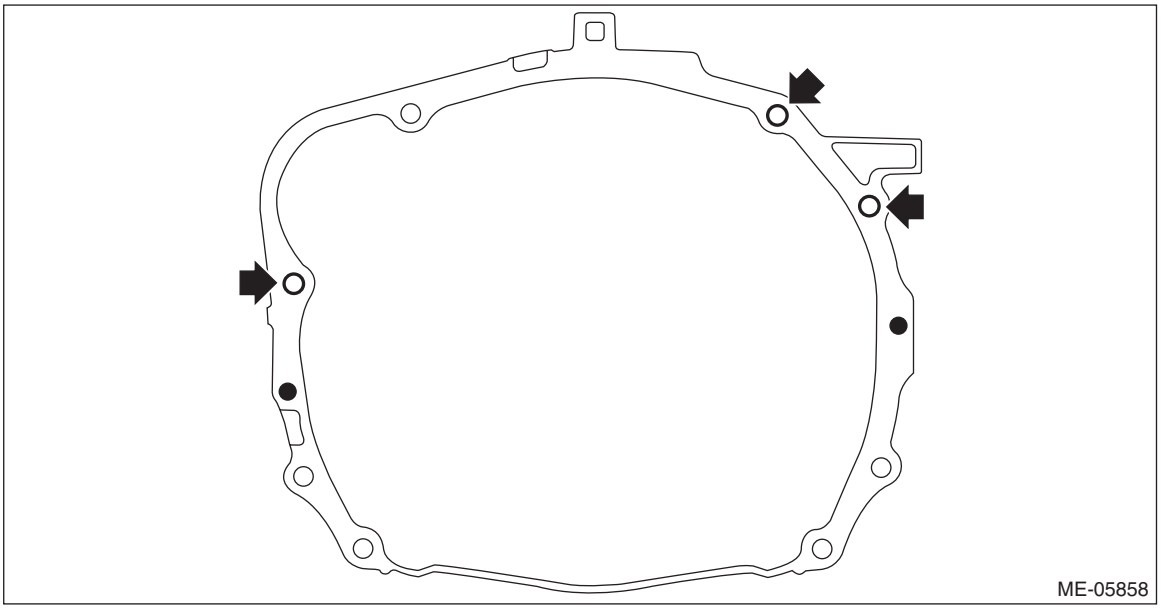
(2) Attach the ST to the torque converter clutch case. (CVT model)

ST 498277200 STOPPER SET

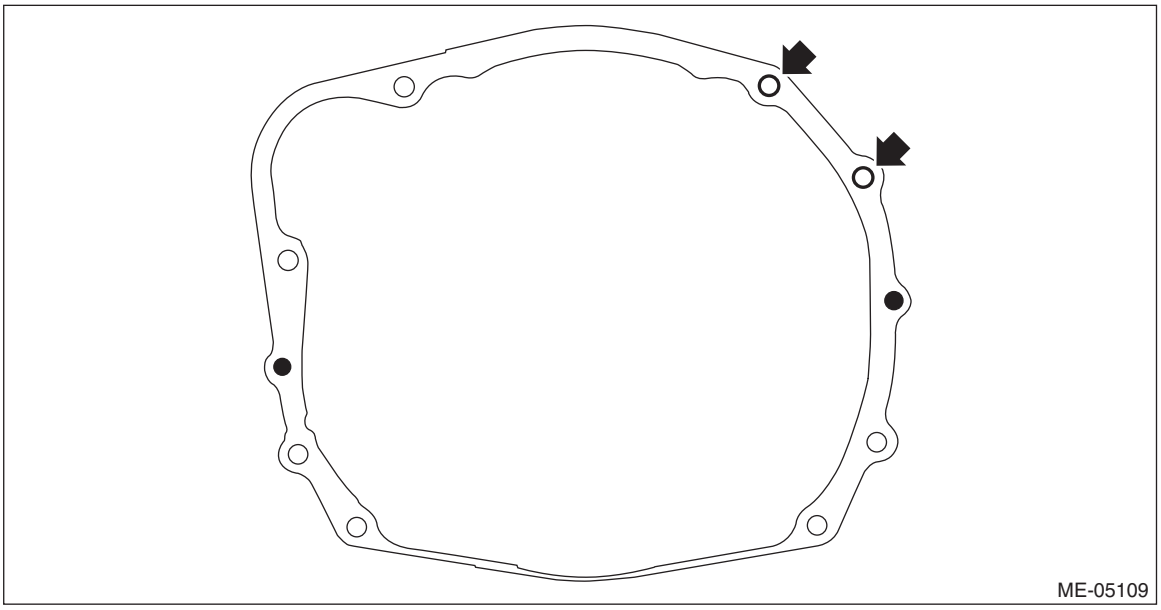


(3) Remove the bolts which hold the upper side of the transmission to the engine.

- CVT model



- MT model



39) Remove the engine from the vehicle.

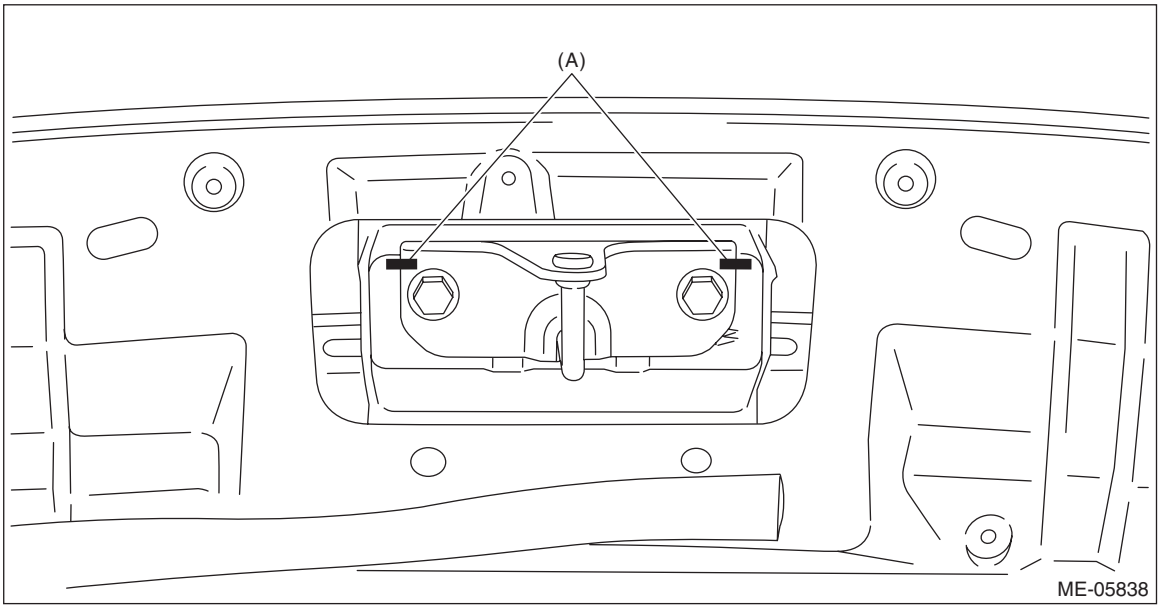
NOTE:
Be careful not to damage adjacent parts or body panels with crank pulley, oil level gauge, etc.

(1) Slightly raise the engine.
(2) Raise the transmission with garage jack.
(3) Move the engine horizontally until main shaft is withdrawn from clutch cover. (MT model)
(4) Slowly move the engine away from engine compartment.

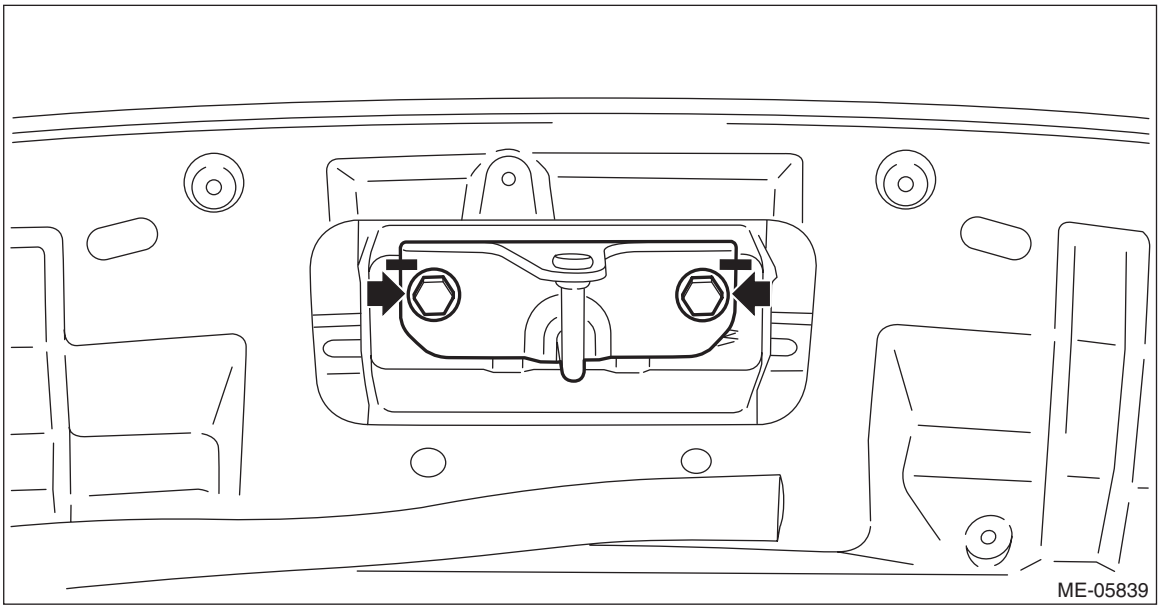
40) Remove the engine mounting from the engine.

2. HEV MODEL

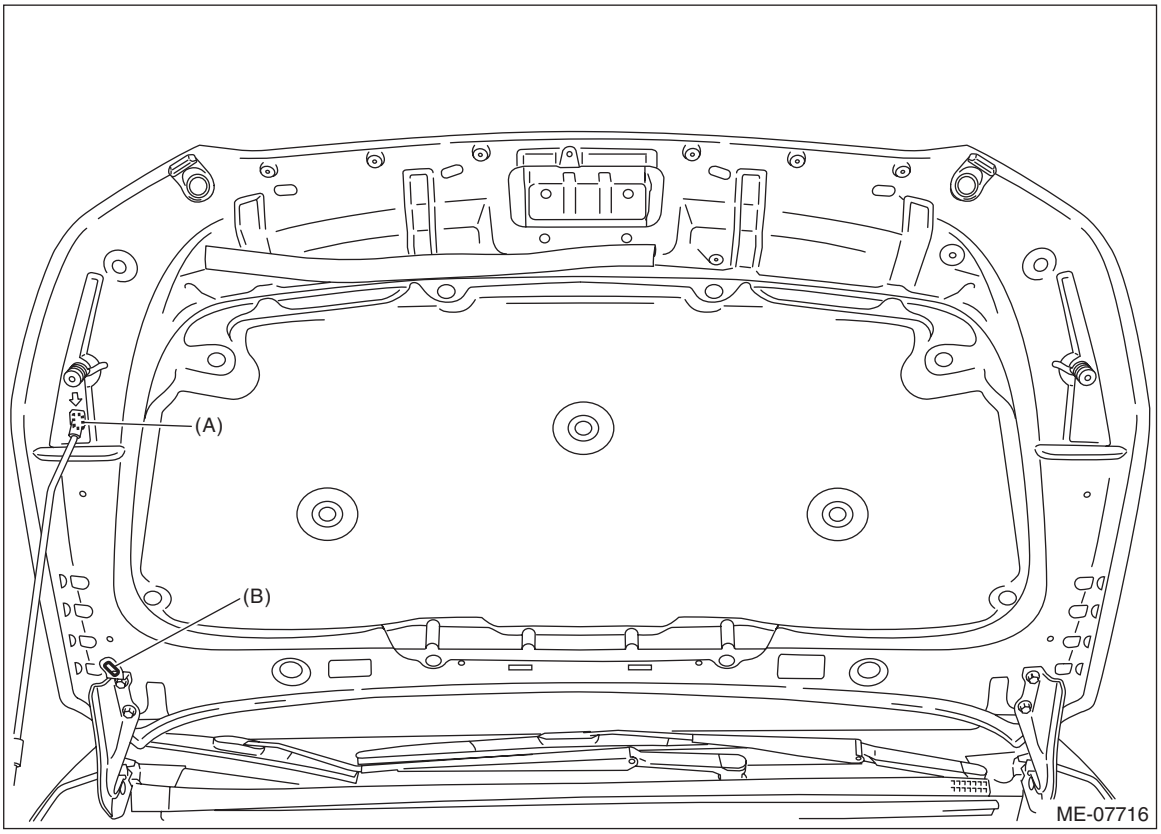
1) Turn the ignition switch to OFF.
2) Open the front hood, and make alignment marks (A) on both the front hood and the front hood striker by using a marker pen.



3) Remove the front hood striker from the front hood.

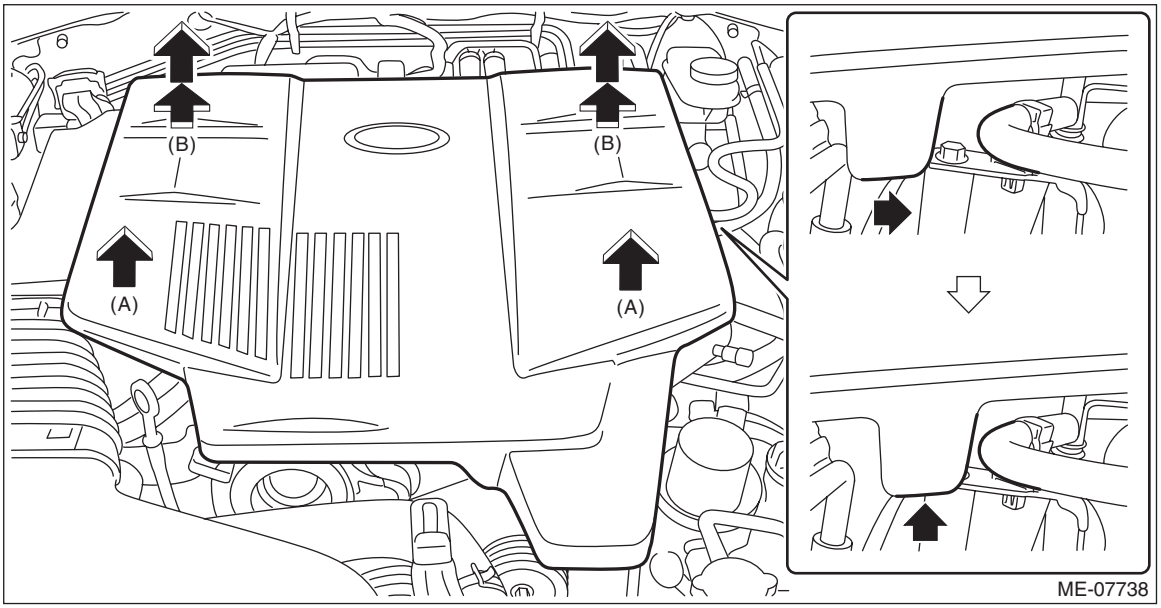


4) Change the front hood stay position from (A) to (B), and completely open the front hood.



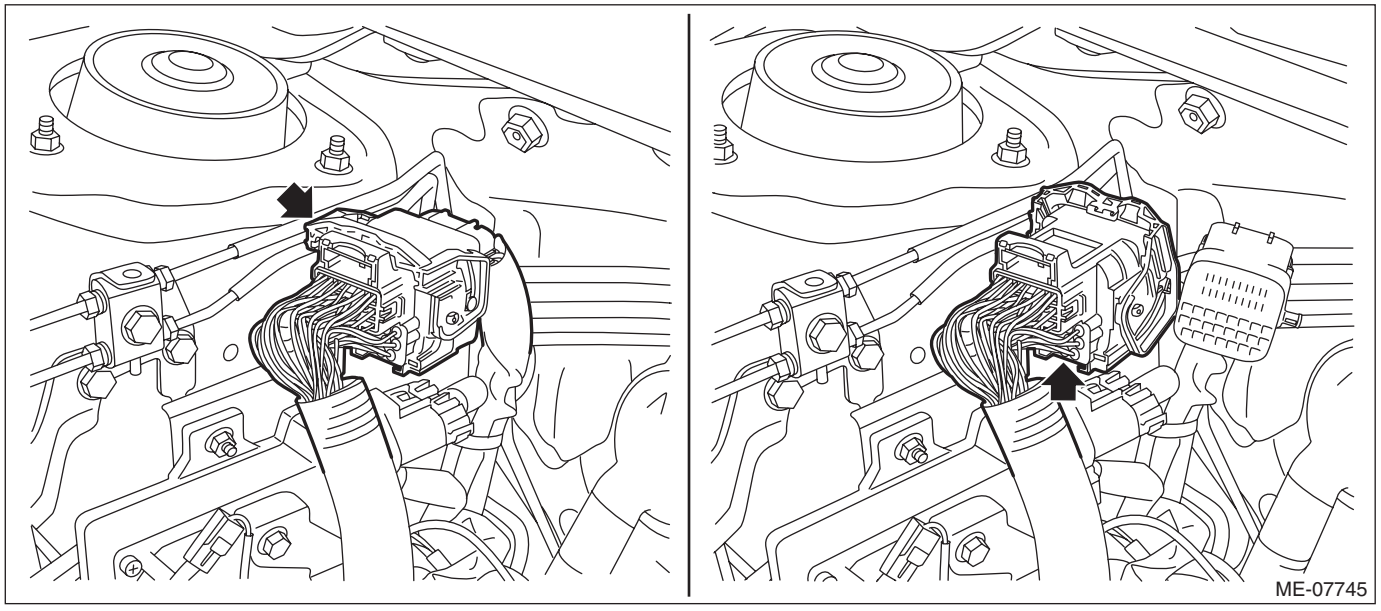
5) Remove the collector cover.
(1) Carefully pull up the front of collector cover at two positions (A).
(2) Carefully pull up the rear of collector cover at two positions (B) while moving it backward.

NOTE:
Be careful not to contact the fuel delivery tube when moving the collector cover rearward.

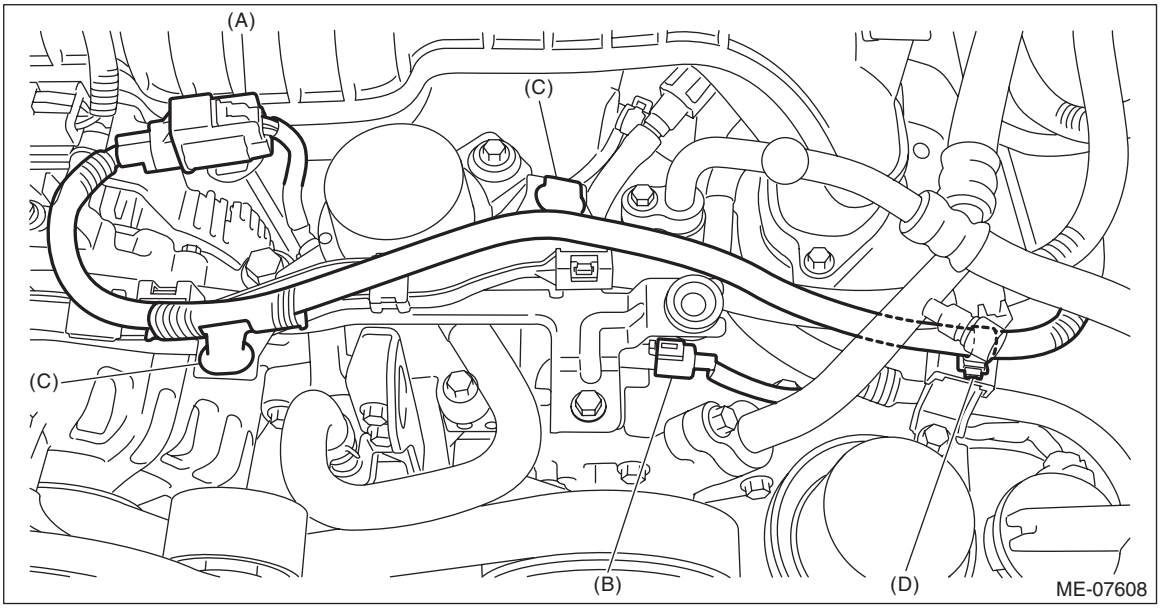


6) Collect the refrigerant from A/C system. <Ref. to AC-28, Refrigerant Recovery Procedure.>
7) Release the fuel pressure. <Ref. to FU(H4DO(HEV))-98, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
8) Disconnect the ground cable from battery. <Ref. to NT-5, BATTERY, NOTE, Note.>

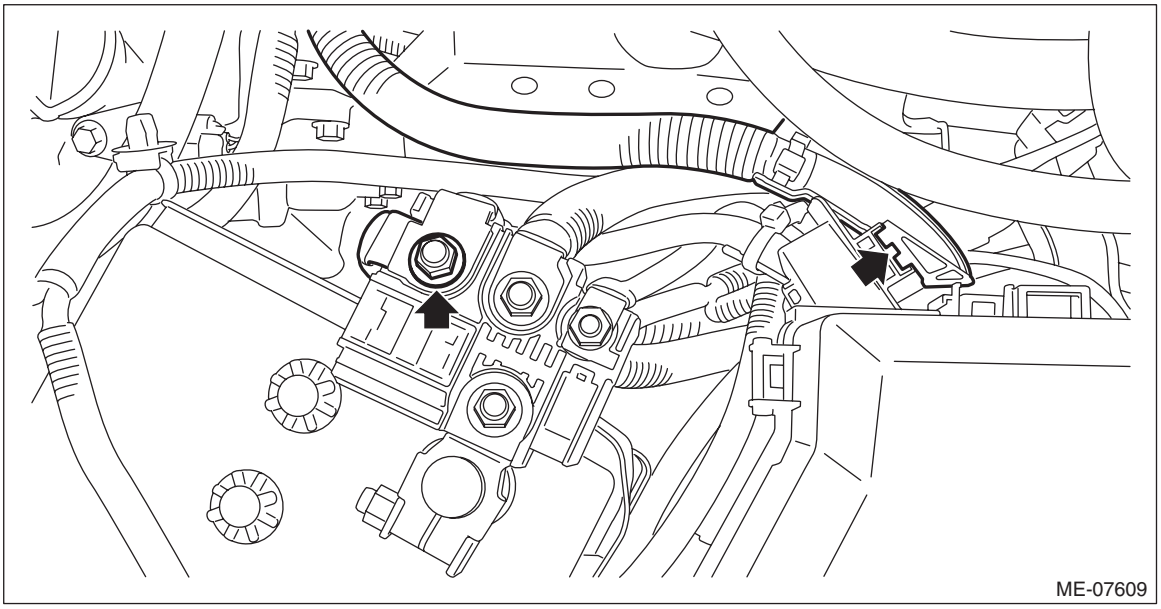
NOTE:
For the 12 volt engine restart battery, disconnect the ground terminal from 12V engine restart battery sensor.
9) Remove the air intake duct. <Ref. to IN(H4DO(HEV))-15, REMOVAL, Air Intake Duct.>
10) Remove the air cleaner case. <Ref. to IN(H4DO(HEV))-6, REMOVAL, Air Cleaner Case.>
11) Remove the radiator. <Ref. to CO(H4DO(w/o HEV))-78, REMOVAL, Radiator.>
12) Disconnect the bulkhead harness connector from the engine harness connector (black), then remove the engine harness connector (black) from the bracket.



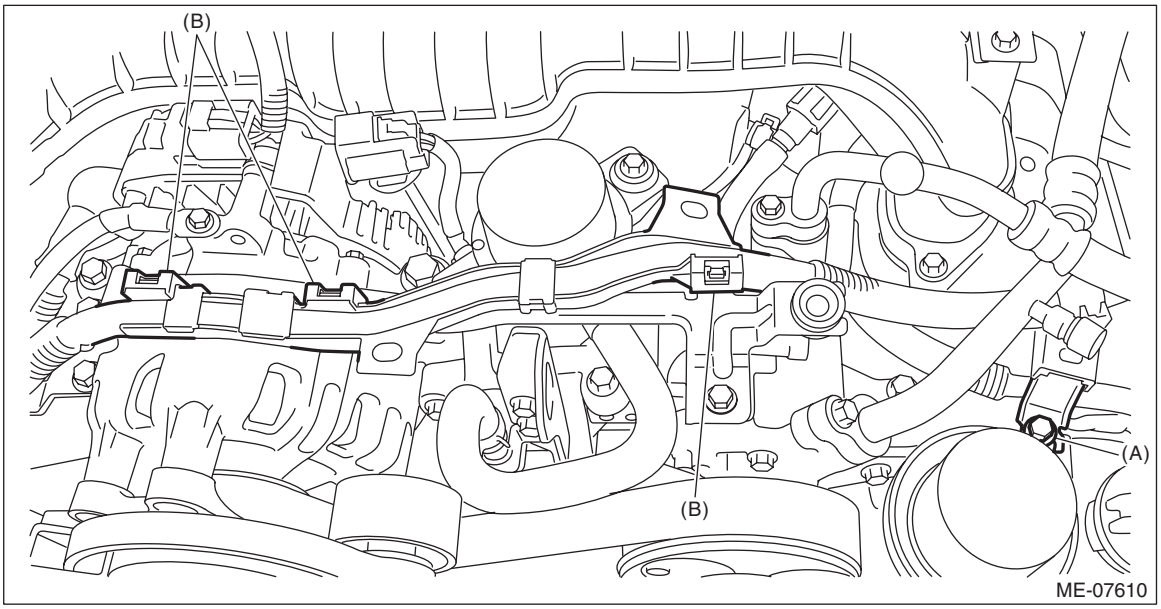
13) Disconnect the connector (A) from the brake vacuum pump, and disconnect the connector (B) from the A/C compressor.
14) Remove the clip (C) and the clip (D) securing the harness to the battery cable assembly, and move the harness to the left side wheel apron.



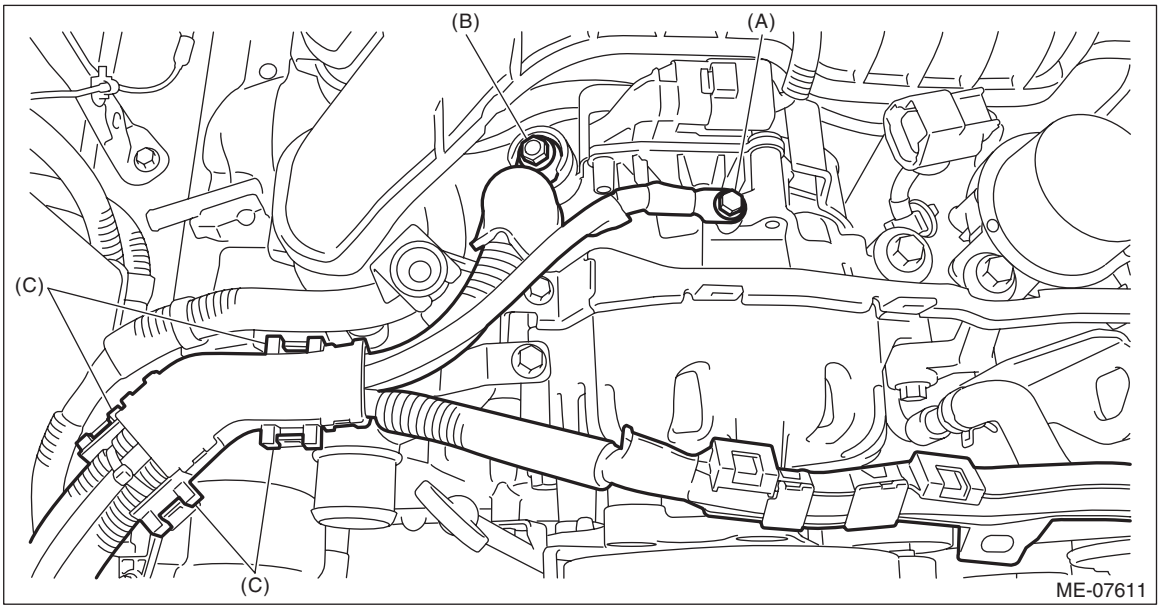
15) Remove the terminal boot from the positive terminal of the 12 volt auxiliary battery.
16) Remove the nuts fastening the battery cable assembly to the slow blow fuse (12 volt auxiliary battery), and remove the battery cable assembly from the main fuse box.



17) Remove the bolt (A) securing the battery cable stay to the chain cover, and remove the clip (B) securing the battery cable assembly to the collector cover bracket.

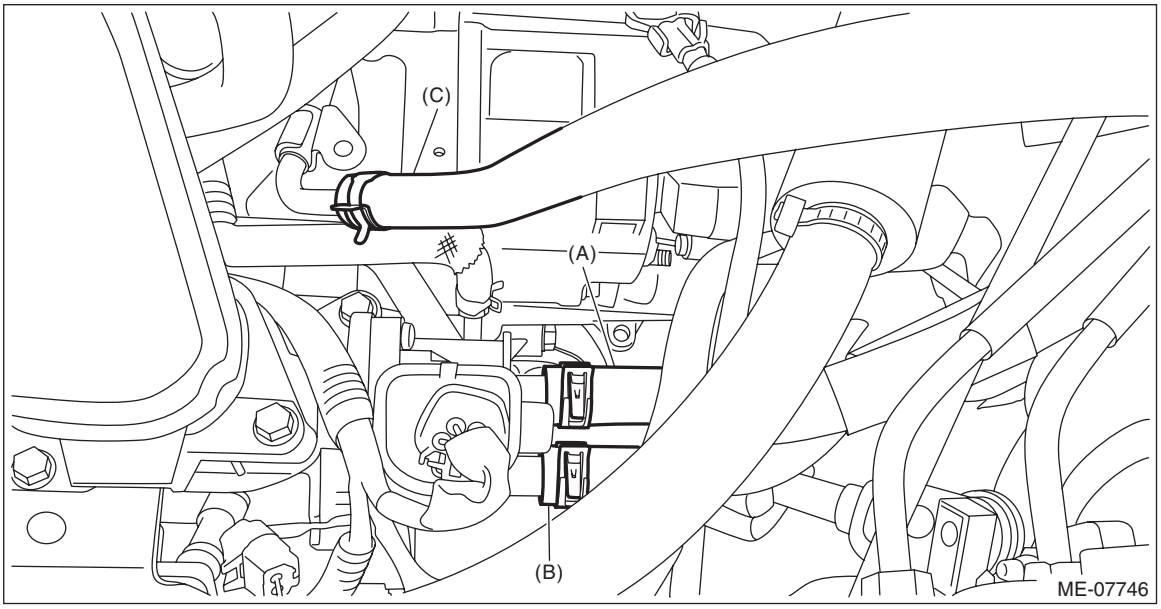


18) Disconnect the terminal (A) and the terminal (B) from ISG.
19) Remove the clip (C) securing the battery cable assembly to the battery cable bracket No. 1, and move the battery cable assembly to the right side wheel apron.

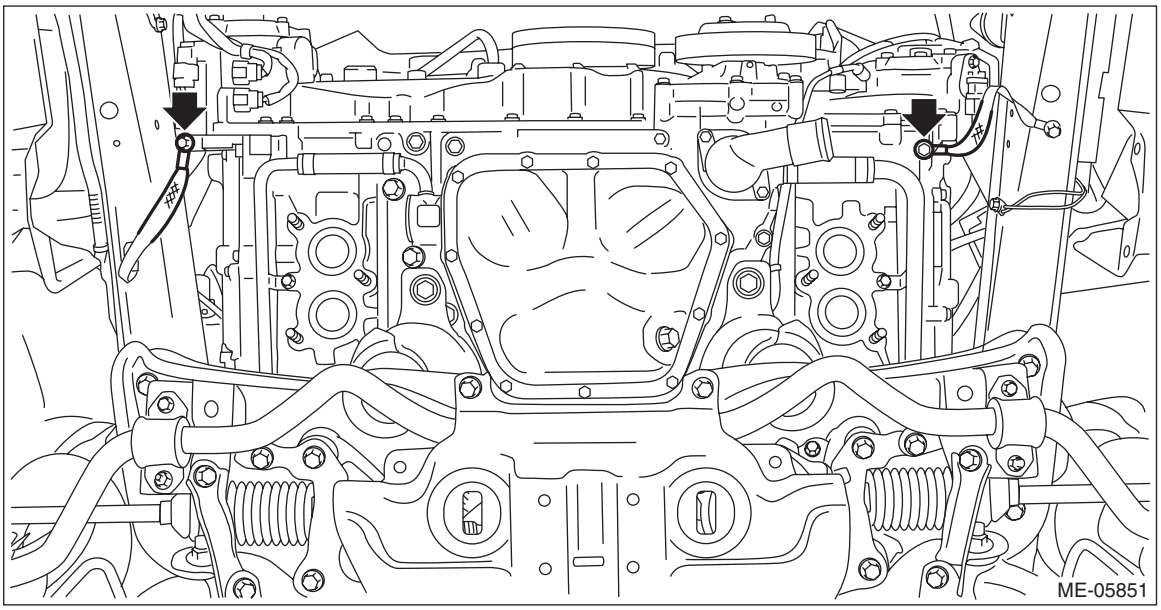


20) Disconnect the A/C pressure hoses from A/C compressor. <Ref. to AC-71, REMOVAL, Hose and Pipe.>

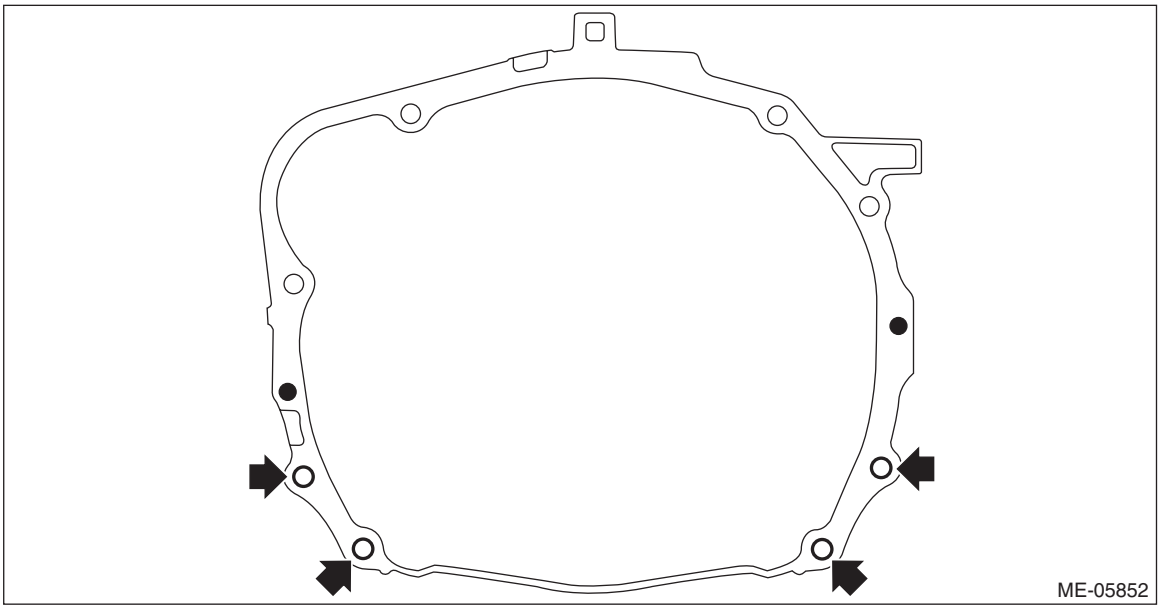
21) Disconnect the heater inlet hose (A) from the water pipe assembly, and disconnect the heater outlet hose (B) from the water pipe LH.
22) Disconnect the brake booster vacuum hose (C) from the brake vacuum pipe.



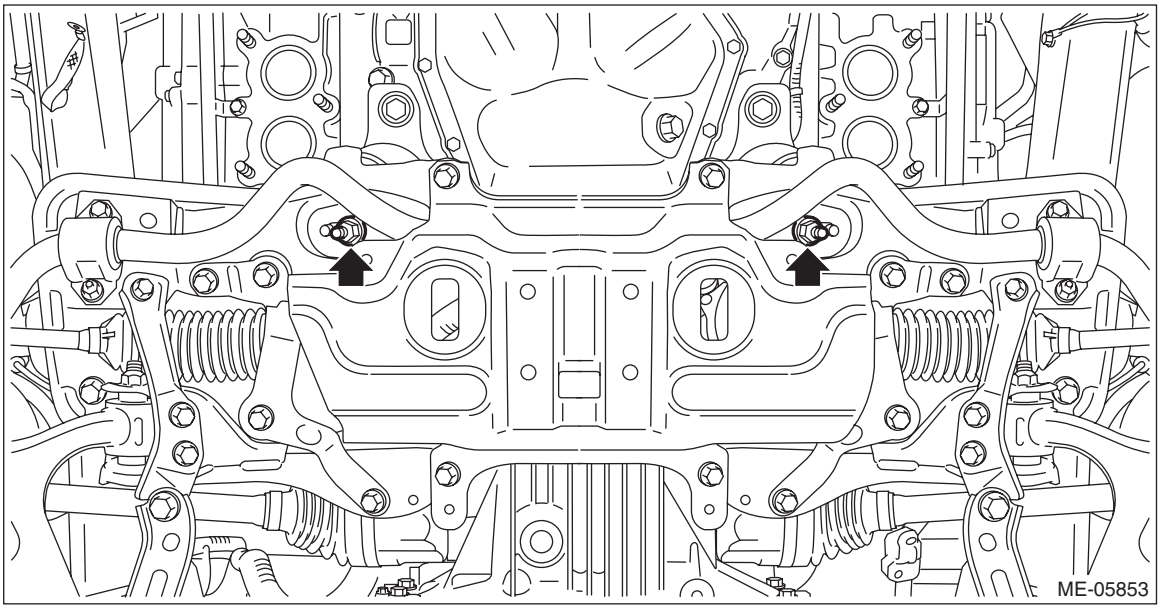
23) Lift up the vehicle.
24) Remove the front exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-6, REMOVAL, Front Exhaust Pipe.>
25) Disconnect the ground cable on the engine side.



26) Remove the bolts and nuts which hold the lower side of transmission to the engine.

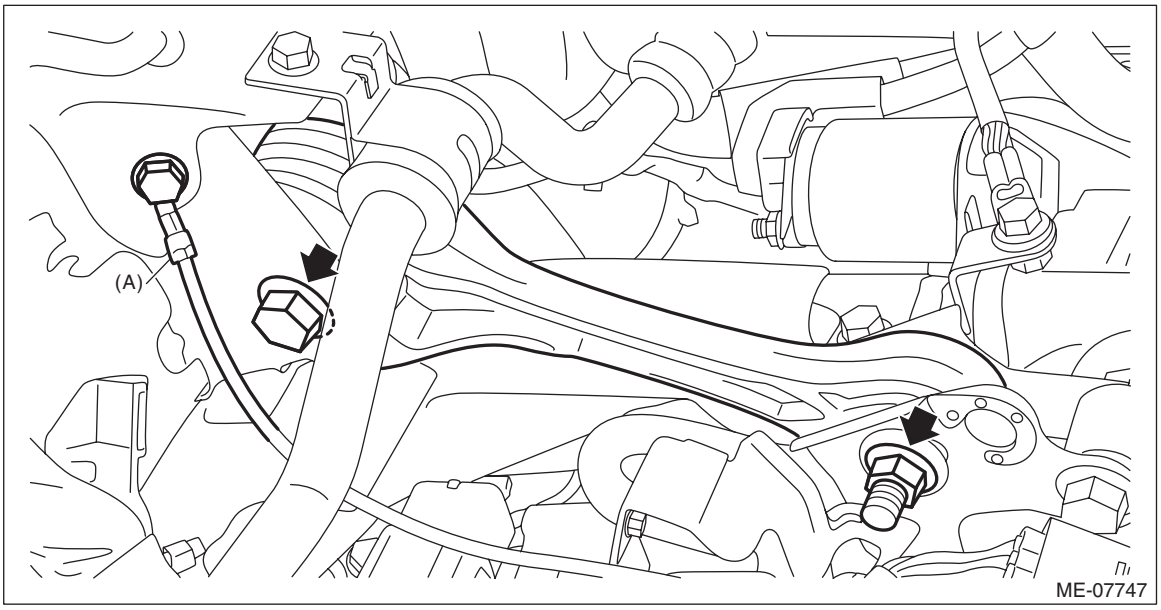


27) Remove the nuts which secure the engine mounting to the front crossmember.

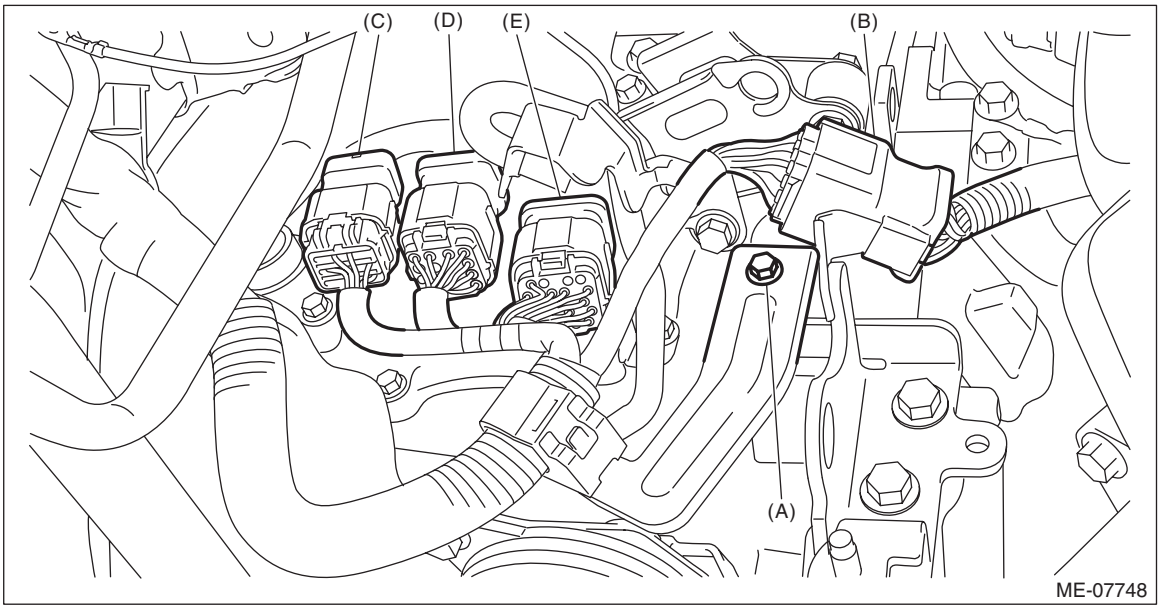


28) Lower the vehicle.

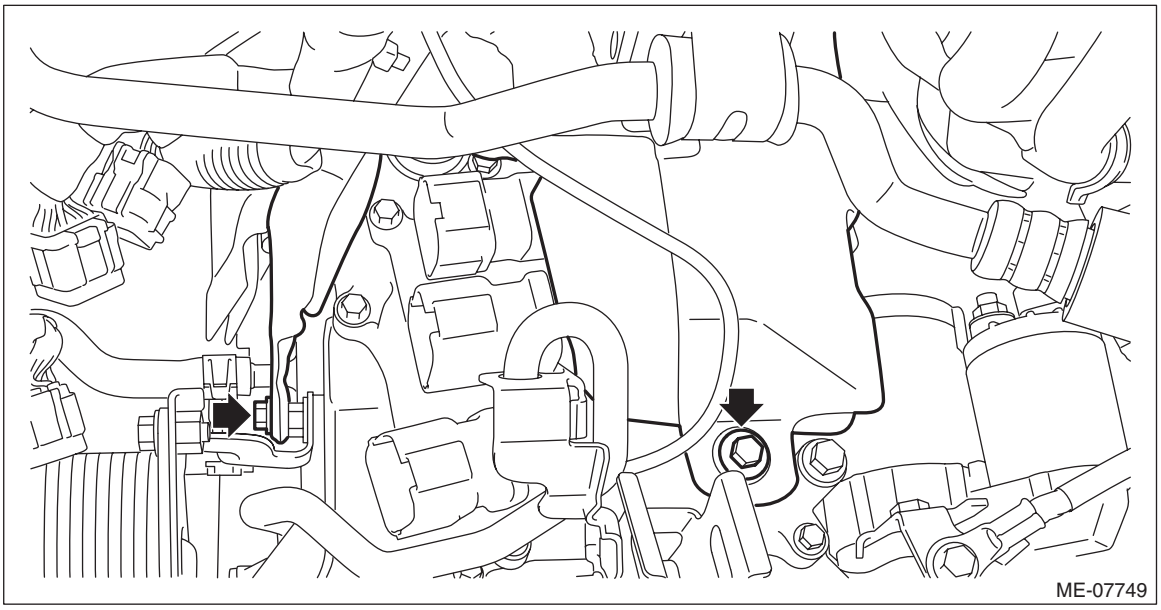
29) Disconnect the transmission radio ground terminal (A) from the vehicle, and remove the pitching stopper.



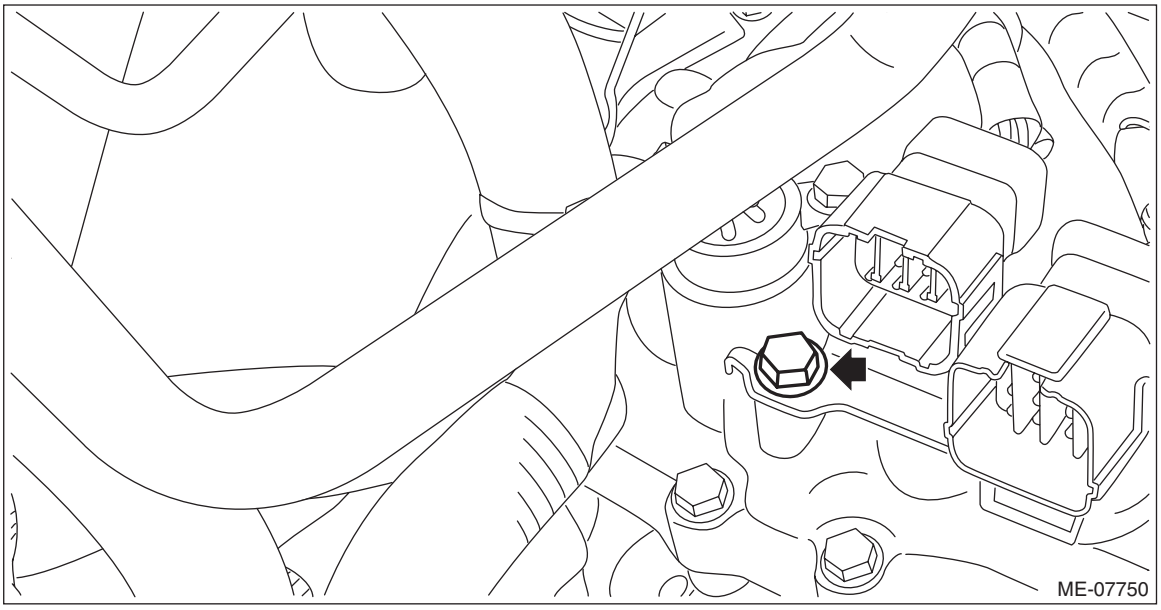
30) Remove the bolt (A) securing the bulkhead harness connector bracket, and disconnect the bulkhead harness connector from the engine harness connector (brown) (B).
31) Disconnect the bulkhead harness connector from the transmission harness connector (C), inhibitor harness connector (D) and drive motor harness connector (E).



32) Remove the transmission case cover.

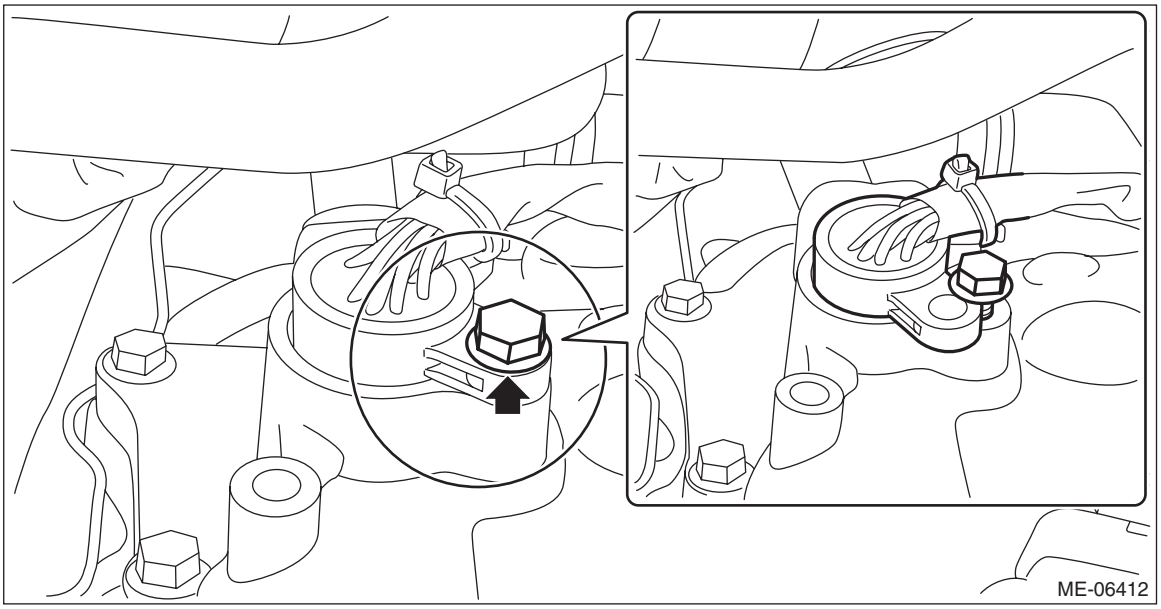


33) Remove the bolt which holds the transmission harness stay.



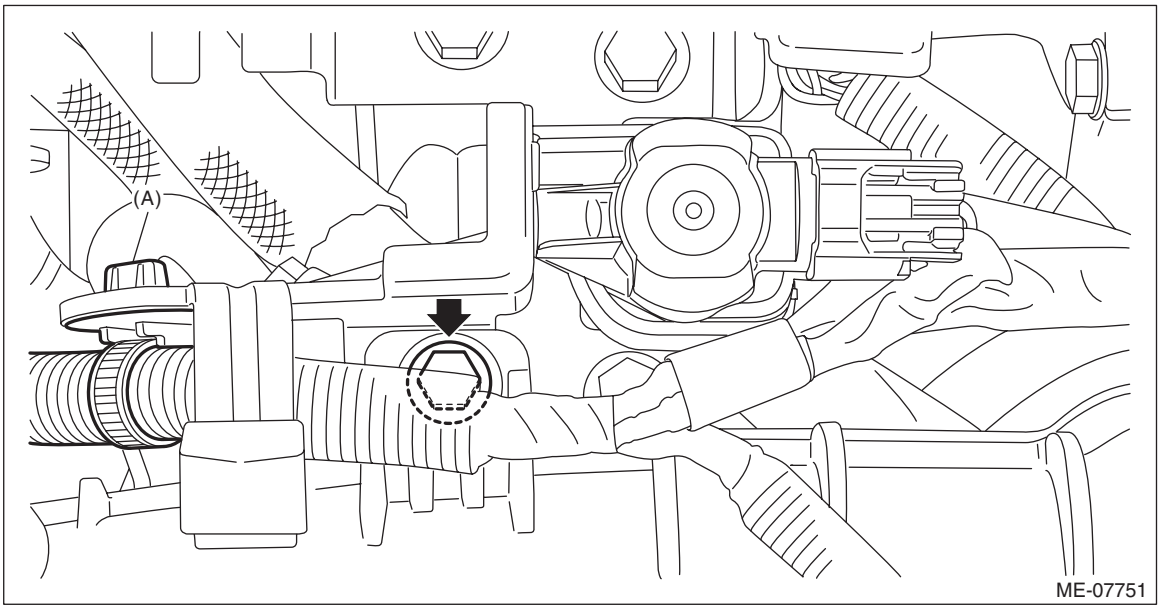
34) Remove the bolt which holds the transmission harness to the control valve body, and turn the transmission harness clockwise till the bolt hole can be seen as shown in the figure, and tighten the bolt to temporary lock the harness.

NOTE:
This procedure is required to prevent the transmission harness from touching the vehicle body during engine removal/installation.

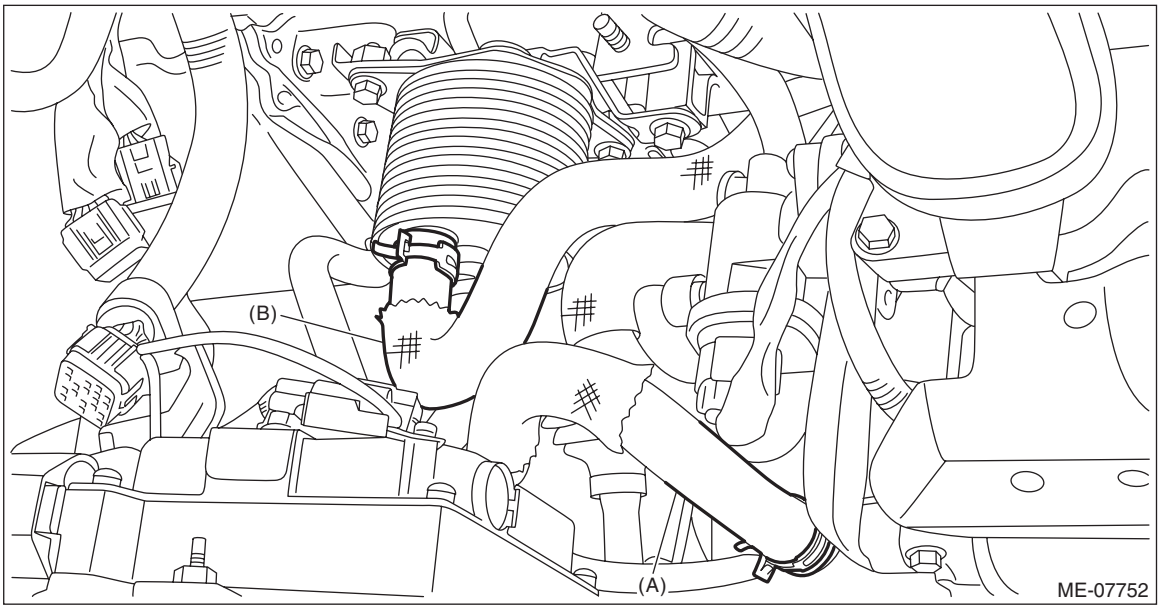


35) Remove the clip (A) securing the engine harness to the purge control solenoid valve bracket, and disconnect the bolt securing the purge control solenoid valve bracket to the intake manifold.

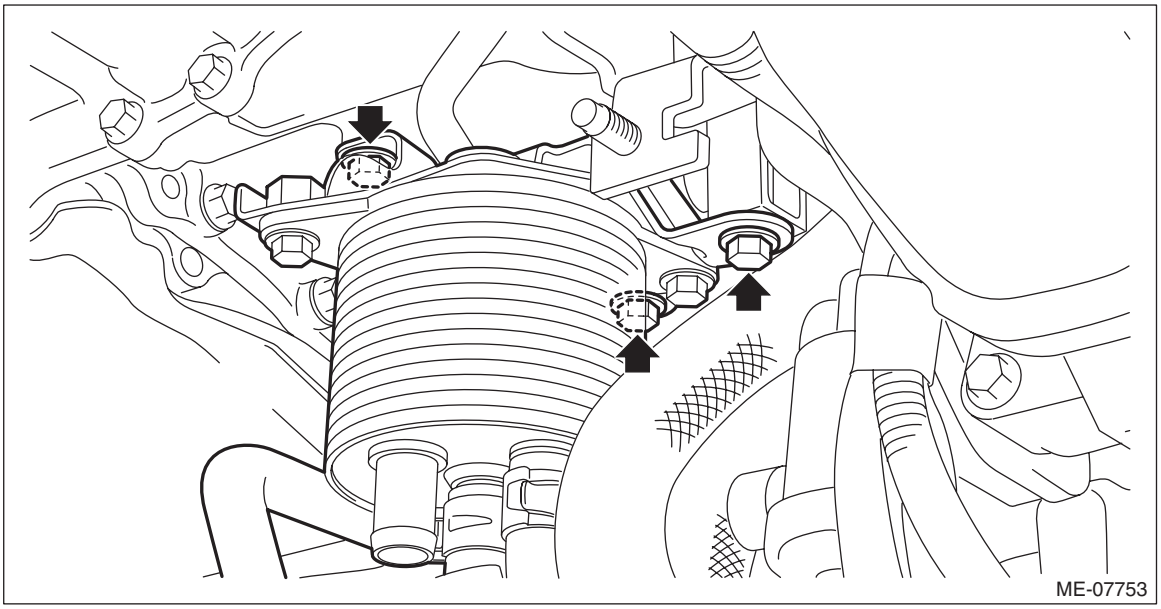
NOTE:
This procedure is required to prevent the wire rope from contacting the purge control solenoid valve during engine removal/installation.



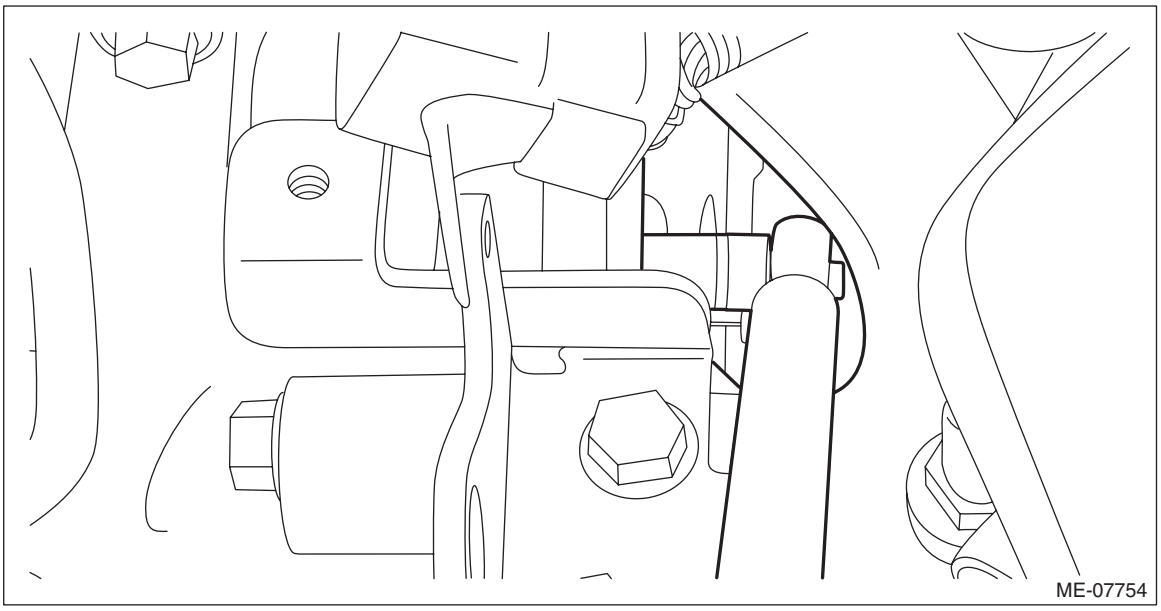
36) Disconnect the engine coolant inlet hose (A) from the EGR cooler, and disconnect the engine coolant outlet hose (B) from the CVTF cooler (with warmer feature).



37) Remove the bolt which secures the CVTF cooler (with warmer feature) to the transmission, and move it at the locations that do not interfere operation.



38) Separate the torque converter clutch from the drive plate.
(1) Remove the service hole plug.
(2) Insert the wrench into the crank pulley bolt and rotate the crank pulley to remove the bolts which hold torque converter clutch to drive plate.

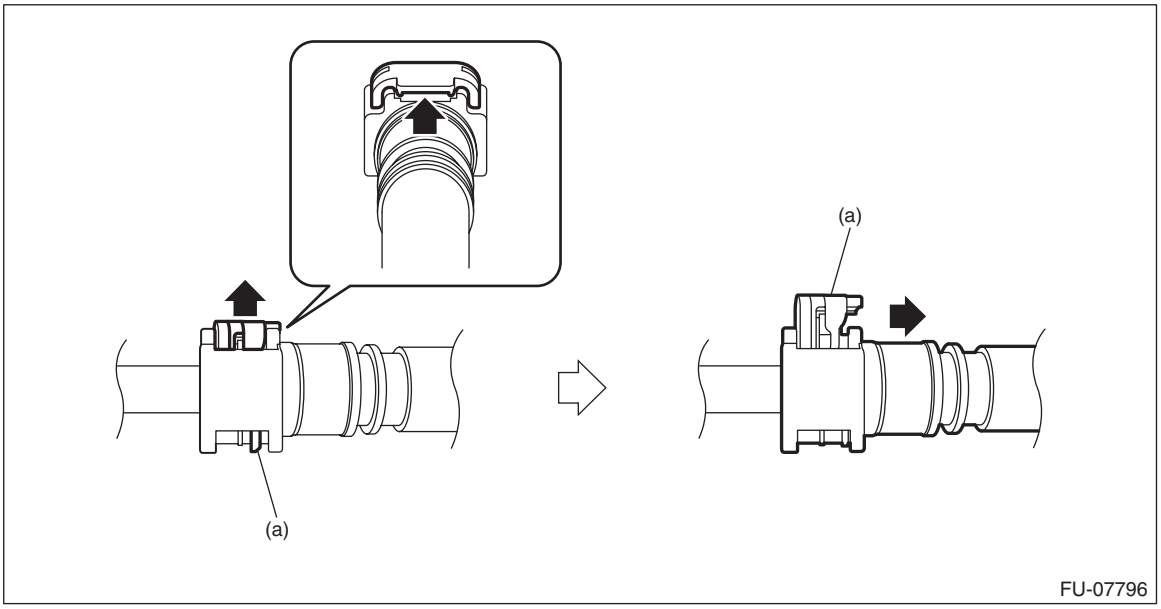


39) Disconnect the fuel delivery tube and evaporation hose.

CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from the tubes using a container or cloth.**

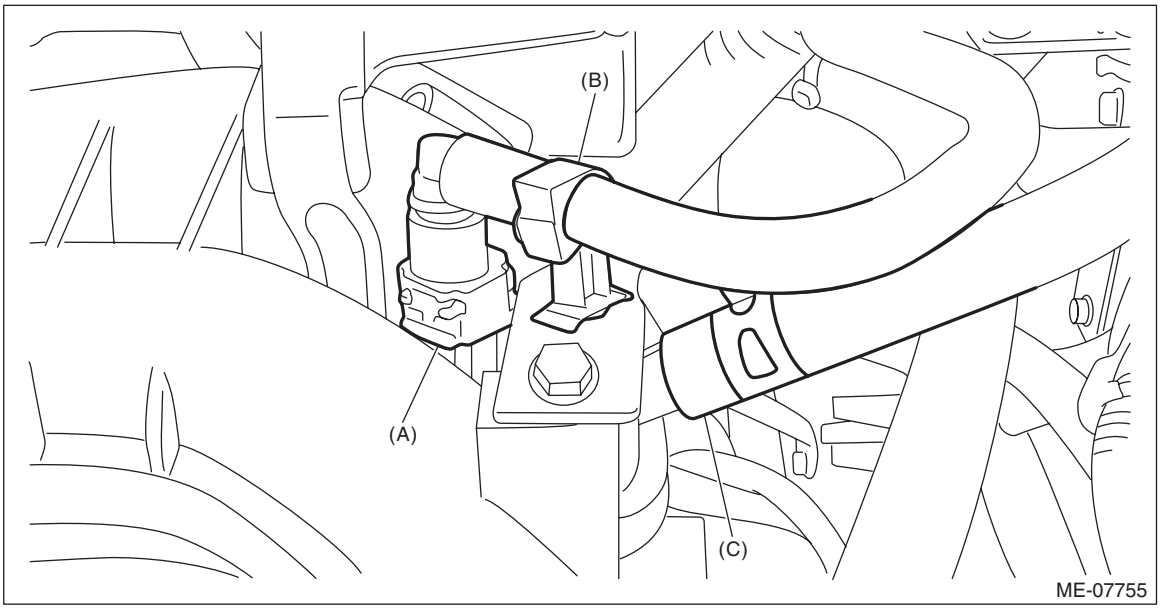
(1) Disconnect the quick connector (A) of the fuel delivery tube from the fuel pipe assembly, and remove the clip (B) securing the fuel delivery tube.

NOTE:
Disconnect the quick connector as shown in the figure.

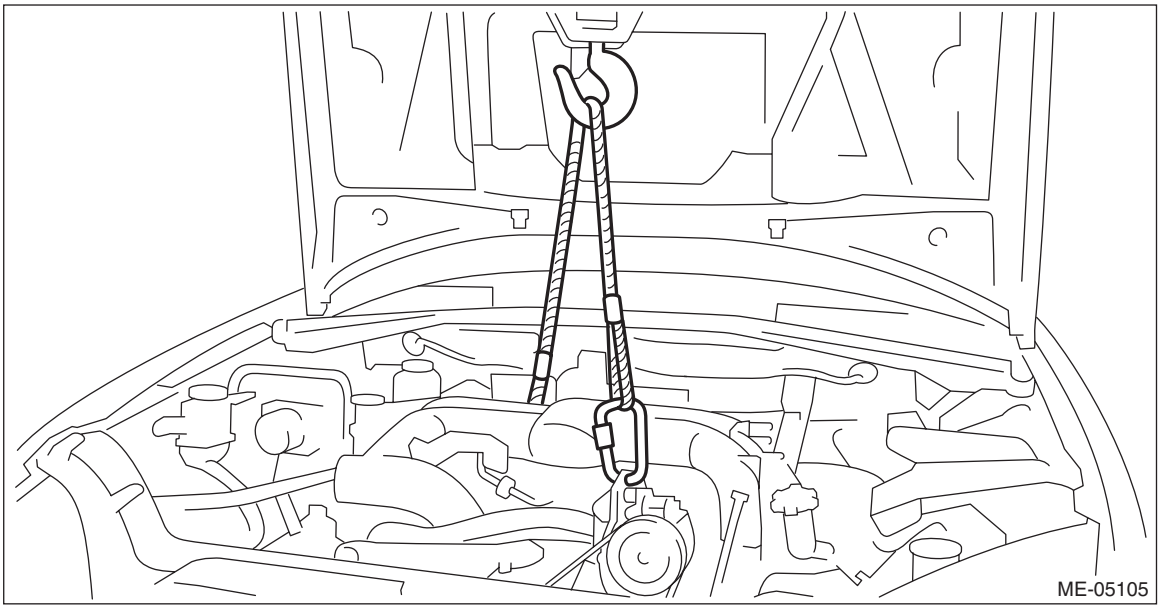


(a) Slider

(2) Disconnect the evaporation hose (C) from the fuel pipe assembly.

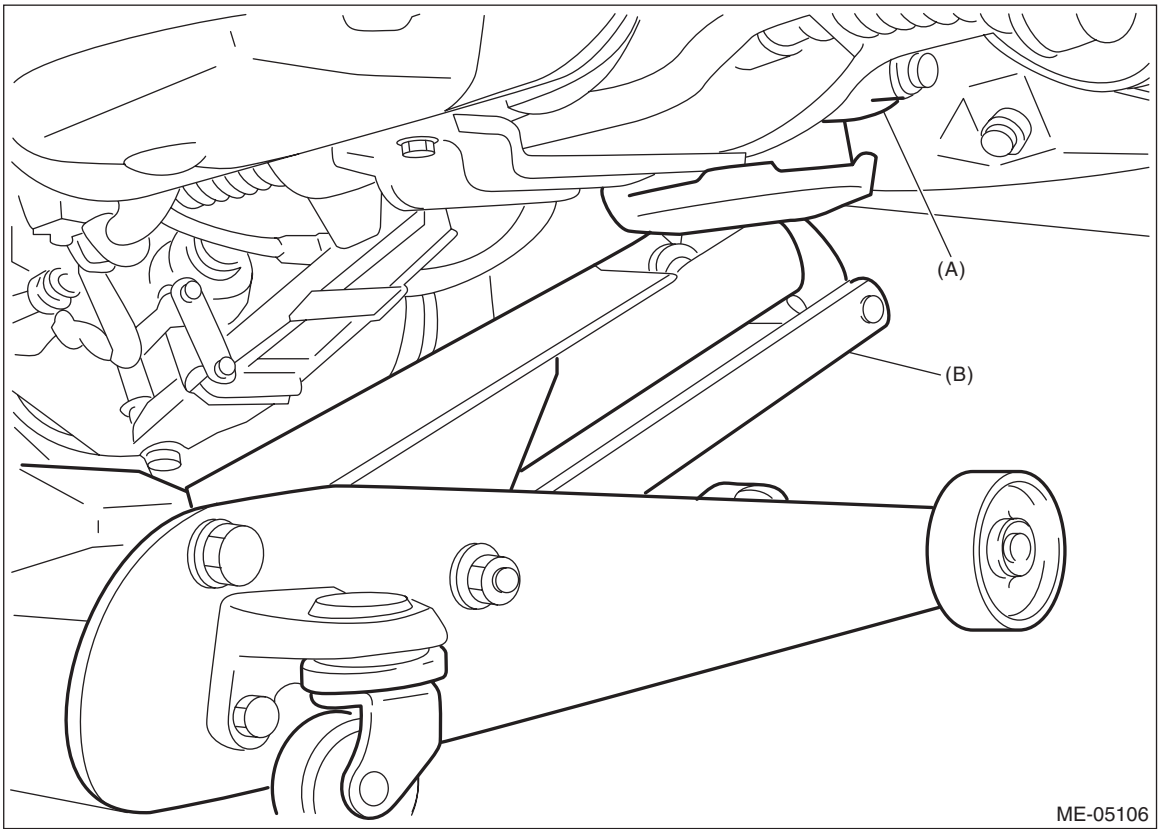


40) Support the engine with a lifting device and wire ropes.



41) Support the transmission with a garage jack.

CAUTION:
Be sure to perform this procedure to prevent the transmission from lowering by its own weight.



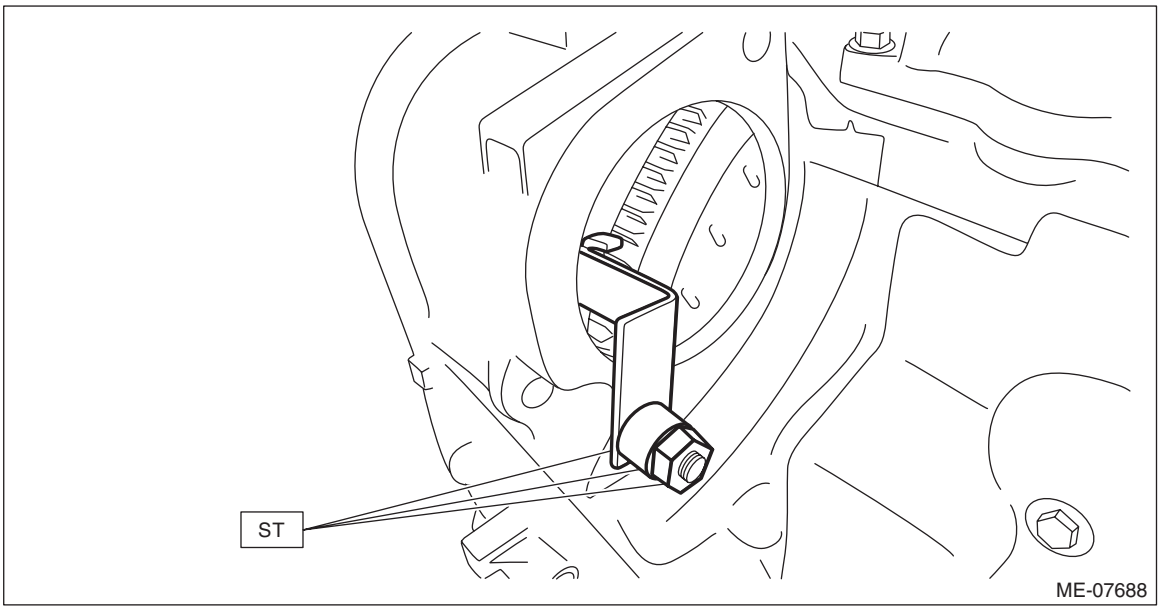
(A) Transmission
(B) Garage jack

42) Separate the engine and transmission.

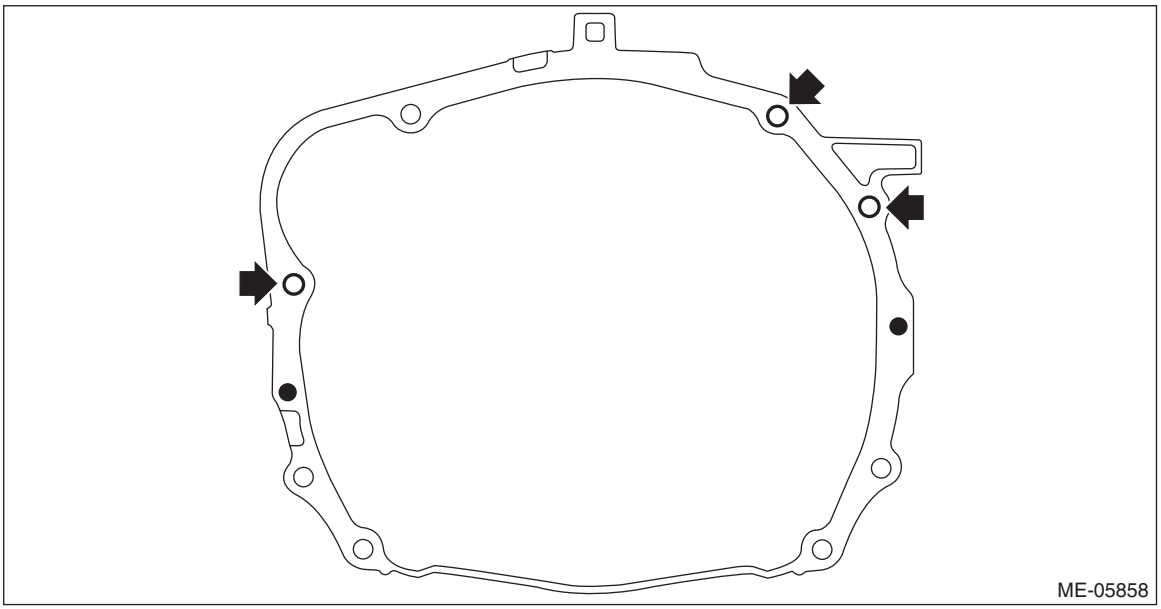
CAUTION:
Before removing the engine away from transmission, check to be sure no work has been overlooked.

(1) Remove the starter. <Ref. to SC(H4DO(HEV))-10, REMOVAL, Starter.>
(2) Attach the ST to the torque converter clutch case.

ST 498277200 STOPPER SET



(3) Remove the bolts which hold the upper side of the transmission to the engine.



43) Remove the engine from the vehicle.

NOTE:
Be careful not to damage adjacent parts or body panels with crank pulley, oil level gauge, etc.

(1) Slightly raise the engine.
(2) Raise the transmission with garage jack.
(3) Slowly move the engine away from engine compartment.

44) Remove the engine mounting from the engine.

B: INSTALLATION

1. GASOLINE ENGINE MODEL

1) Install the engine mounting onto the engine.

Tightening torque:
35 N·m (3.6 kgf-m, 25.8 ft-lb)

2) Apply a small amount of grease to splines of main shaft. (MT model)

Grease:
NICHIMOLY N-130 or equivalent

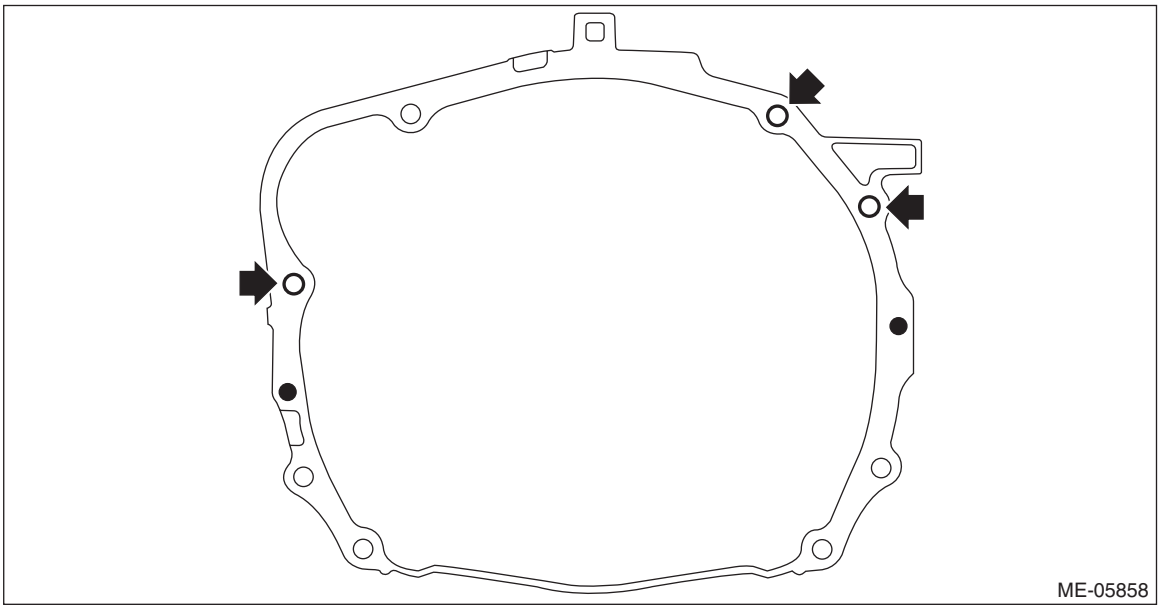
3) Position the engine in engine compartment and align it with transmission.

NOTE:
Be careful not to damage adjacent parts or body panels with crank pulley, oil level gauge, etc.

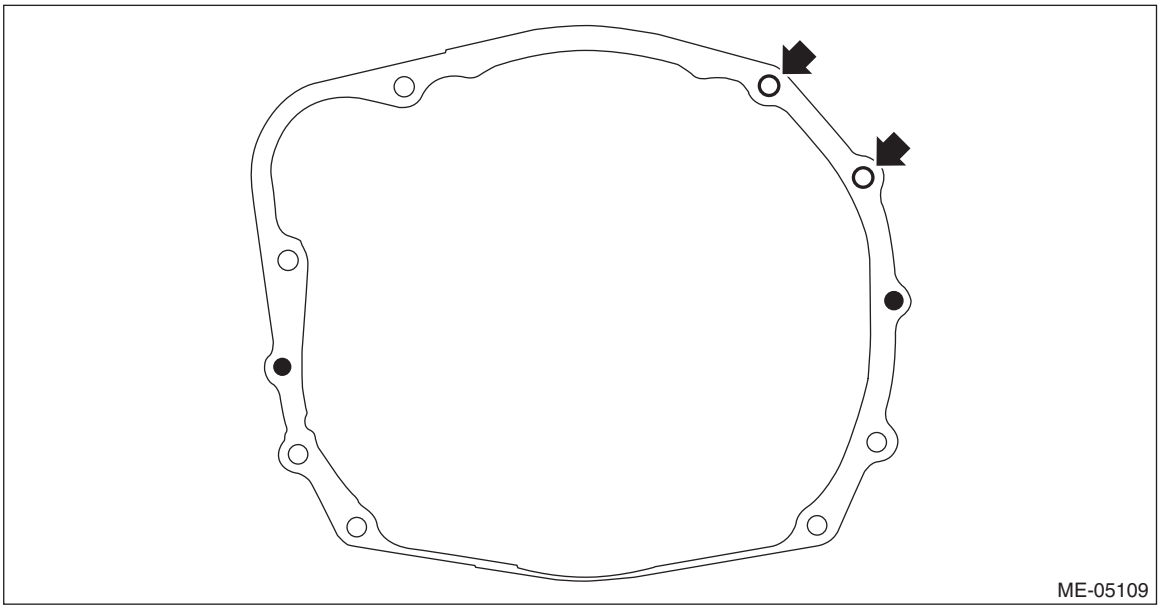
4) Install the bolts which hold upper side of transmission to engine.

Tightening torque:
50 N·m (5.1 kgf-m, 36.9 ft-lb)

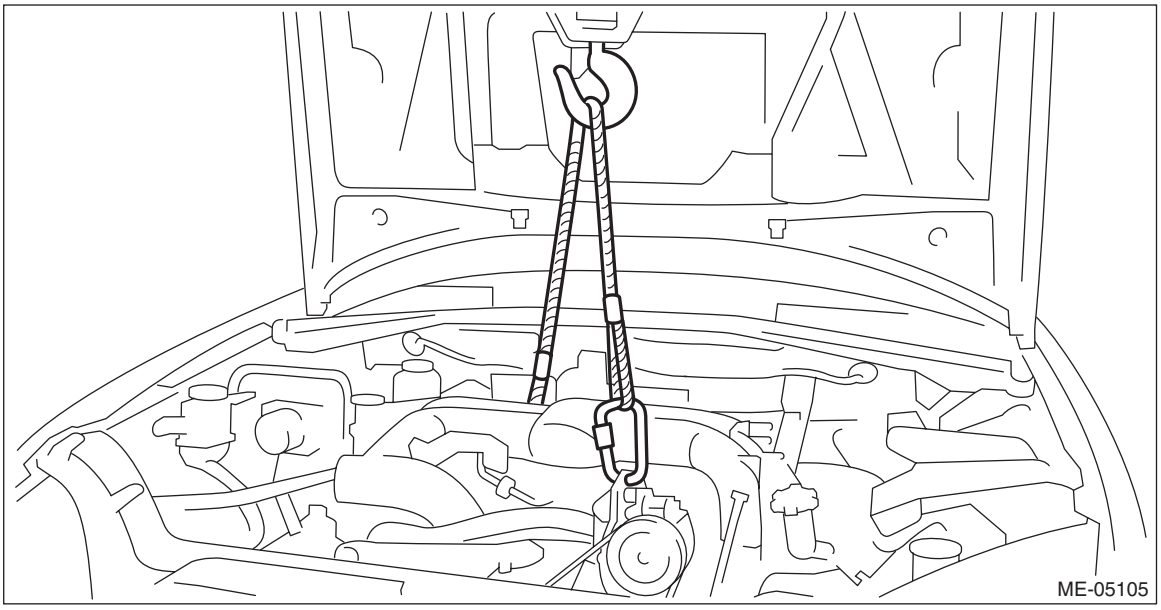
- CVT model



- MT model



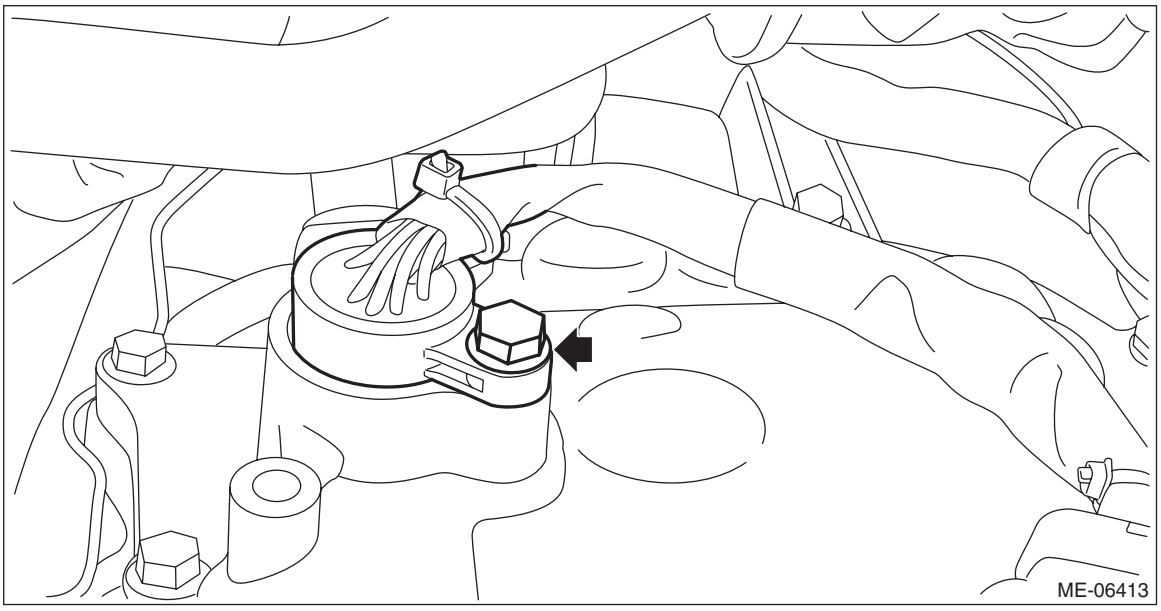
5) Remove the lifting device and wire ropes.



6) Remove the garage jack.

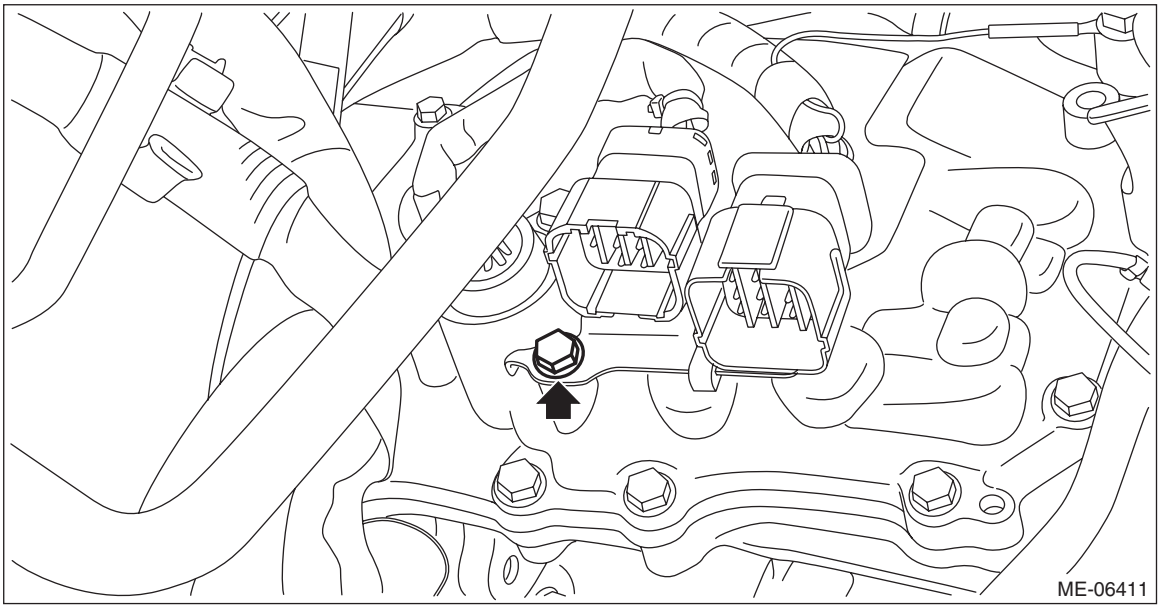
7) Remove the bolt and turn the transmission harness counterclockwise to install the transmission harness to the control valve body. (CVT model)

Tightening torque:
7 N·m (0.7 kgf-m, 5.2 ft-lb)



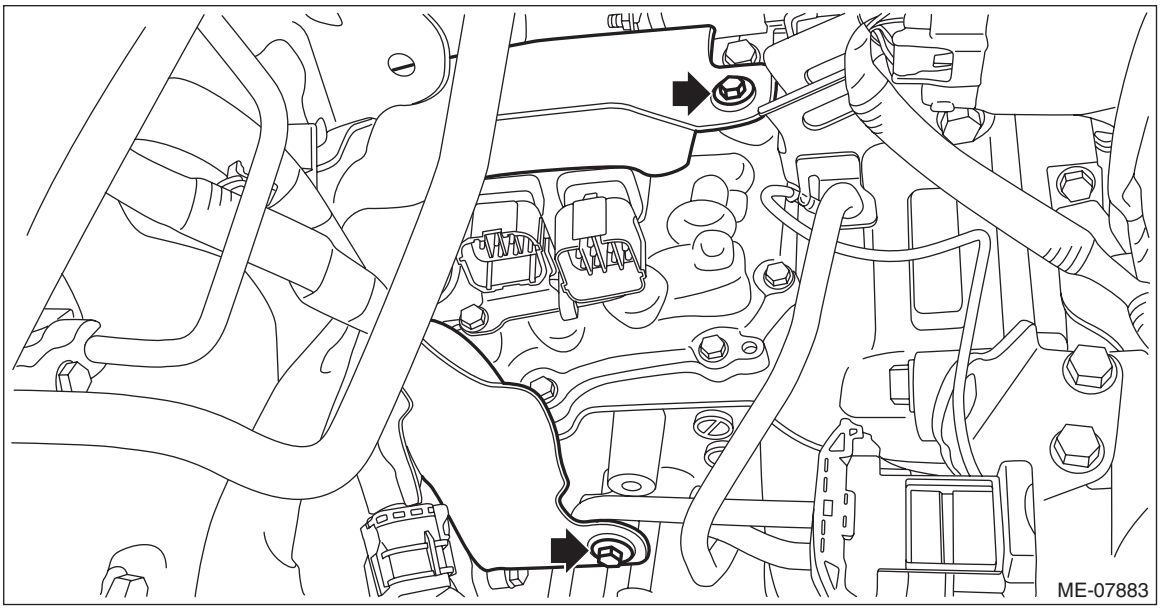
8) Install the bolt which holds the transmission harness stay. (CVT model)

Tightening torque:
7 N·m (0.7 kgf-m, 5.2 ft-lb)



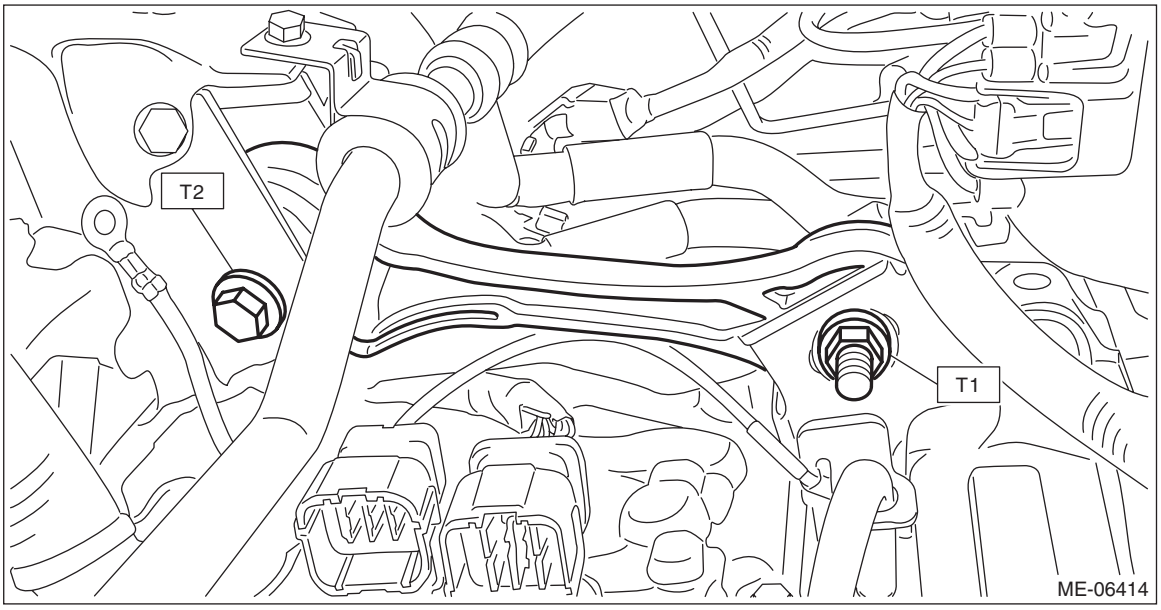
9) Install the transmission case cover. (CVT model)

Tightening torque:
8 N·m (0.8 kgf-m, 5.9 ft-lb)



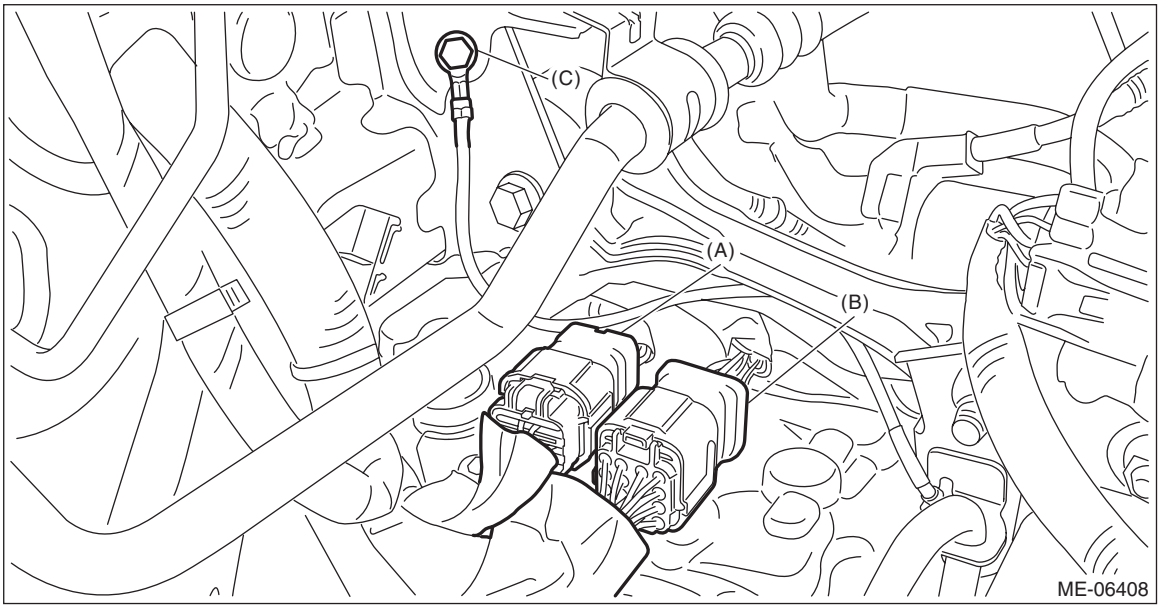
10) Install the pitching stopper.

Tightening torque:
T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)
T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)



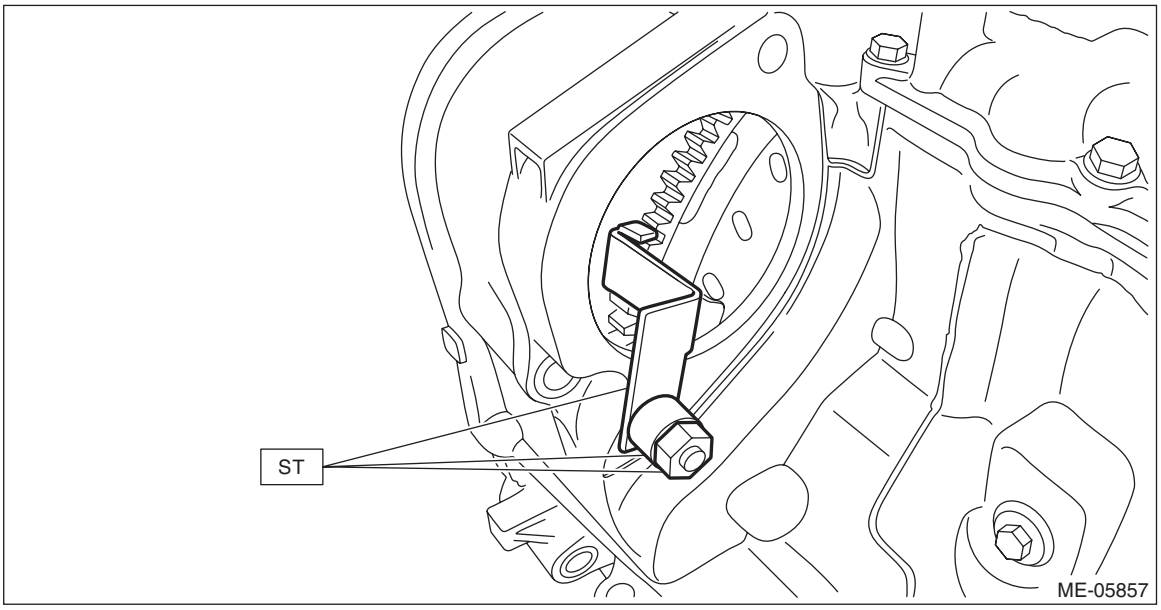
11) Connect the transmission radio ground terminal (C) to the vehicle body, and connect the bulkhead harness connector to the transmission harness connector (A) and the inhibitor harness connector (B). (CVT model)

Tightening torque:
13 N·m (1.3 kgf-m, 9.6 ft-lb)



12) Remove the ST from torque converter clutch case. (CVT model)

NOTE:
Be careful not to drop the ST into the torque converter clutch case when removing the ST.
ST 498277200 STOPPER SET

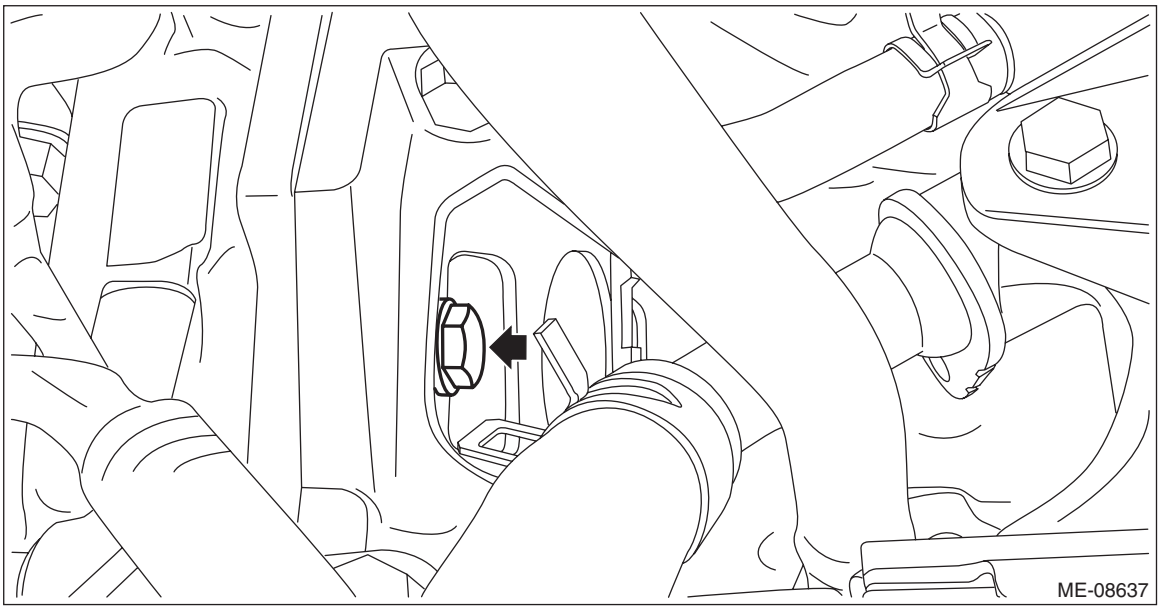


13) Install the starter. <Ref. to SC(H4DO(w/o HEV))-10, INSTALLATION, Starter.>

14) Install the torque converter clutch to drive plate. (CVT model)
(1) Insert the wrench into the crank pulley bolt, and rotate the crank pulley to attach the four bolts securing the torque converter clutch to the drive plate.

NOTE:
Be careful not to drop bolts into the torque converter clutch case.

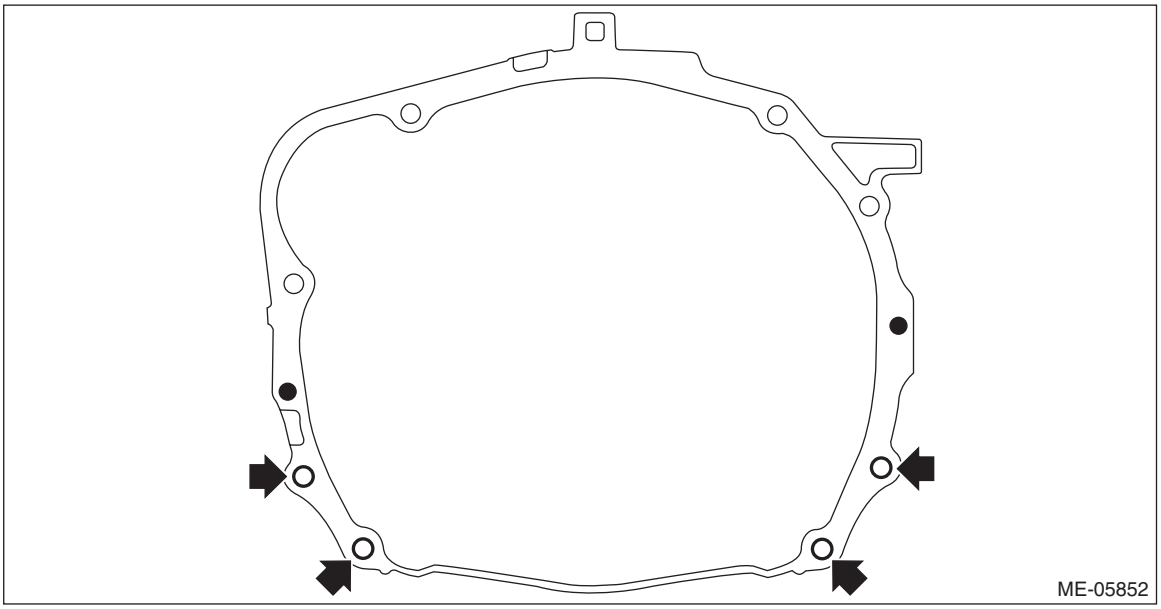
Tightening torque:
25 N·m (2.5 kgf-m, 18.4 ft-lb)



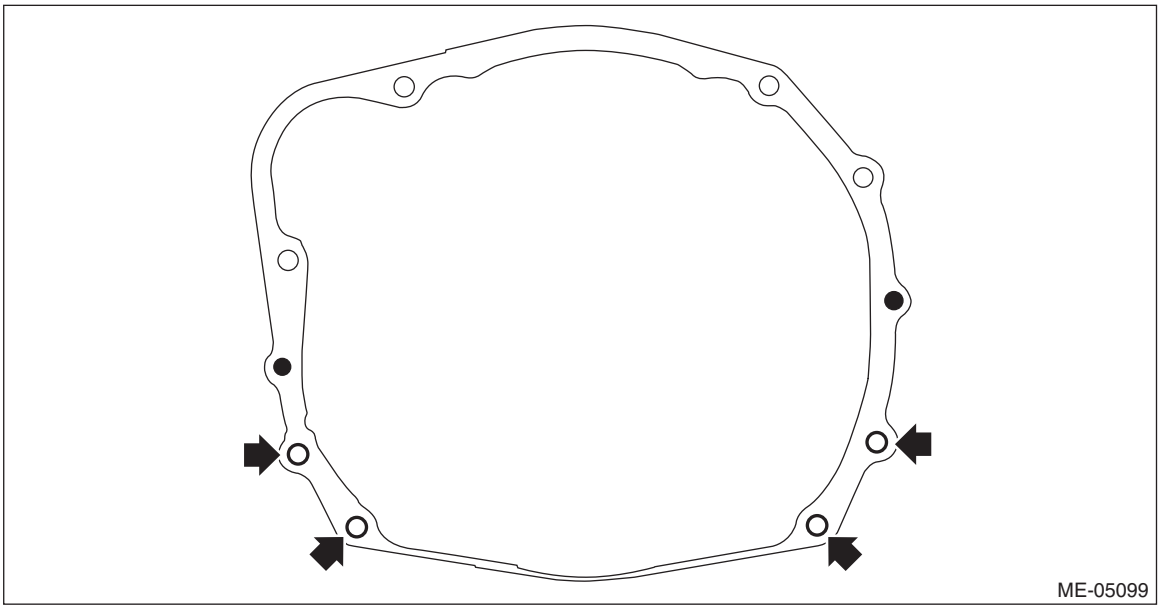
(2) Fit the plug to service hole.
(3) Install the throttle body. <Ref. to FU(H4DO(w/o HEV))-16, INSTALLATION, Throttle Body.>
15) Lift up the vehicle.
16) Install the bolts and nuts which hold lower side of the transmission to engine.

Tightening torque:
50 N·m (5.1 kgf-m, 36.9 ft-lb)

- CVT model



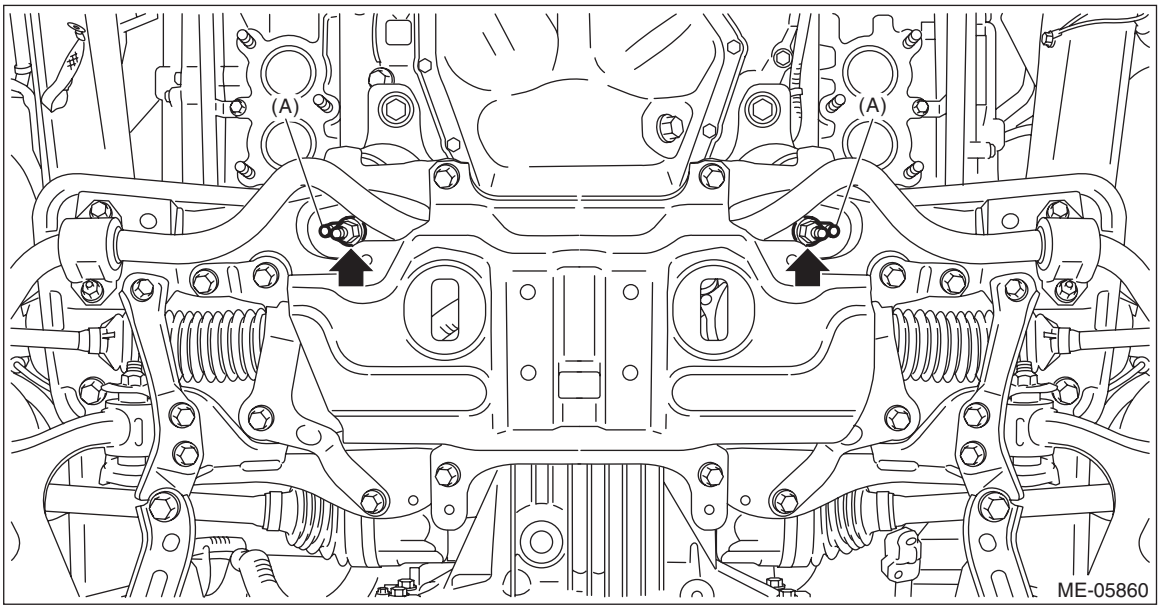
- MT model



17) Install the nuts which hold the engine mounting to the crossmember. (CVT model)

NOTE:
- Make sure that locators (A) of the engine mounting are securely inserted.
- Use a new nut.

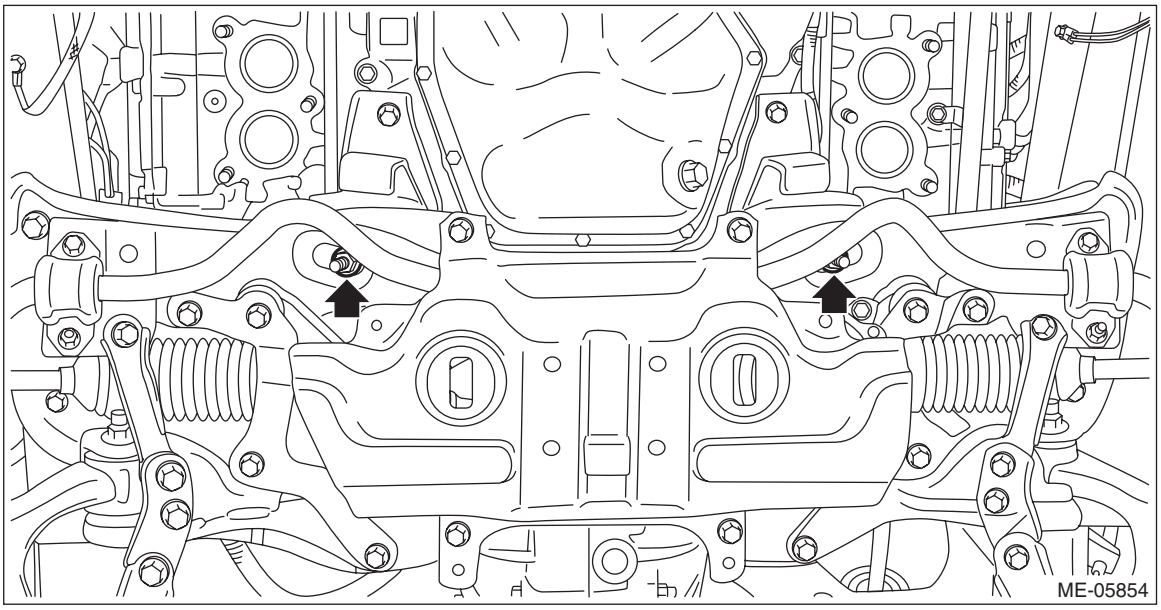
Tightening torque:
60 N·m (6.1 kgf-m, 44.3 ft-lb)



18) Install the nuts which hold the engine mounting to the crossmember. (MT model)

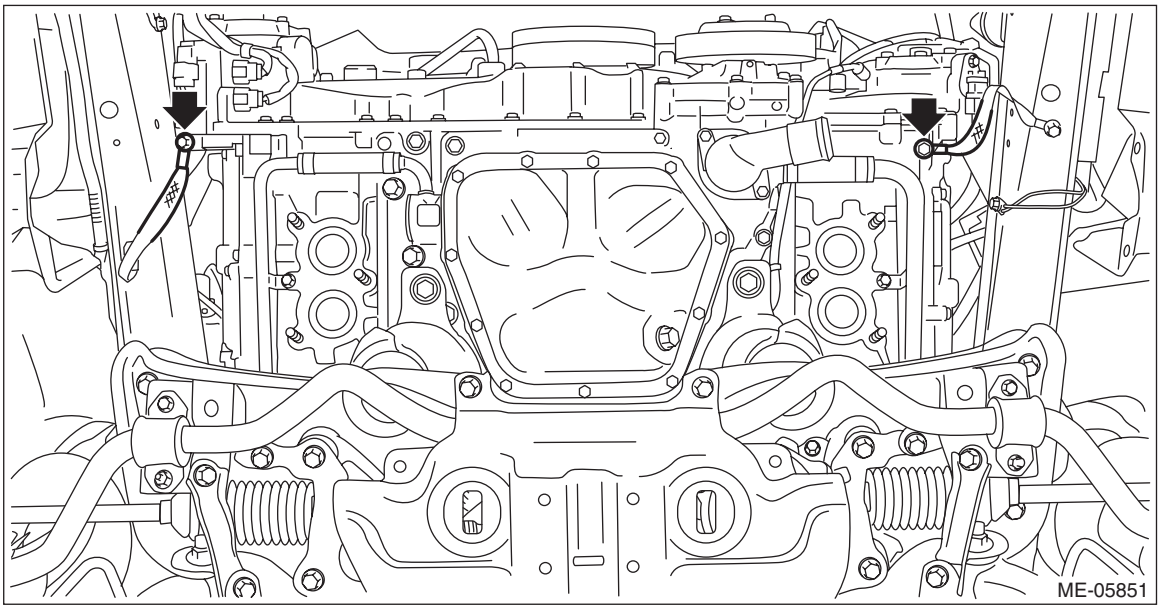
NOTE:
Use a new nut.

Tightening torque:
60 N·m (6.1 kgf-m, 44.3 ft-lb)



19) Connect the ground cable.

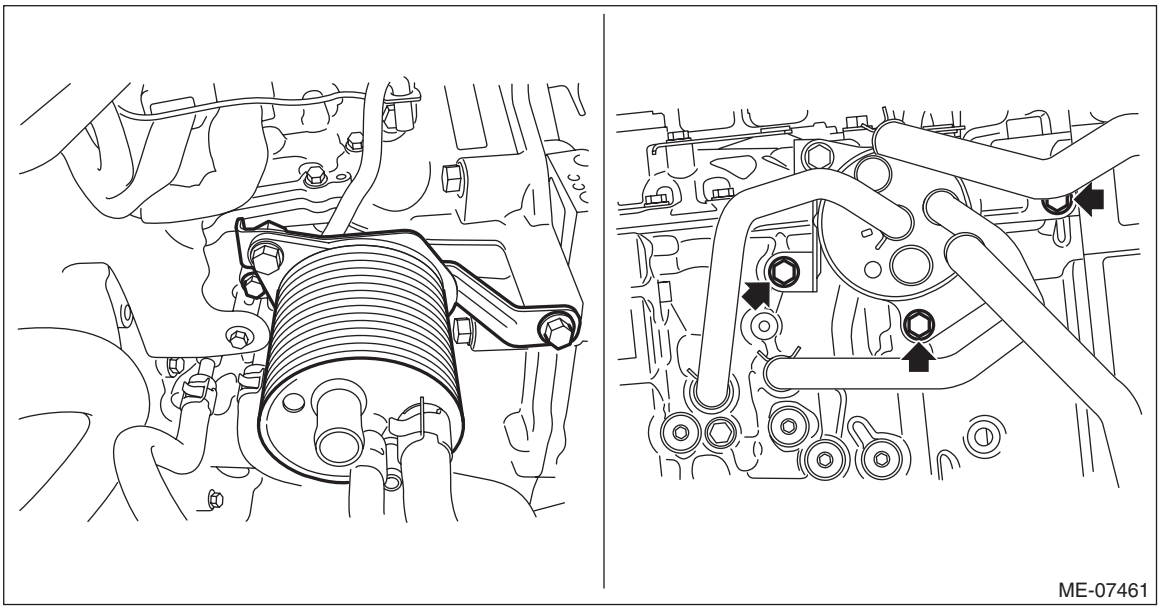
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



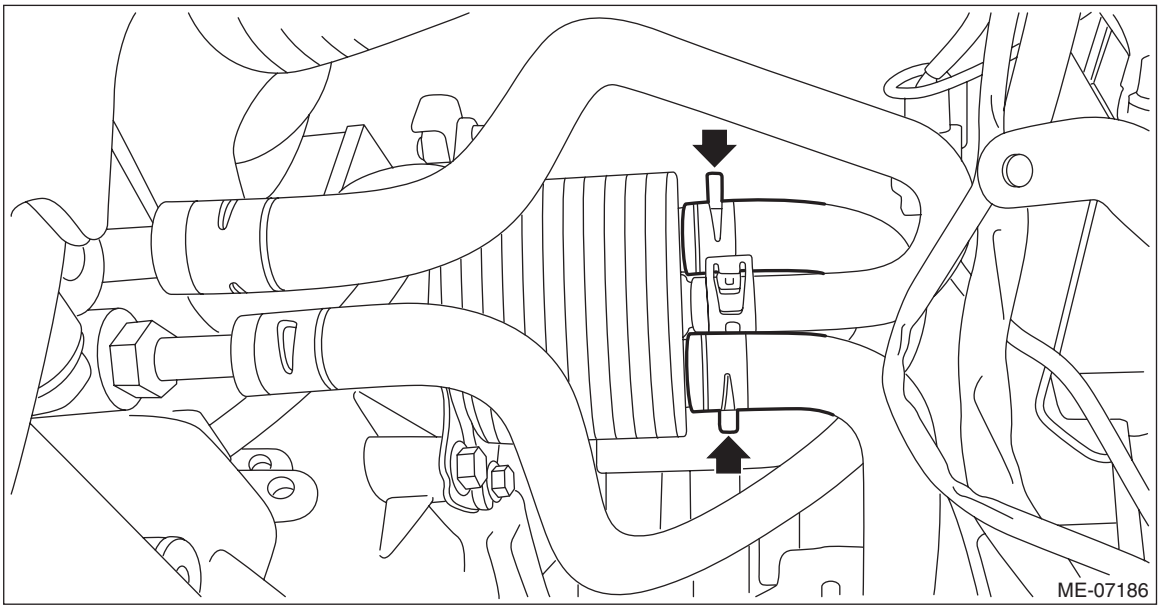
20) Install the front exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-8, INSTALLATION, Front Exhaust Pipe.>
21) Lower the vehicle.

22) Install the CVTF cooler (with warmer feature) to the transmission. (CVT model)

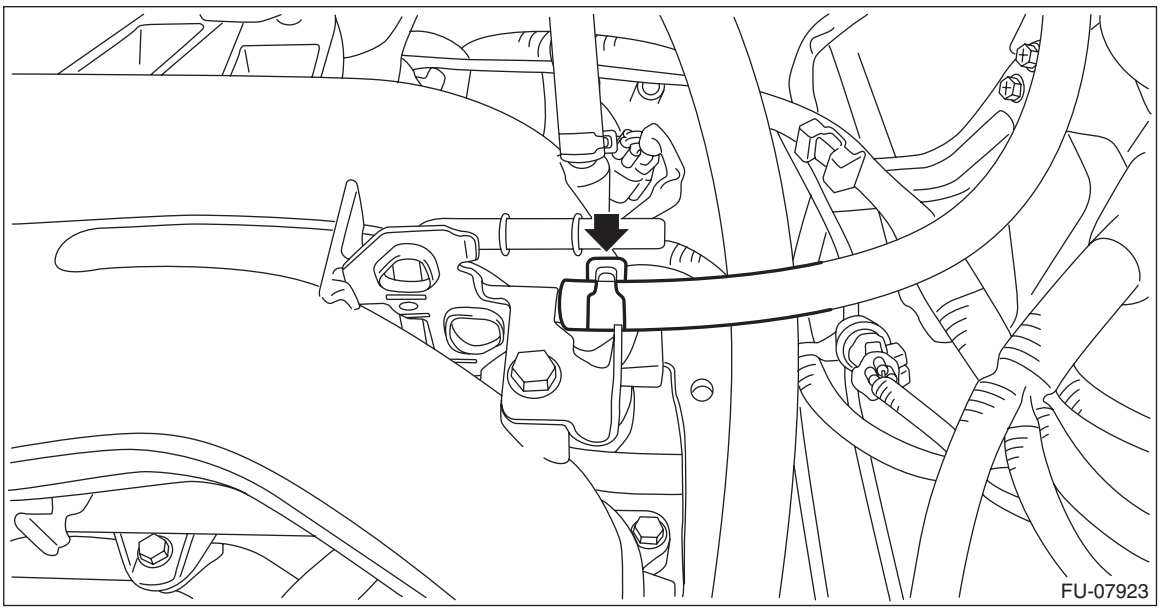
Tightening torque:
23 N·m (2.3 kgf-m, 17.0 ft-lb)



23) Connect the water hose to the CVTF cooler (with warmer feature). (CVT model)



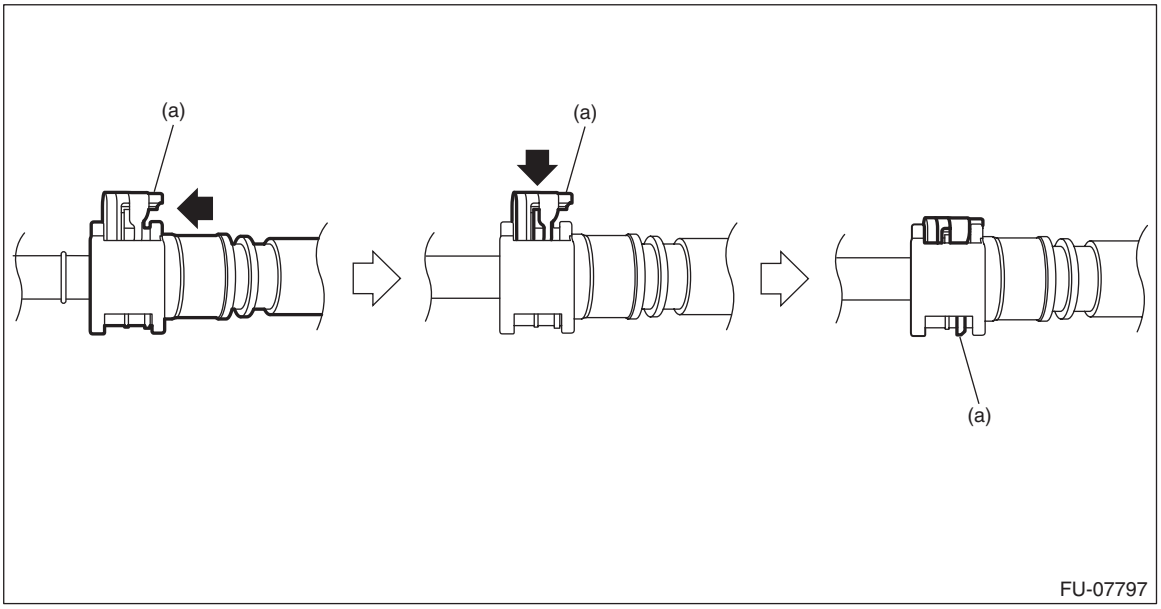
24) Connect the fuel delivery tube and evaporation hose.
(1) Connect the evaporation hose to fuel pipe assembly.



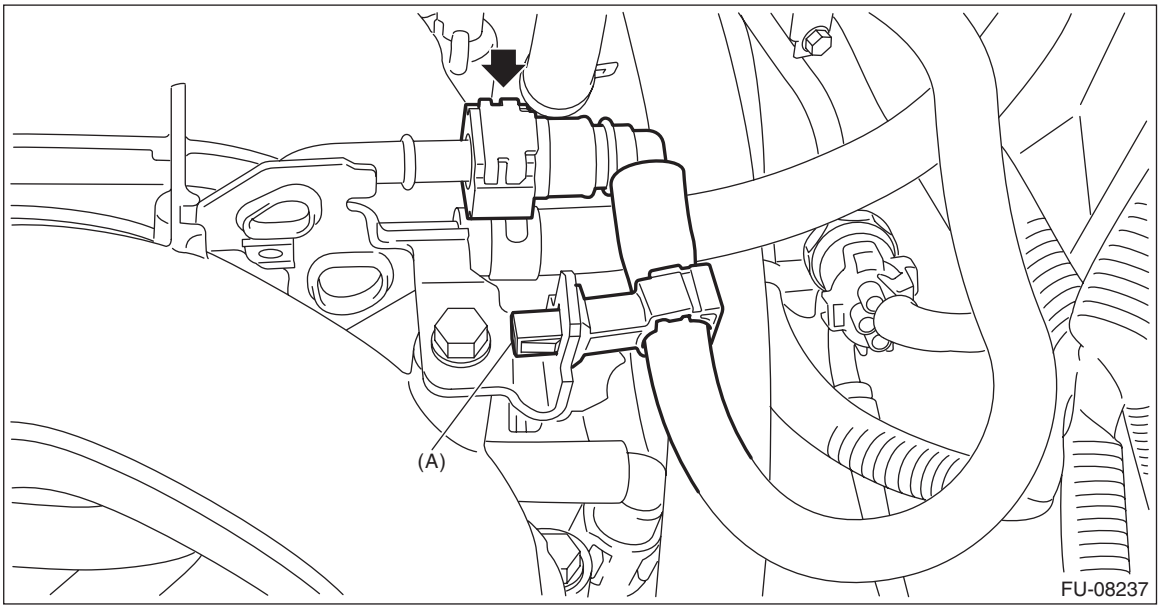
(2) Connect the quick connector on the fuel delivery tube to the fuel pipe assembly, and fix the fuel delivery tube using clip (A).

CAUTION:
• Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
• When connecting the quick connector, make sure to insert the pipe all the way in before locking the slider.
• When it is difficult to lock the slider, check that the pipe is fully inserted.
• Make sure that the quick connector is securely connected.

NOTE:
Connect the quick connector as shown in the figure.

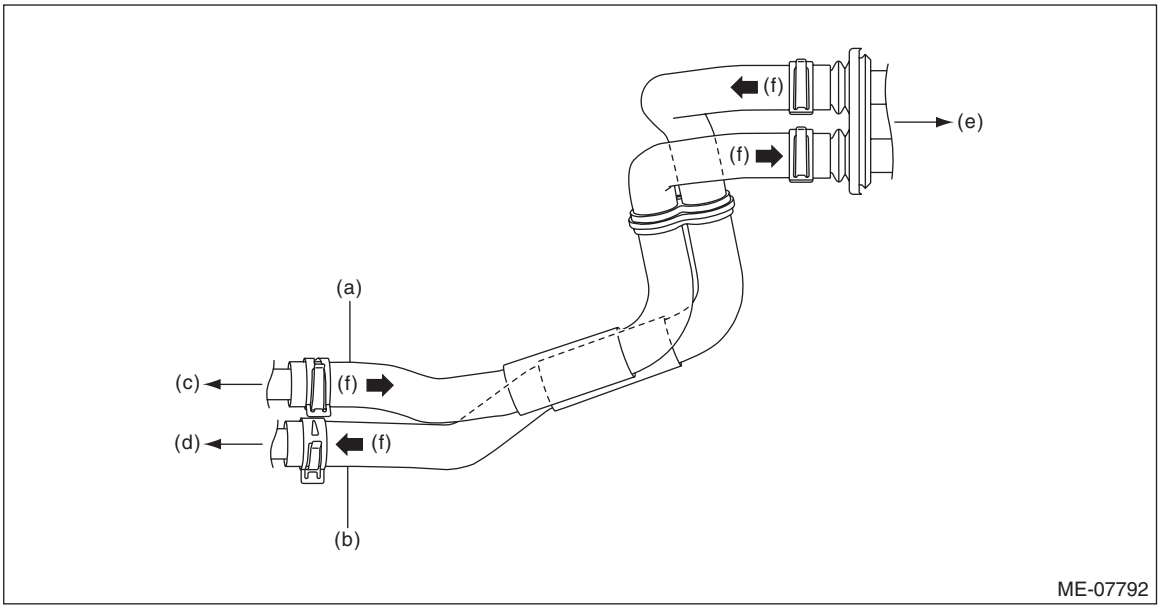


(a) Slider



25) Connect the heater inlet hose and heater outlet hose.

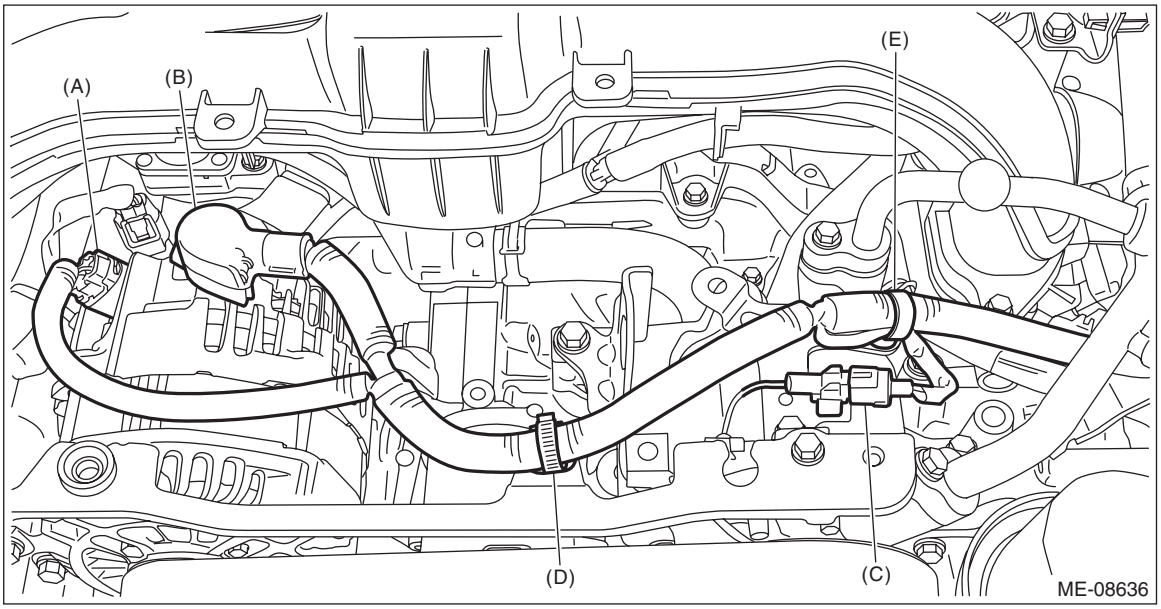
NOTE:
Be careful not to mix up the heater inlet hose and the heater outlet hose when connecting them.



(a)	Heater inlet hose	(c)	To water pipe ASSY	(e)	To heater core ASSY
(b)	Heater outlet hose	(d)	To water pipe LH	(f)	Engine coolant flow

26) Connect the A/C pressure hose to A/C compressor. <Ref. to AC-74, INSTALLATION, Hose and Pipe.>
27) Place the generator code and install the generator cord to the clip (D) and clip (E).
28) Connect connector (A) and terminal (B) to the generator, and connect connector (C) to A/C compressor.

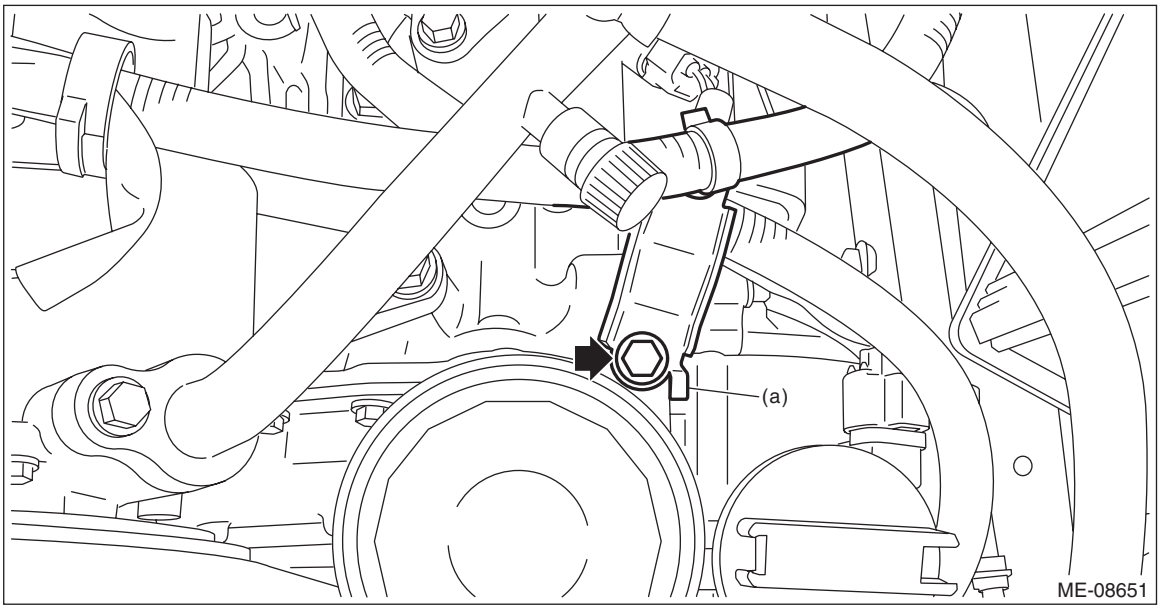
Tightening torque:
15 N·m (1.5 kgf-m, 11.1 ft-lb)



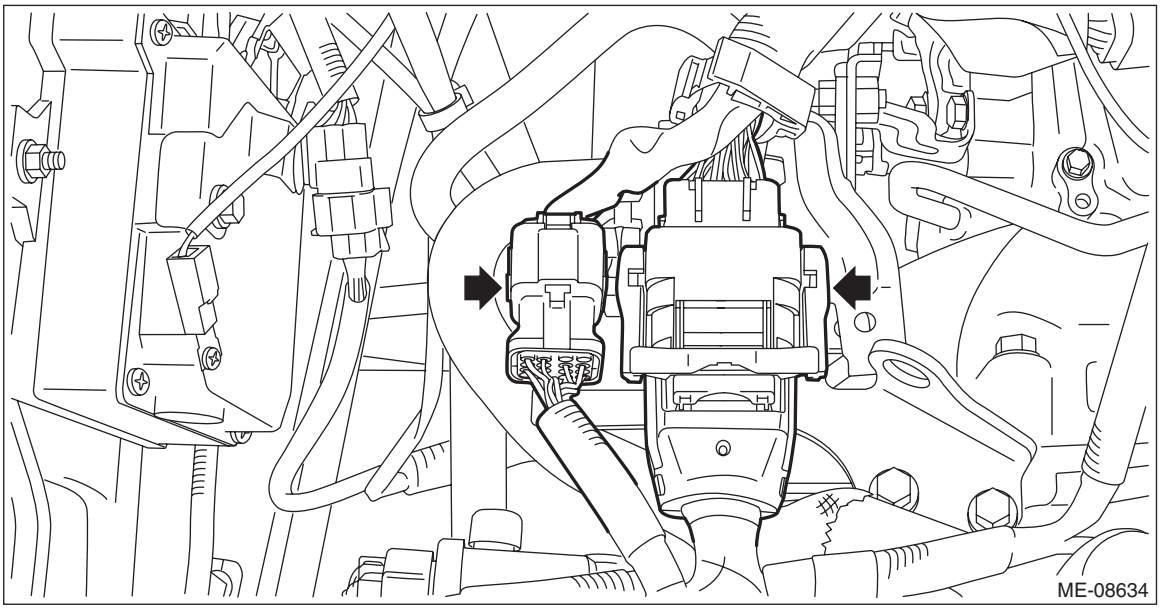
29) Install the generator cord stay to the chain cover.

NOTE:
Install the generator cord stay so that the folded end (a) touches the chain cover boss.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

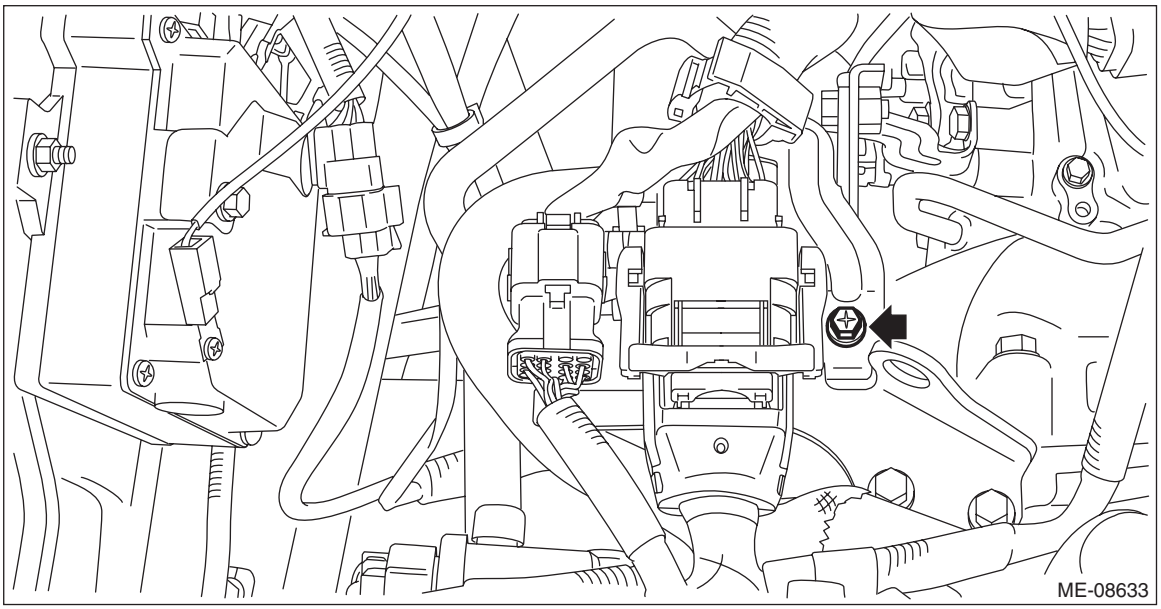


30) Connect the engine harness connector.
(1) Connect the bulkhead harness connector to the engine harness connector (black) and engine harness connector (brown).

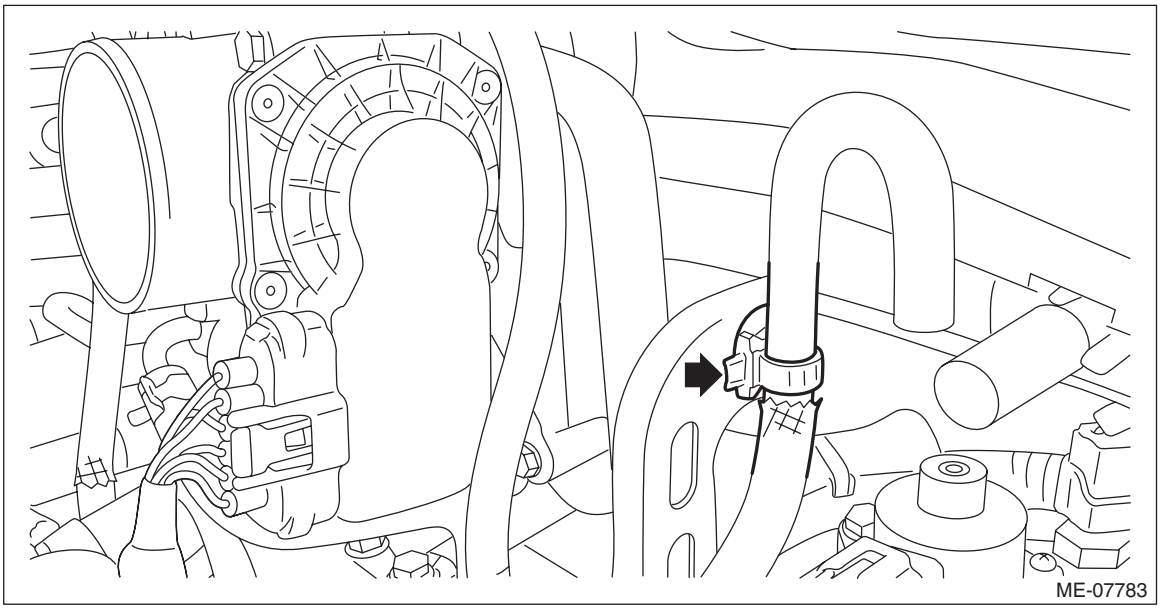


(2) Install the bolt which secures the bulkhead harness connector bracket.

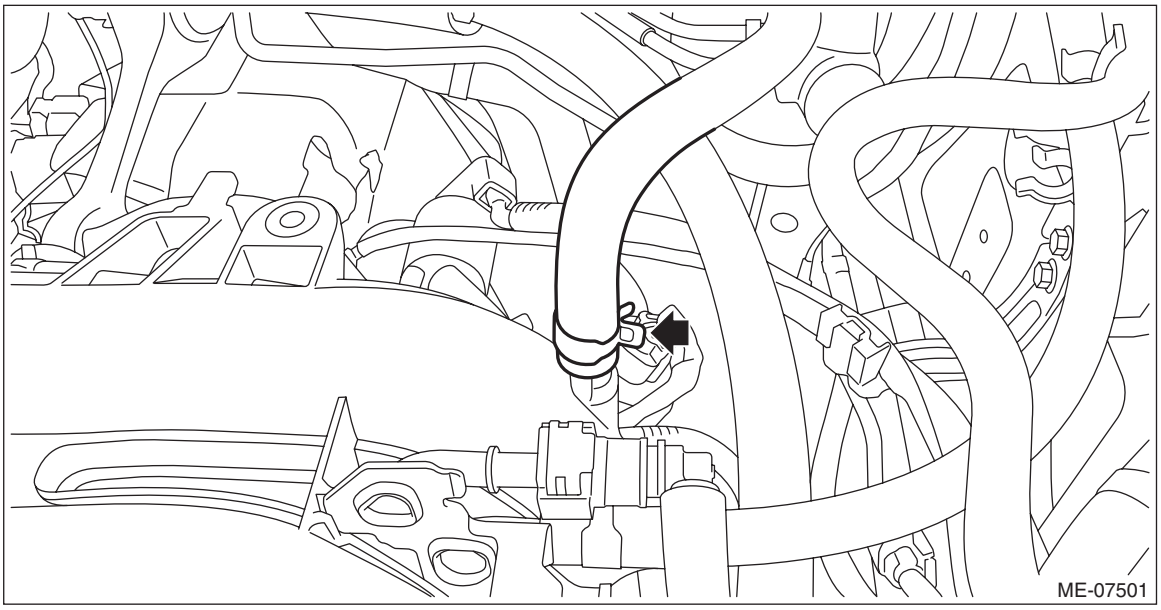
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



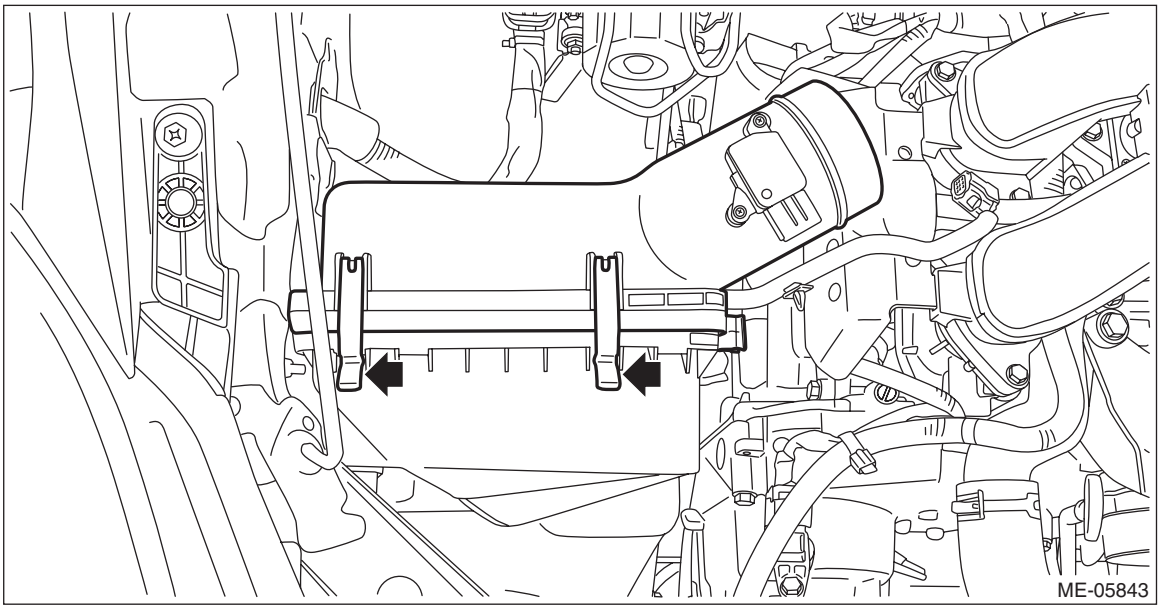
31) Secure the air breather hose to the engine rear hanger using clip. (MT model)



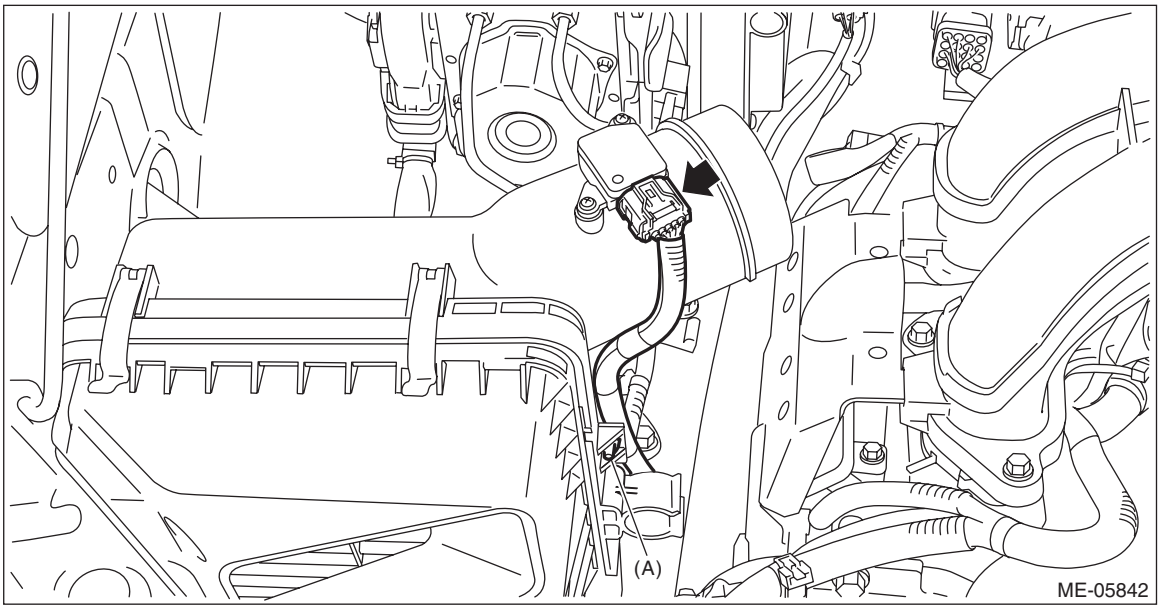
32) Connect the brake booster vacuum hose to the intake manifold.



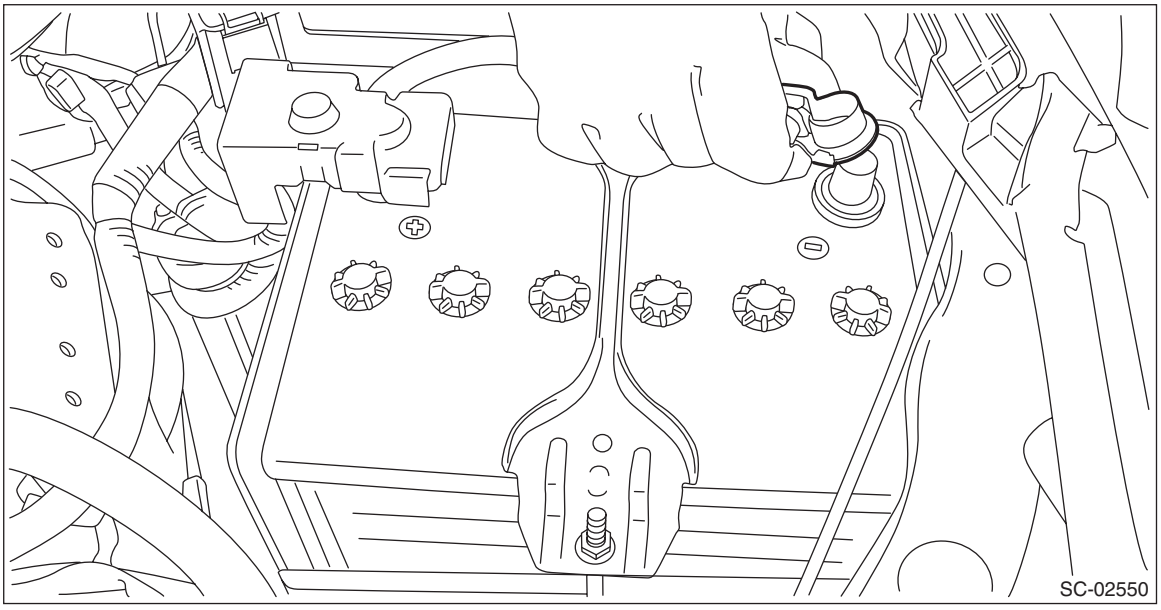
33) Install the radiator. <Ref. to CO(H4DO(w/o HEV))-82, INSTALLATION, Radiator.>
34) Install the air intake case (rear).



35) Install the clip (A) which secures the air flow and intake air temperature sensor harness, and connect the connector to the air flow and intake air temperature sensor.



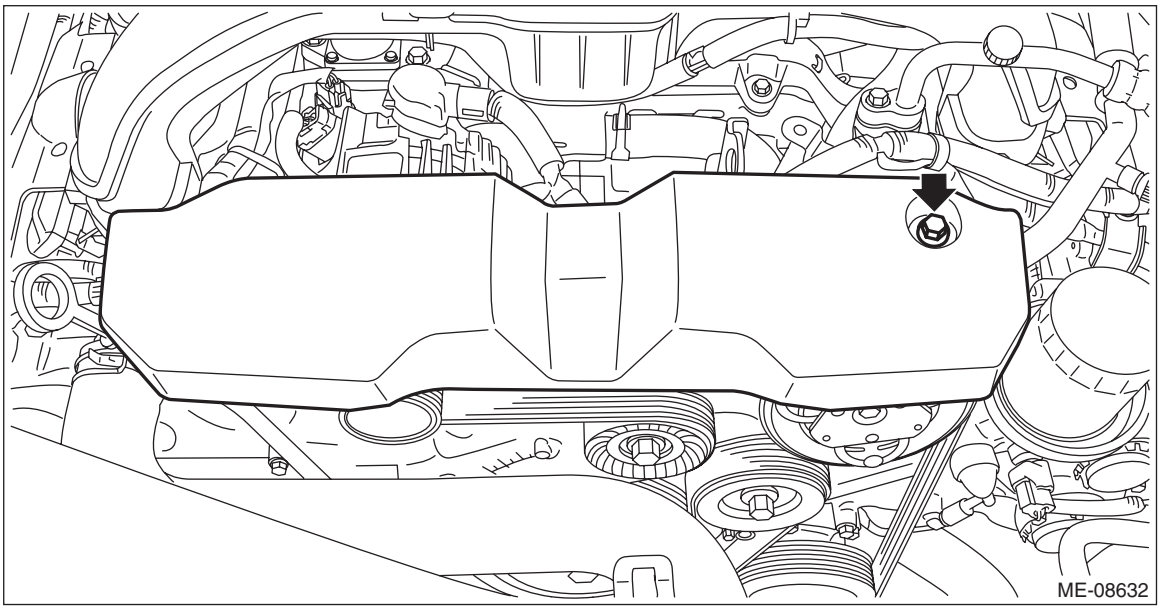
36) Install the air intake boot. <Ref. to IN(H4DO(w/o HEV))-12, INSTALLATION, Air Intake Boot.>
37) Install the air intake duct. <Ref. to IN(H4DO(w/o HEV))-13, INSTALLATION, Air Intake Duct.>
38) Connect the battery ground terminal.



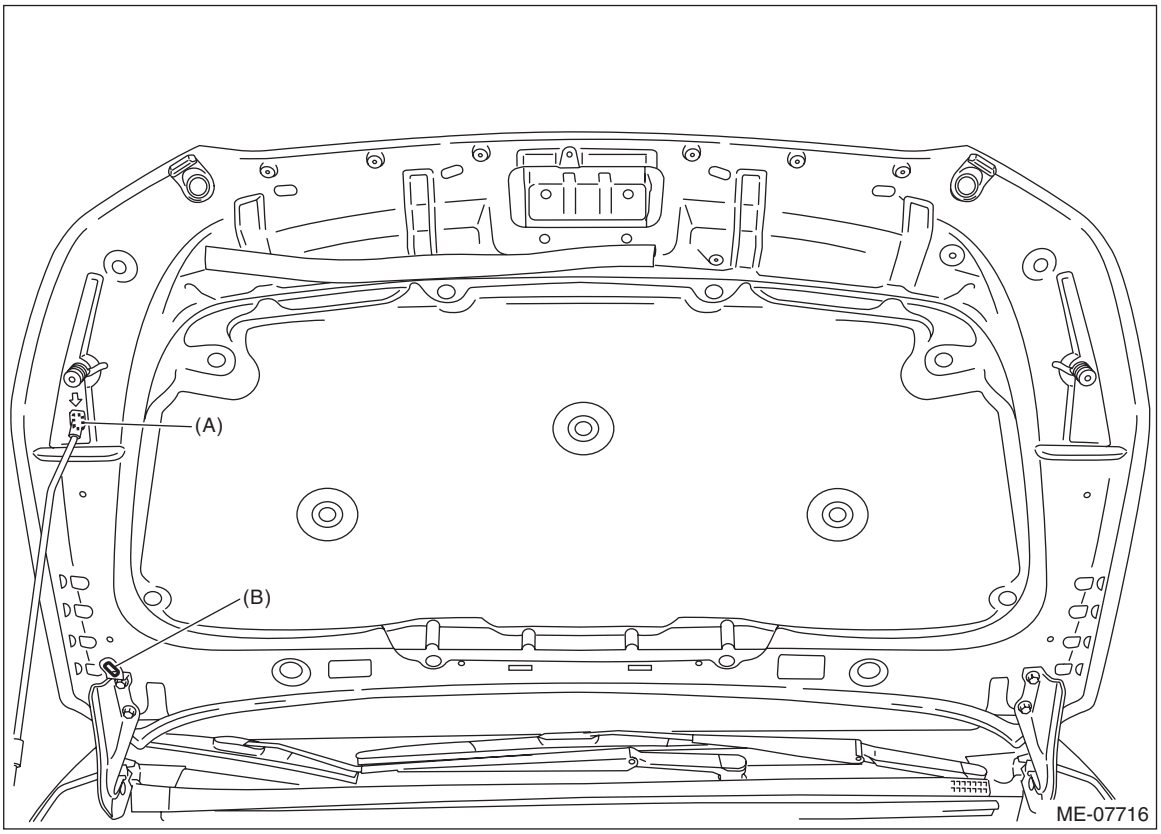
39) Fill engine coolant. <Ref. to CO(H4DO(w/o HEV))-16, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
40) Charge the A/C system with refrigerant. <Ref. to AC-30, PROCEDURE, Refrigerant Charging Procedure.>

41) Install the V-belt cover.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

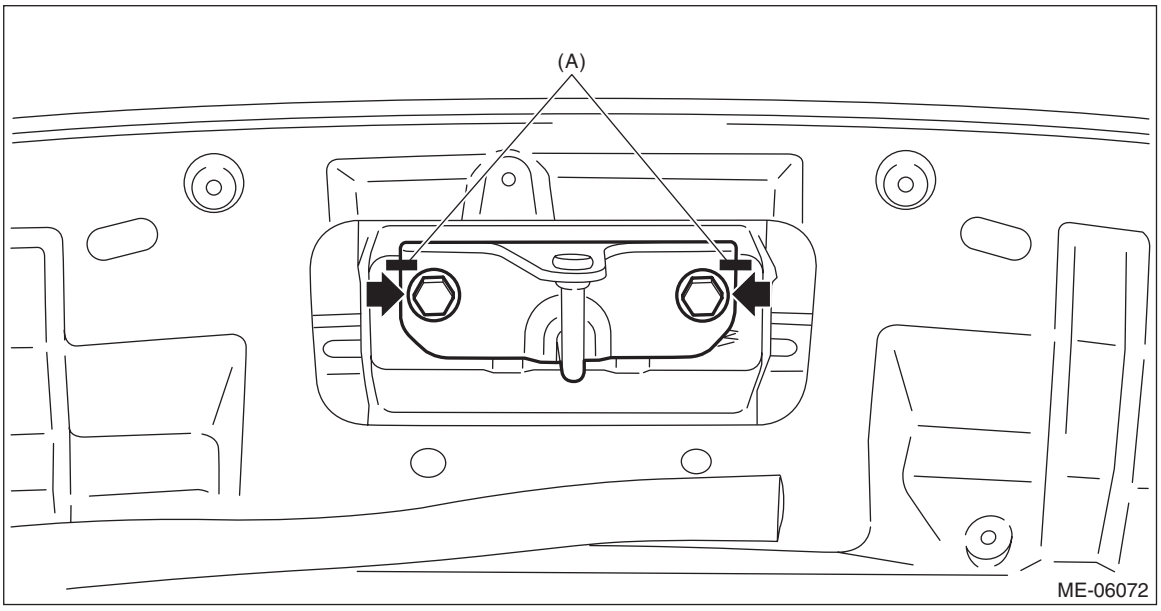


42) Change the front hood stay position from (B) to (A).



43) Install the front hood striker to the front hood by aligning the alignment marks (A), and close the front hood.

Tightening torque:
33 N·m (3.4 kgf-m, 24.3 ft-lb)



2. HEV MODEL

1) Install the engine mounting onto the engine.

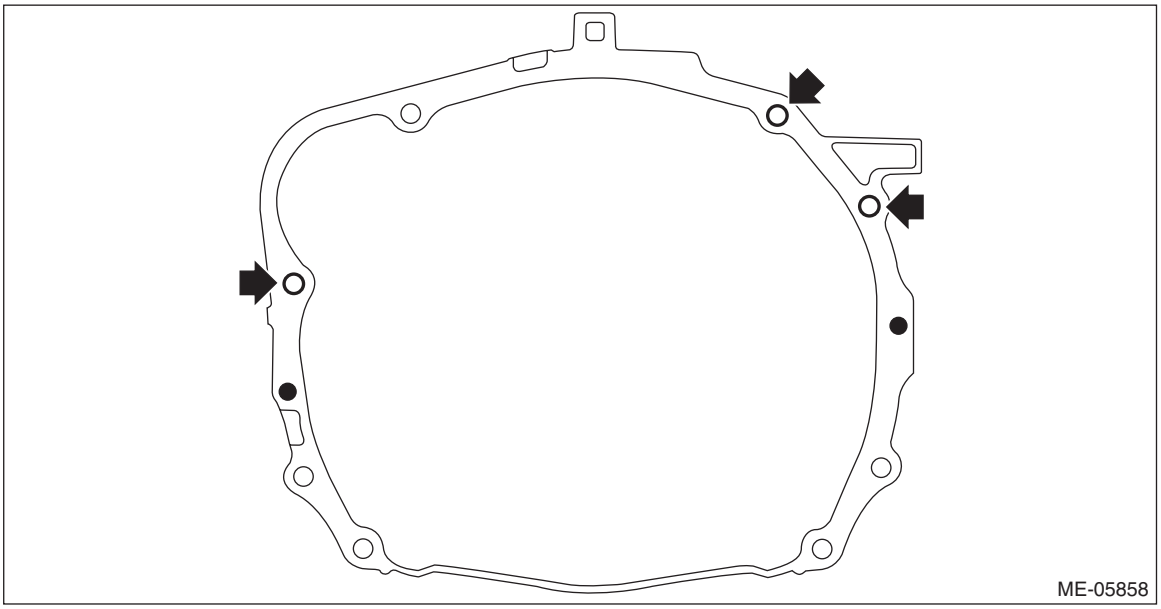
Tightening torque:
35 N·m (3.6 kgf-m, 25.8 ft-lb)

2) Position the engine in engine compartment and align it with transmission.

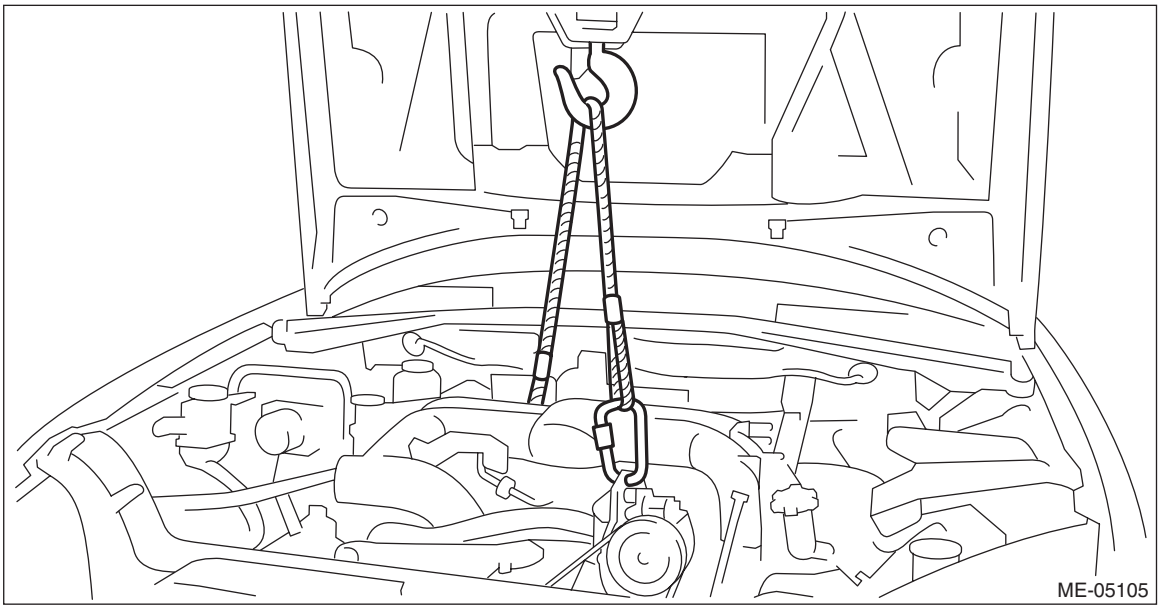
NOTE:
Be careful not to damage adjacent parts or body panels with crank pulley, oil level gauge, etc.

3) Install the bolts which hold upper side of transmission to engine.

Tightening torque:
50 N·m (5.1 kgf-m, 36.9 ft-lb)



4) Remove the lifting device and wire ropes.

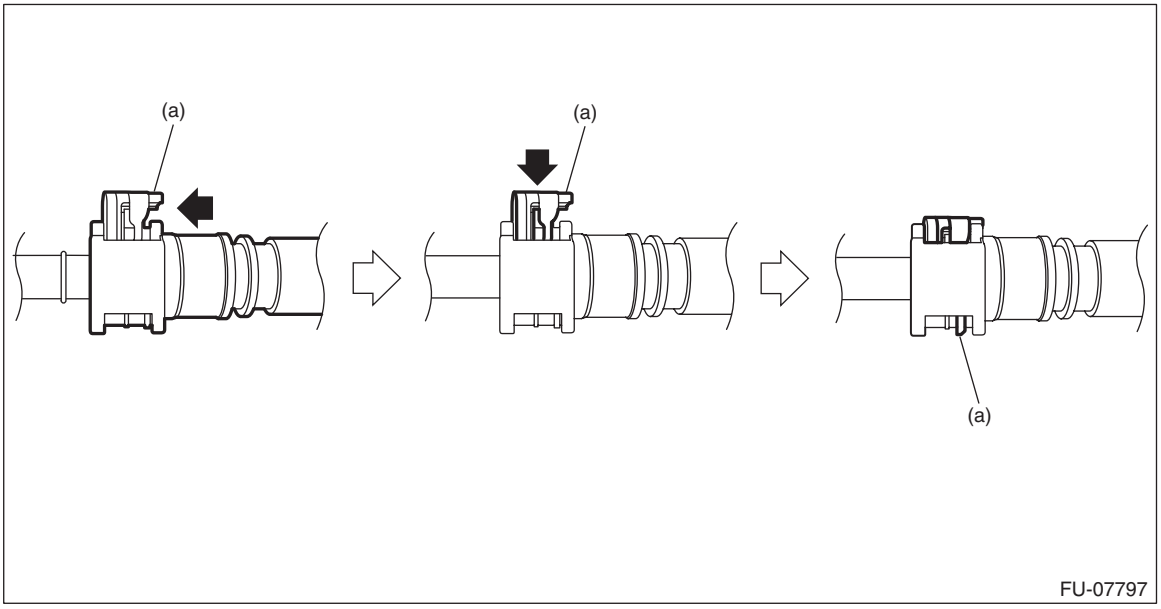


5) Remove the garage jack.

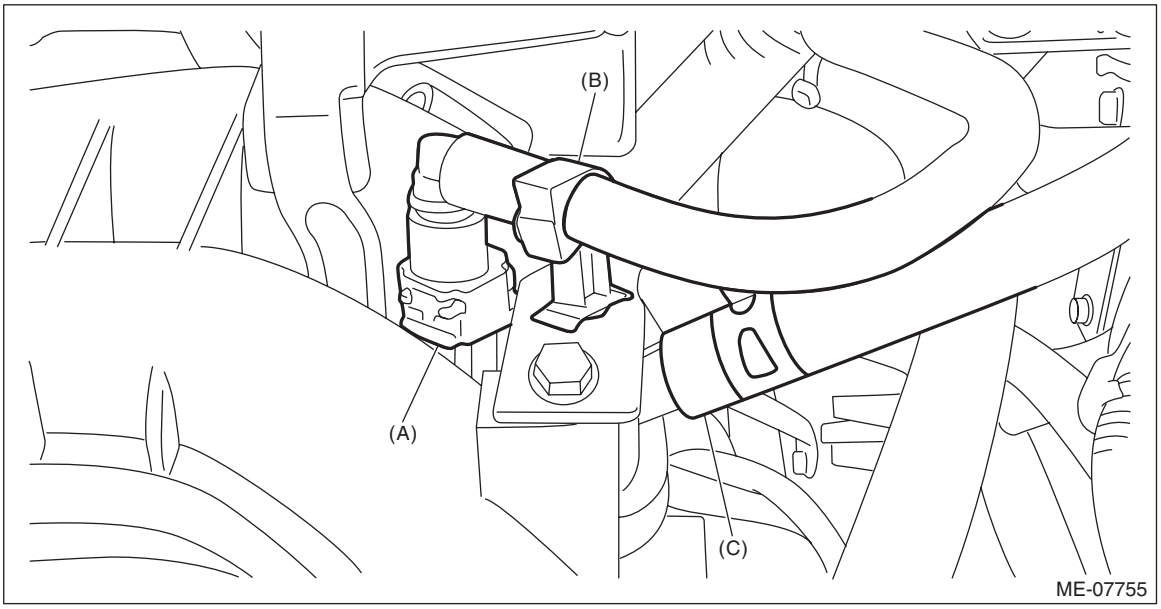
6) Connect the fuel delivery tube and evaporation hose.
(1) Connect the evaporation hose (C) to fuel pipe assembly.
(2) Connect the quick connector (A) of the fuel delivery tube to the fuel pipe assembly, and secure the fuel delivery tube using clip (B).

CAUTION:
• Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
• When connecting the quick connector, make sure to insert the pipe all the way in before locking the slider.
• When it is difficult to lock the slider, check that the pipe is fully inserted.
• Make sure that the quick connector is securely connected.

NOTE:
Connect the quick connector as shown in the figure.

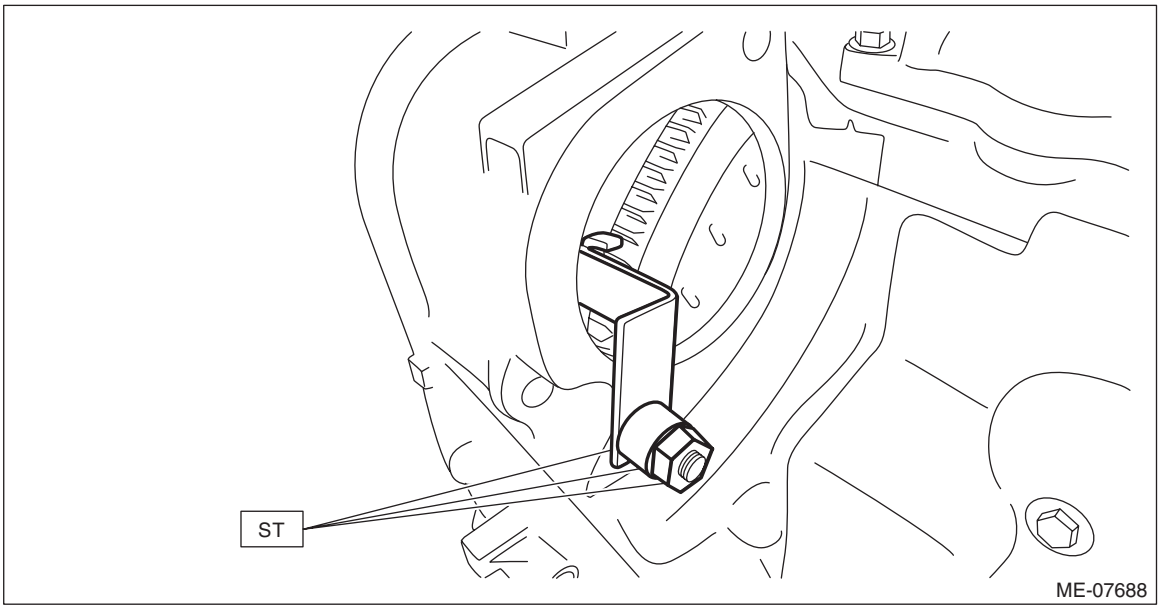


(a) Slider



7) Remove the ST from torque converter clutch case.

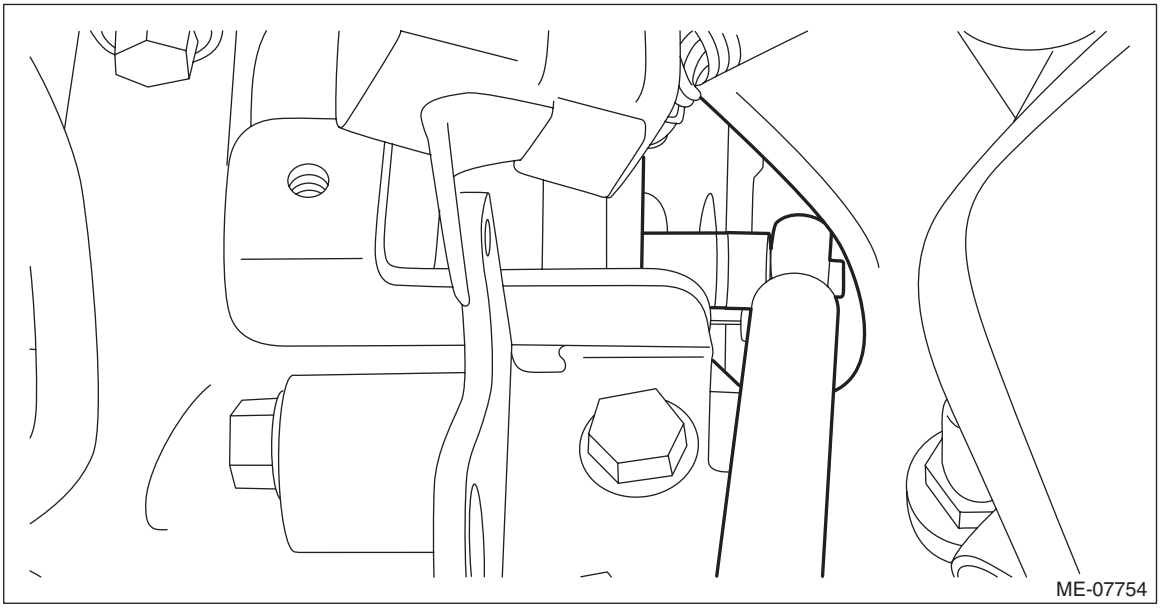
NOTE:
Be careful not to drop the ST into the torque converter clutch case when removing the ST.
ST 498277200 STOPPER SET



8) Install the torque converter clutch to drive plate.
(1) Insert the wrench into the crank pulley bolt and rotate the crank pulley to install the bolts which hold torque converter clutch to drive plate.

NOTE:
Be careful not to drop bolts into the torque converter clutch case.

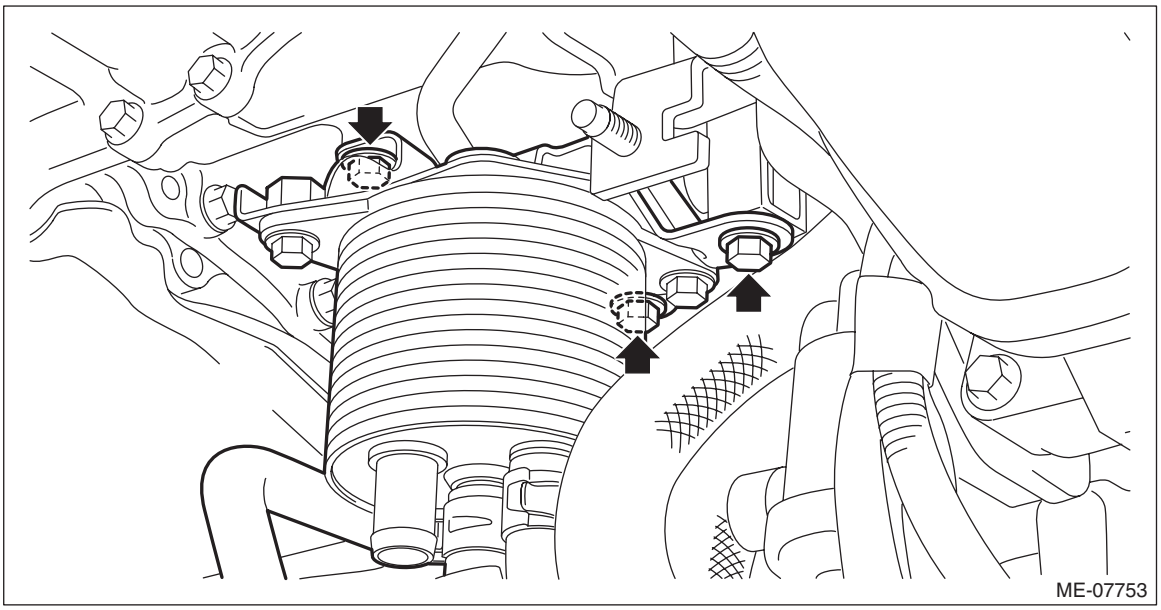
Tightening torque:
25 N·m (2.5 kgf-m, 18.4 ft-lb)



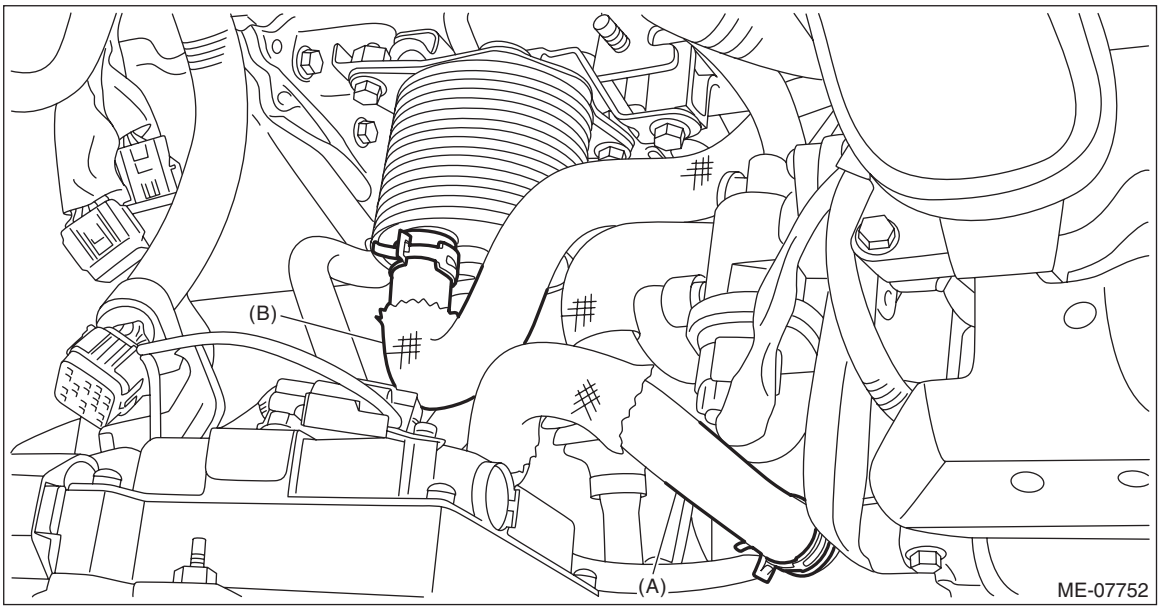
(2) Fit the plug to service hole.

9) Install the starter. <Ref. to SC(H4DO(HEV))-11, INSTALLATION, Starter.>
10) Set the CVTF cooler (with warmer feature) to the transmission, and install the bolts which secure the CVTF cooler (with warmer feature) to the transmission.

Tightening torque:
23 N·m (2.3 kgf-m, 17.0 ft-lb)

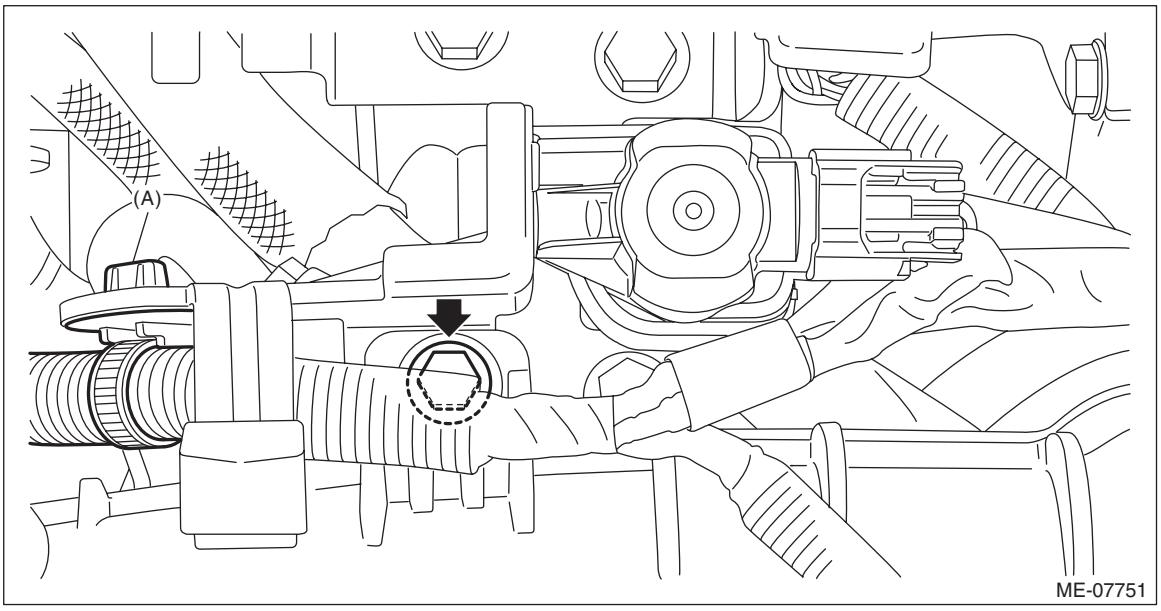


11) Connect the engine coolant inlet hose (A) to the EGR cooler, and connect the engine coolant outlet hose (B) to the CVTF cooler (with warmer feature).



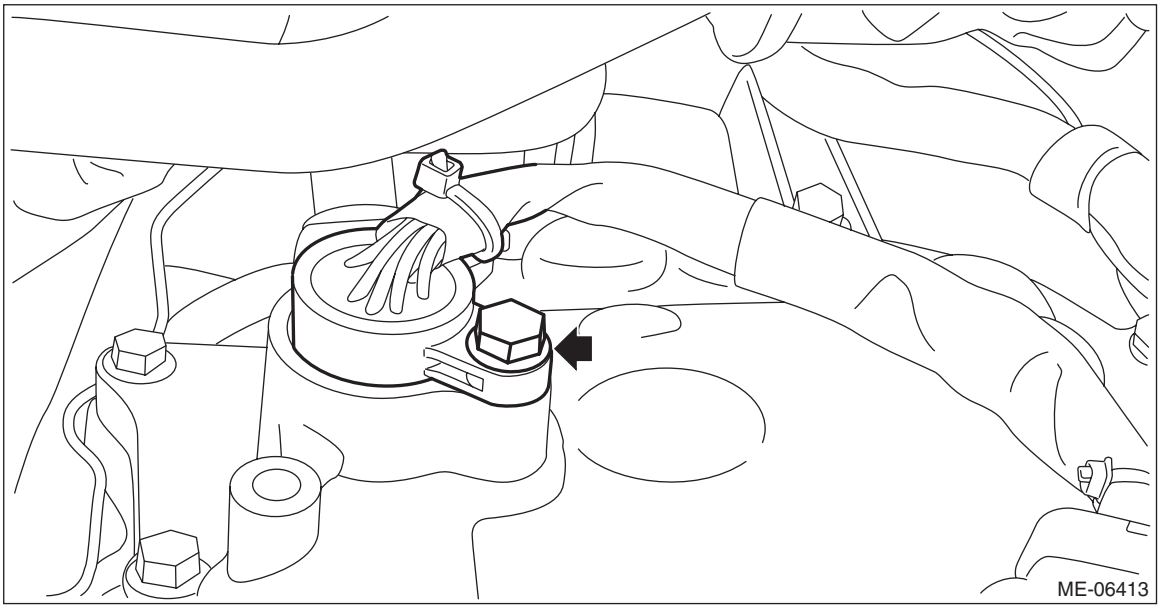
12) Install the bolts which secure the purge control solenoid valve bracket to the intake manifold, and secure the engine harness to the purge control solenoid valve bracket with the clip (A).

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



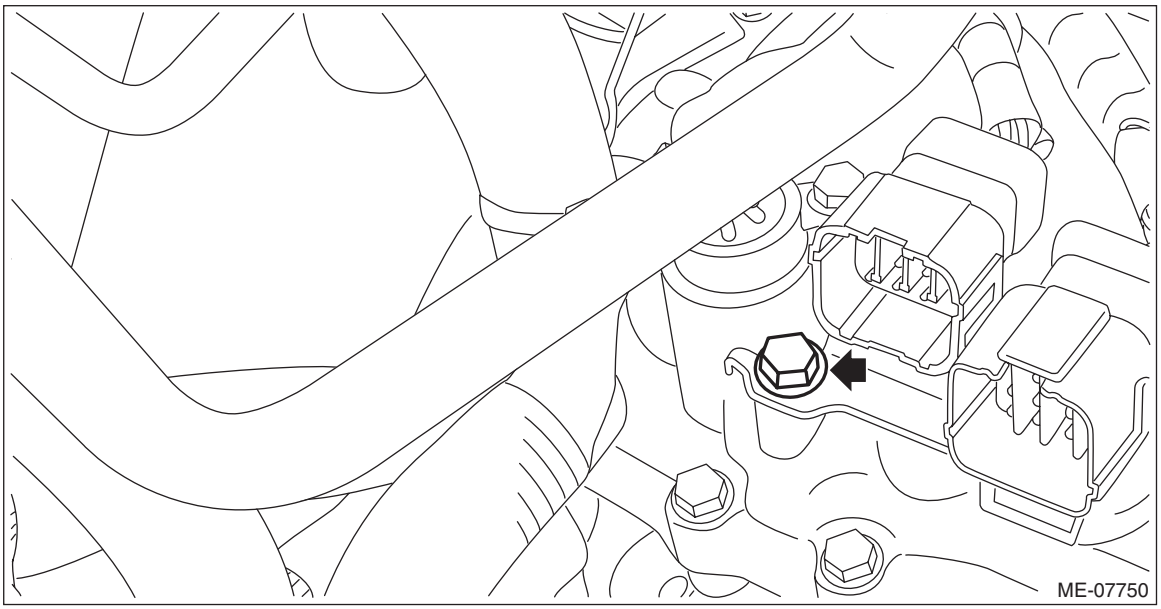
13) Remove the bolt and turn the transmission harness counterclockwise to install the transmission harness to the control valve body.

Tightening torque:
7 N·m (0.7 kgf-m, 5.2 ft-lb)



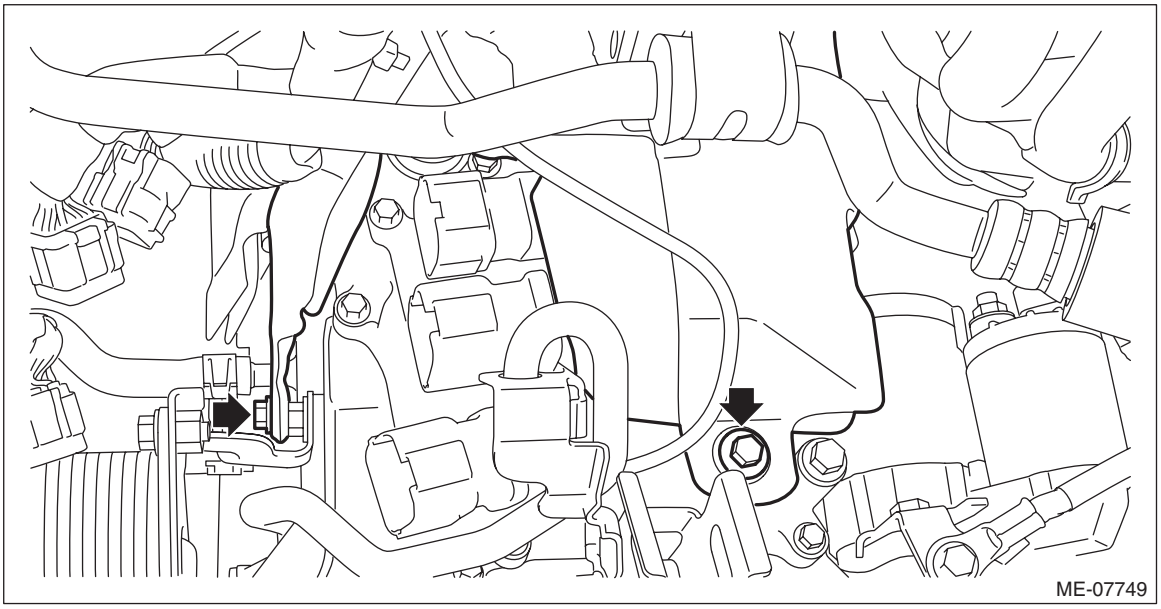
14) Install the bolt which holds the transmission harness stay.

Tightening torque:
7 N·m (0.7 kgf-m, 5.2 ft-lb)



15) Install the transmission case cover.

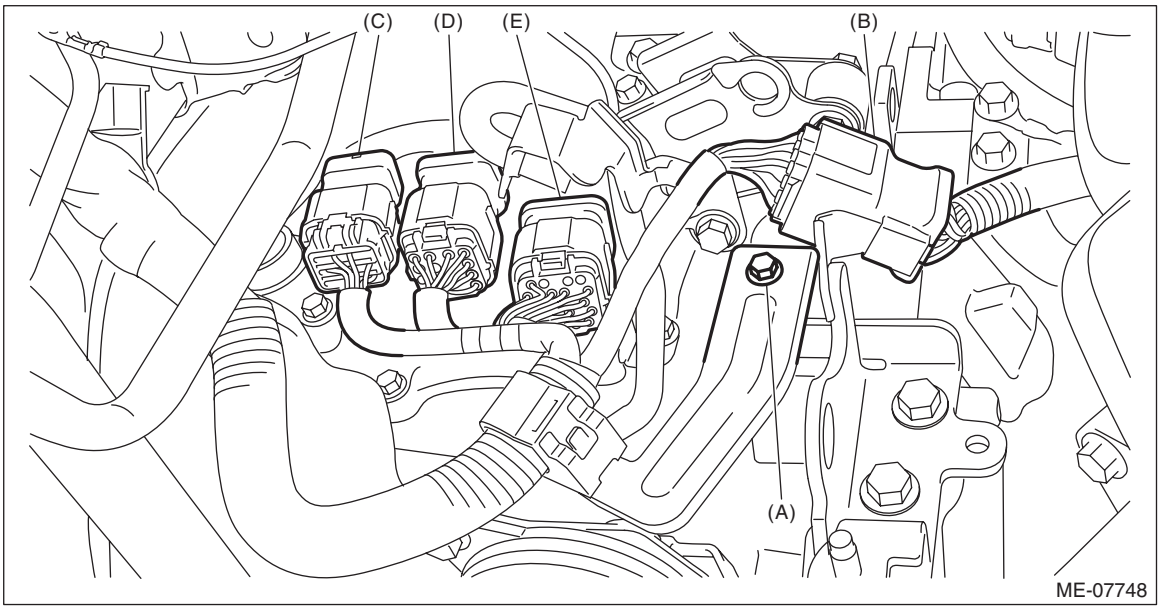
Tightening torque:
8 N·m (0.8 kgf-m, 5.9 ft-lb)



16) Connect the bulkhead harness connector to the transmission harness connector (C), inhibitor harness connector (D) and drive motor harness connector (E).

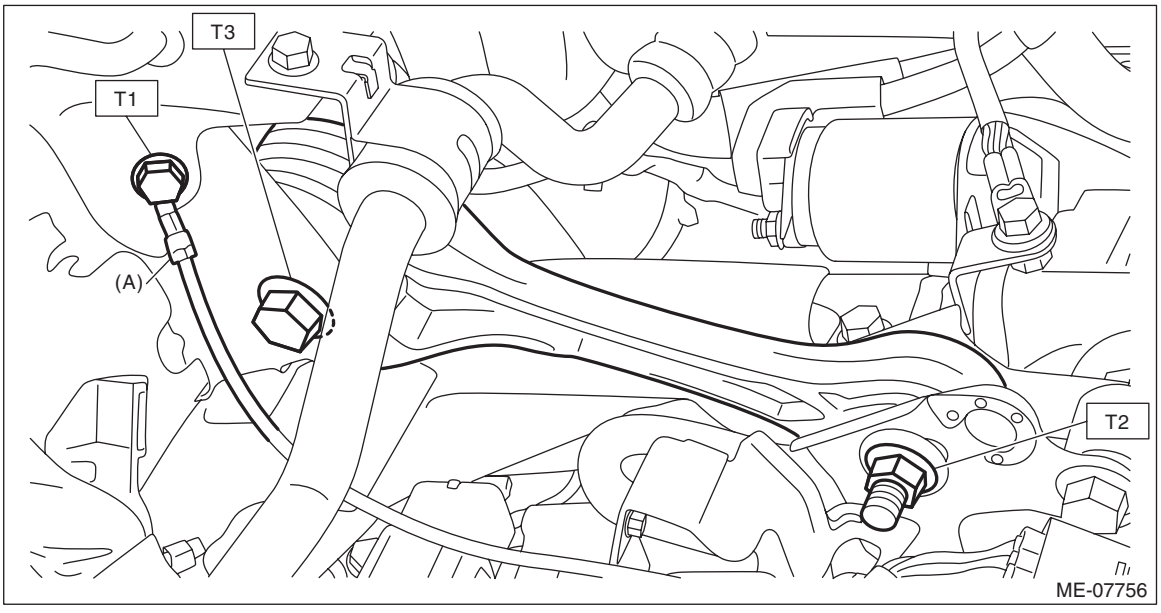
17) Connect the bulkhead harness connector to the engine harness connector (brown) (B), and install the bolt (A) securing the bulkhead harness connector bracket.

Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



18) Install the pitching stopper, and connect the transmission radio ground terminal (A) to the vehicle.

Tightening torque:
T1: 13 N·m (1.3 kgf-m, 9.6 ft-lb)
T2: 50 N·m (5.1 kgf-m, 36.9 ft-lb)
T3: 58 N·m (5.9 kgf-m, 42.8 ft-lb)

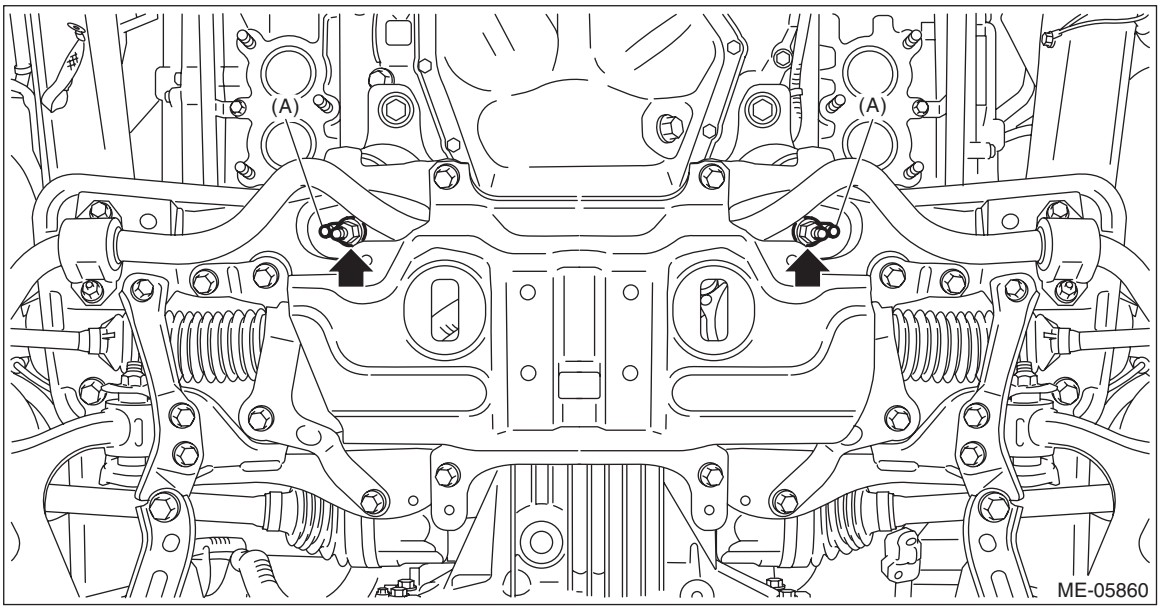


19) Lift up the vehicle.

20) Install the nuts which hold the engine mounting to the crossmember.

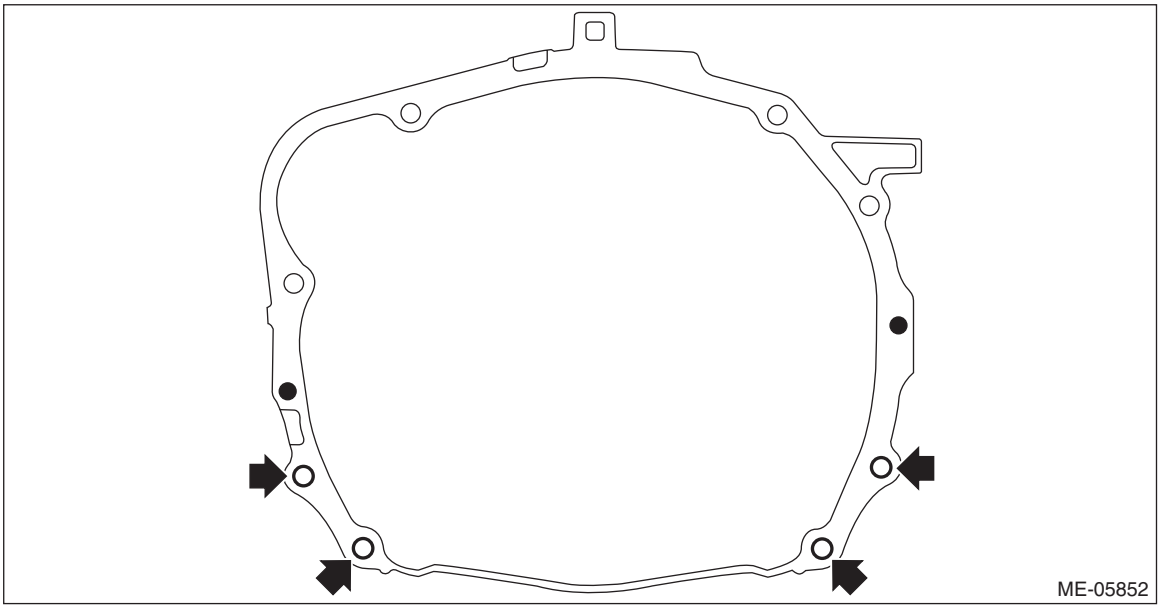
NOTE:
- Make sure that locators (A) of the engine mounting are securely inserted.
- Use a new nut.

Tightening torque:
60 N·m (6.1 kgf-m, 44.3 ft-lb)



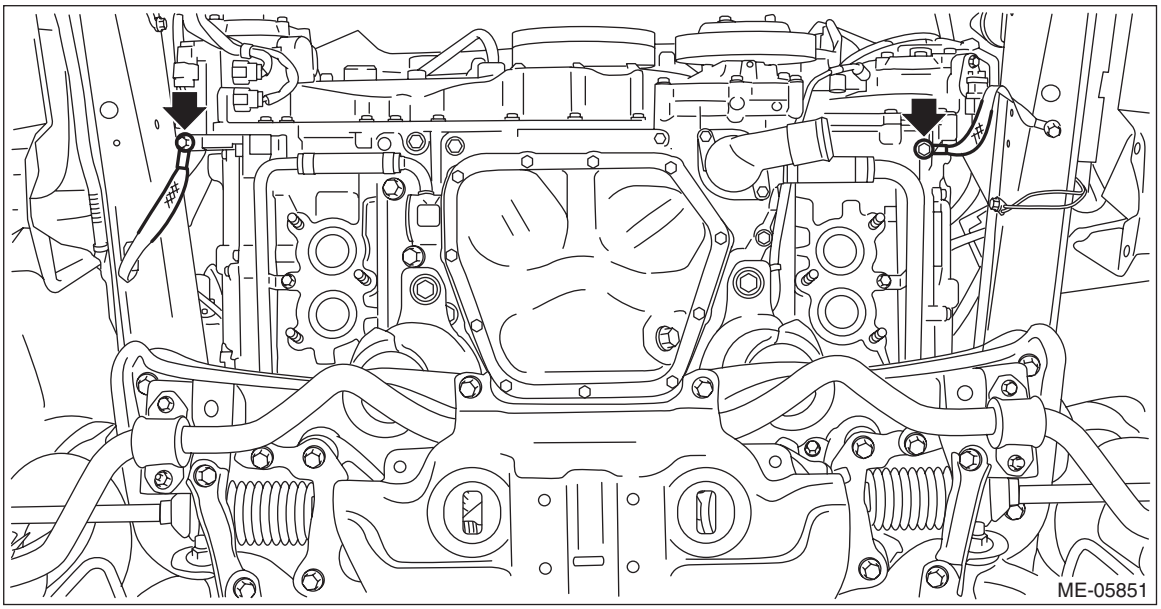
21) Install the bolts and nuts which hold lower side of the transmission to engine.

Tightening torque:
50 N·m (5.1 kgf-m, 36.9 ft-lb)



22) Connect the ground cable.

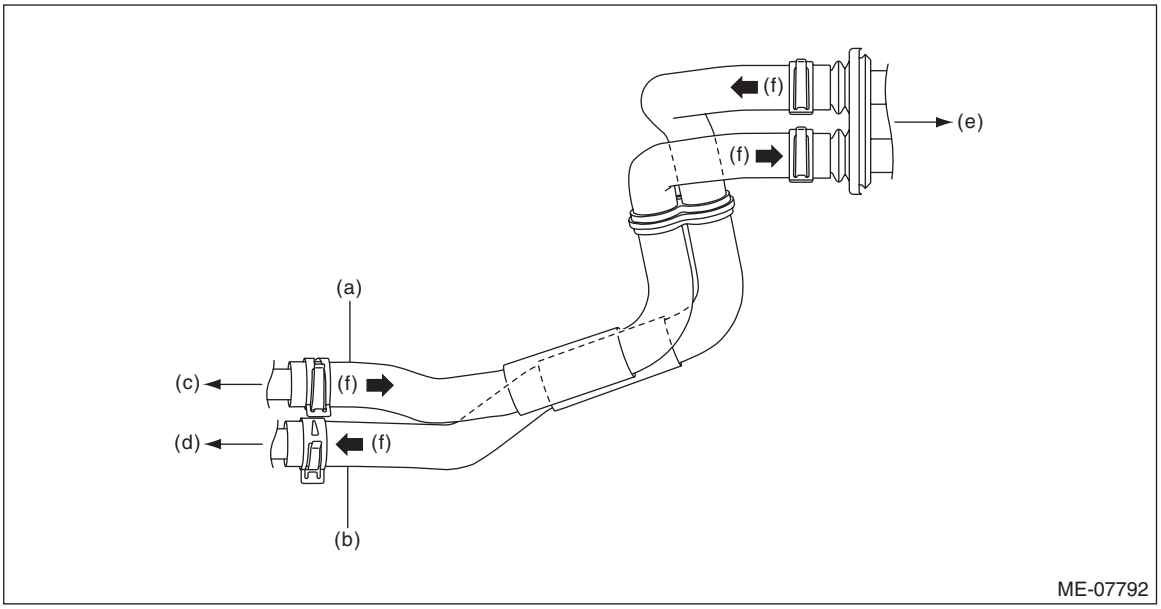
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



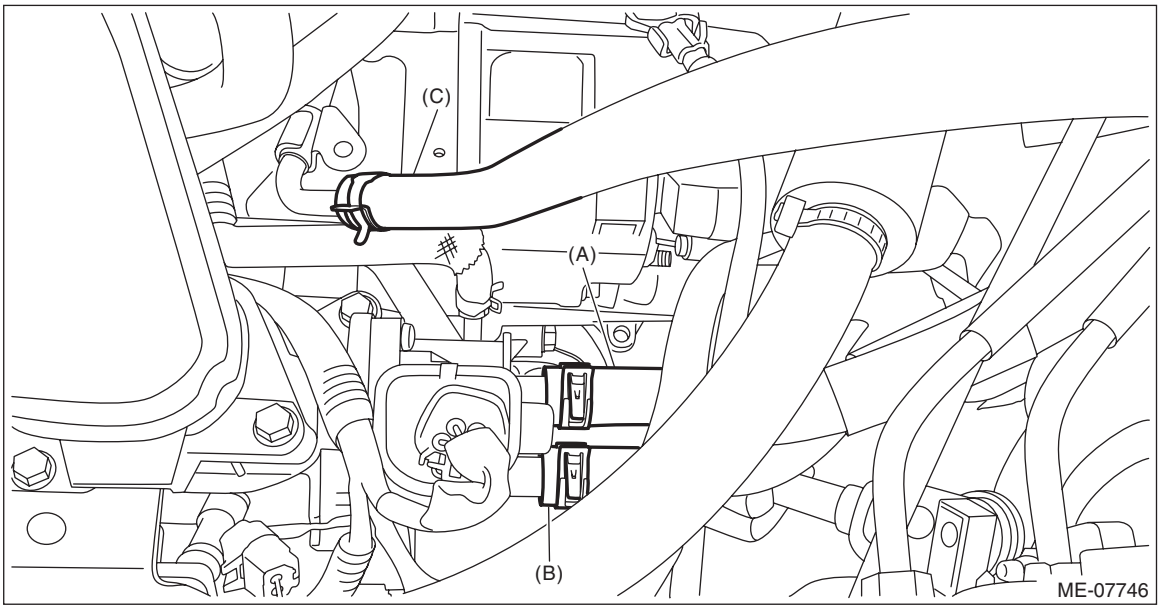
23) Install the front exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-8, INSTALLATION, Front Exhaust Pipe.>
24) Lower the vehicle.
25) Connect the brake booster vacuum hose (C) to the brake vacuum pipe.

26) Connect the heater inlet hose (A) to the water pipe assembly, and connect the heater outlet hose (B) to the water pipe LH.

NOTE:
Be careful not to mix up the heater inlet hose and the heater outlet hose when connecting them.



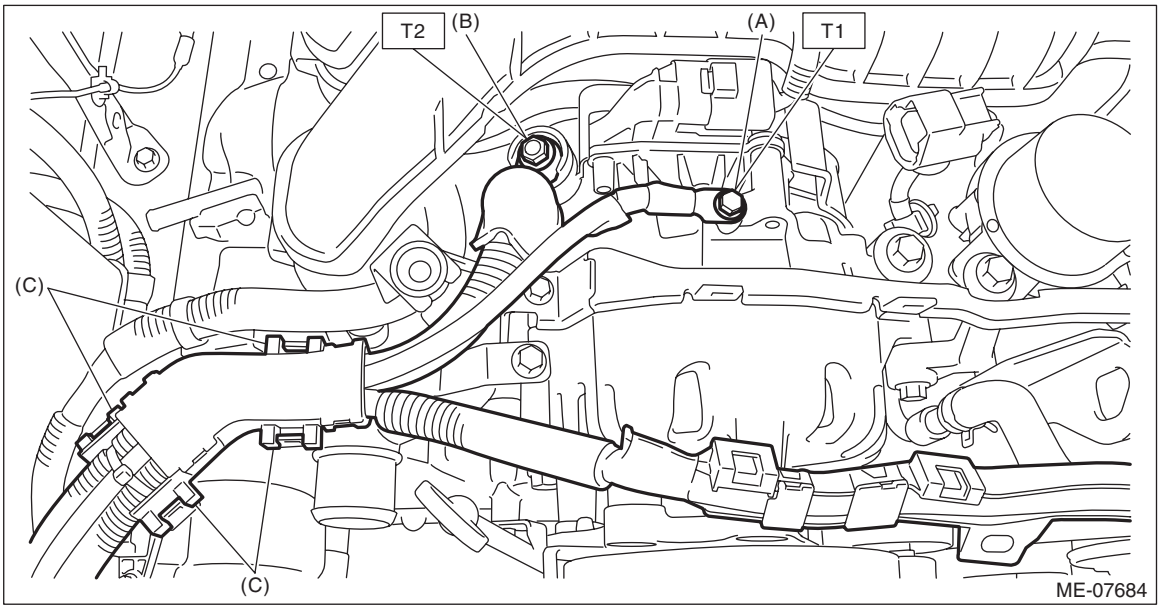
(a) Heater inlet hose
(b) Heater outlet hose
(c) To water pipe ASSY
(d) To water pipe LH
(e) To heater core ASSY
(f) Engine coolant flow



27) Connect the A/C pressure hose to A/C compressor. <Ref. to AC-71, REMOVAL, Hose and Pipe.>

28) Set the battery cable assembly, and secure the battery cable assembly to the battery cable bracket No. 1 with the clip (C).
29) Connect the terminal (A) and the terminal (B) to ISG.

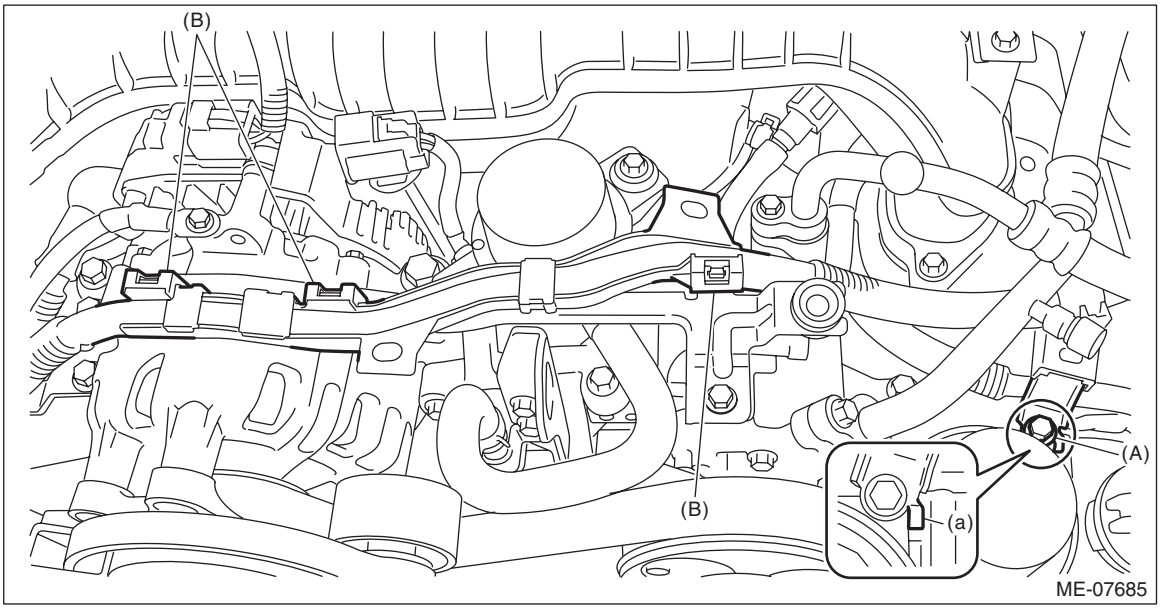
Tightening torque:
T1: 7.5 N·m (0.8 kgf-m, 5.5 ft-lb)
T2: 15.5 N·m (1.6 kgf-m, 11.4 ft-lb)



30) Secure the battery cable assembly to the collector cover bracket with the clip (B), and install the bolt (A) which secures the battery cable stay to the chain cover.

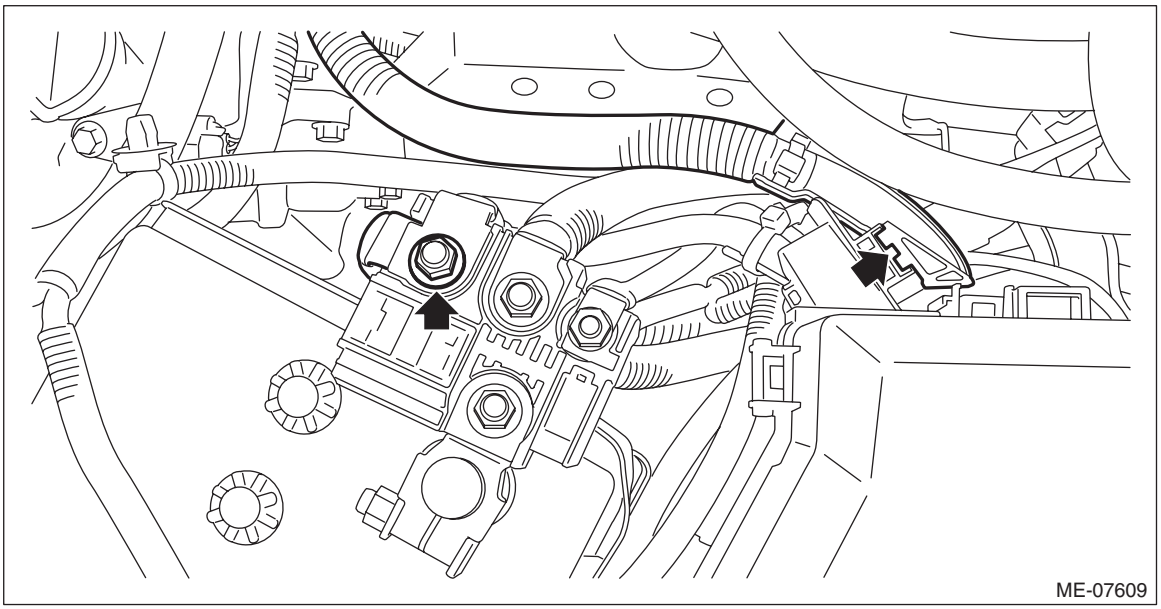
NOTE:
When installing the battery cable stay, install it by fitting the folded end (a) of the battery cable stay to the chain cover boss.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

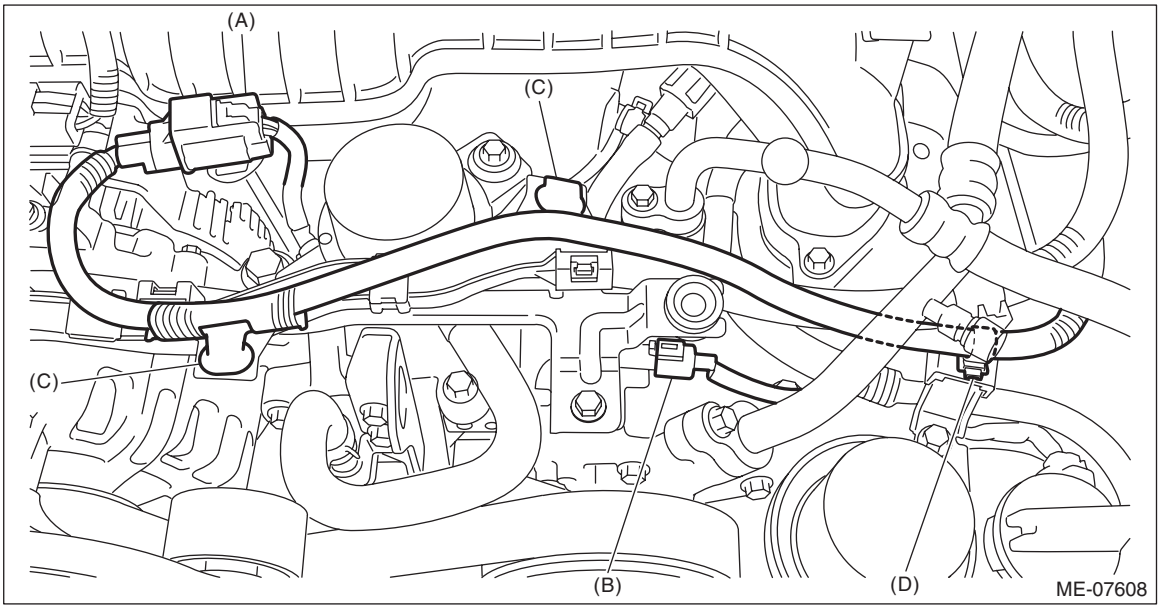


31) Install the battery cable assembly to the main fuse box, and install the nut which secures the battery cable assembly to the slow blow fuse (12 volt auxiliary battery).

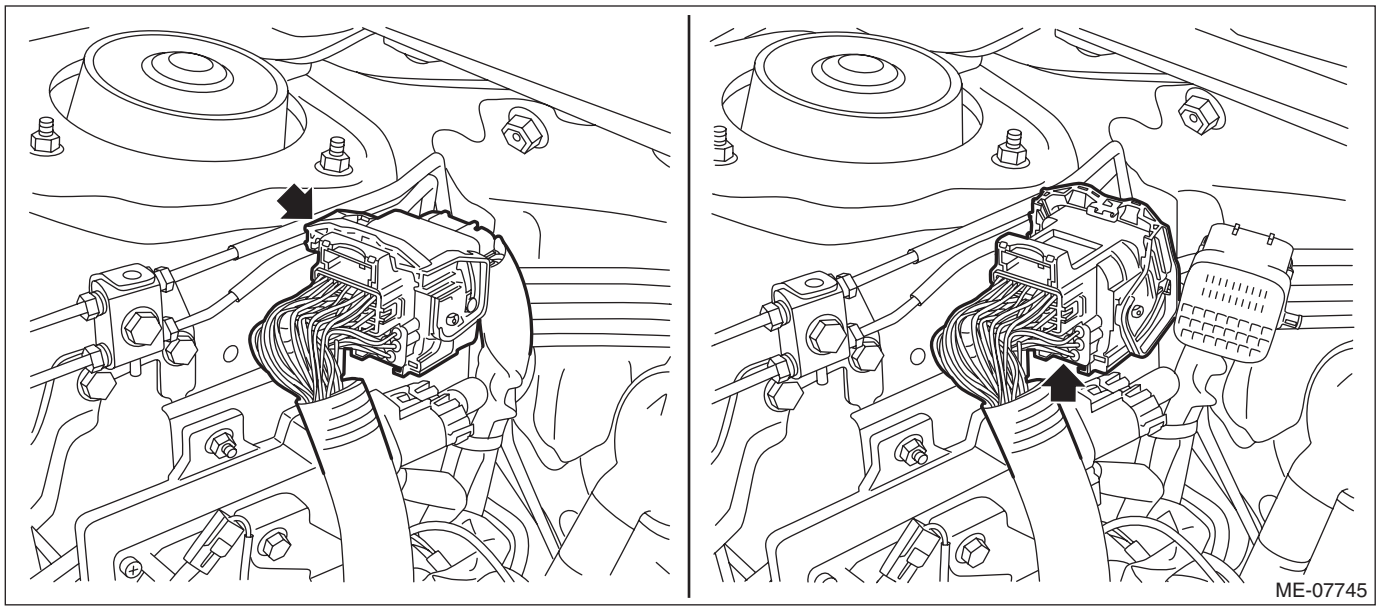
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



32) Install the terminal boot to the positive terminal of the 12 volt auxiliary battery.
33) Set the harness, and secure the harness to the battery cable assembly with the clip (C) and the clip (D).
34) Connect the connector (A) to the brake vacuum pump, and connect the connector (B) to the A/C compressor.

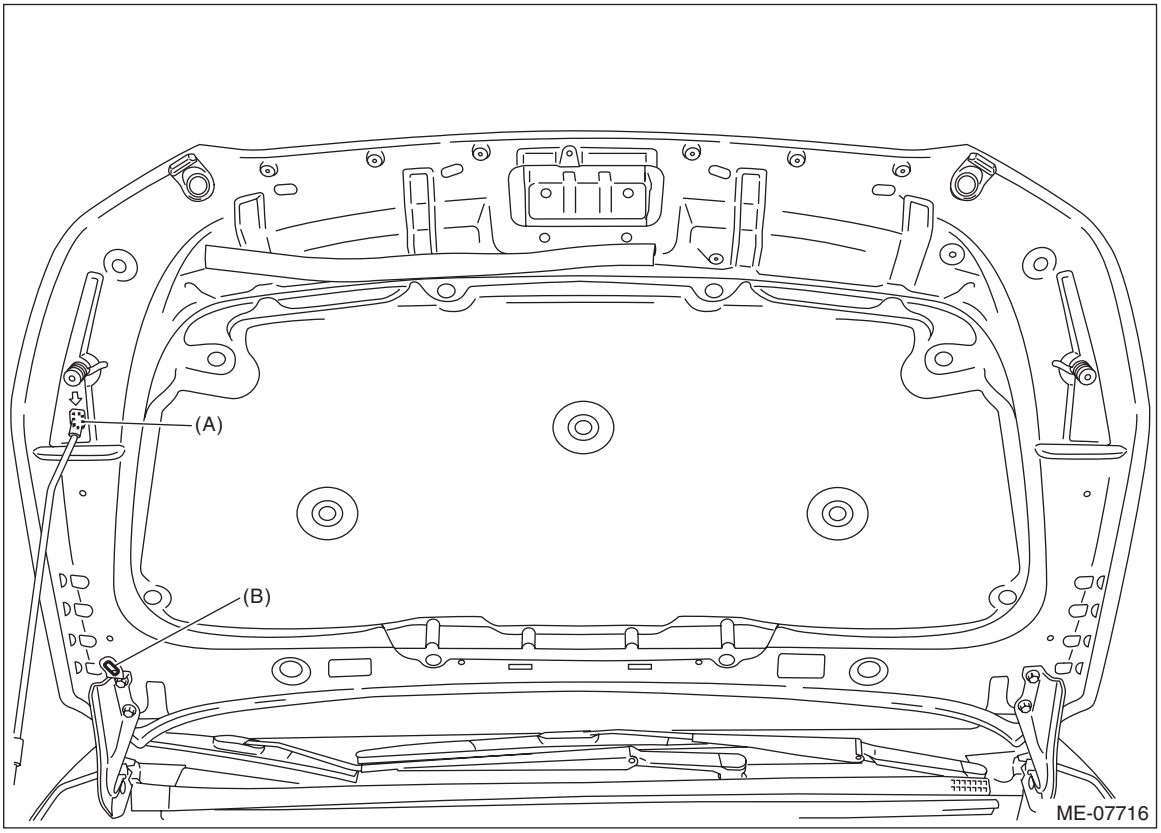


35) Install the engine harness connector (black) to bracket, then connect the bulkhead harness connector to the engine harness connector (black).



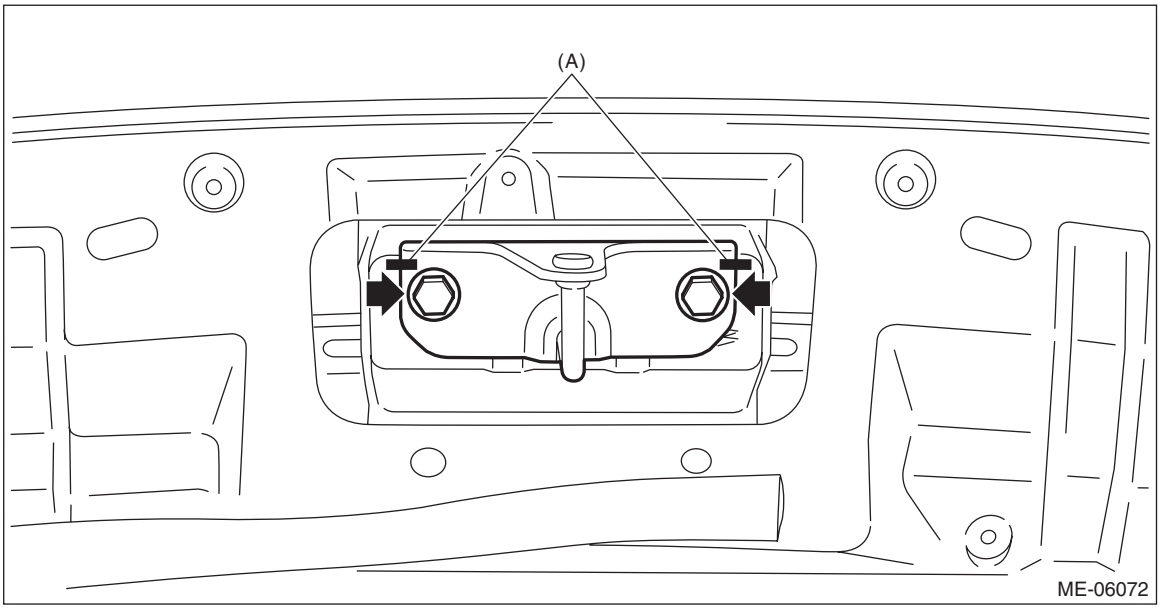
36) Install the radiator. <Ref. to CO(H4DO(w/o HEV))-82, INSTALLATION, Radiator.>
37) Install the air cleaner case. <Ref. to IN(H4DO(HEV))-8, INSTALLATION, Air Cleaner Case.>
38) Install the air intake duct. <Ref. to IN(H4DO(HEV))-15, INSTALLATION, Air Intake Duct.>
39) Connect the battery ground terminal. <Ref. to NT-5, BATTERY, NOTE, Note.>
40) Fill engine coolant. <Ref. to CO(H4DO(w/o HEV))-16, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
41) Charge the A/C system with refrigerant. <Ref. to AC-30, PROCEDURE, Refrigerant Charging Procedure.>
42) Install the collector cover.

43) Change the front hood stay position from (B) to (A).



44) Install the front hood striker to the front hood by aligning the alignment marks (A), and close the front hood.

Tightening torque:
33 N·m (3.4 kgf-m, 24.3 ft-lb)



C: INSPECTION

1) Check that pipes, hoses, connectors and clamps are installed firmly.
2) Check the engine coolant is at specified level.
3) Start the engine and check for exhaust gas, engine coolant, leaks of fuel, etc. Also check for noise and vibrations.

10.Engine Mounting

A: REMOVAL

1) Remove the front crossmember. <Ref. to FS-18, REMOVAL, Front Crossmember.>
2) Remove the engine mounting from the engine.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
35 N·m (3.6 kgf-m, 25.8 ft-lb)

C: INSPECTION

Make sure that there are no cracks or other damages.

11.Preparation for Overhaul

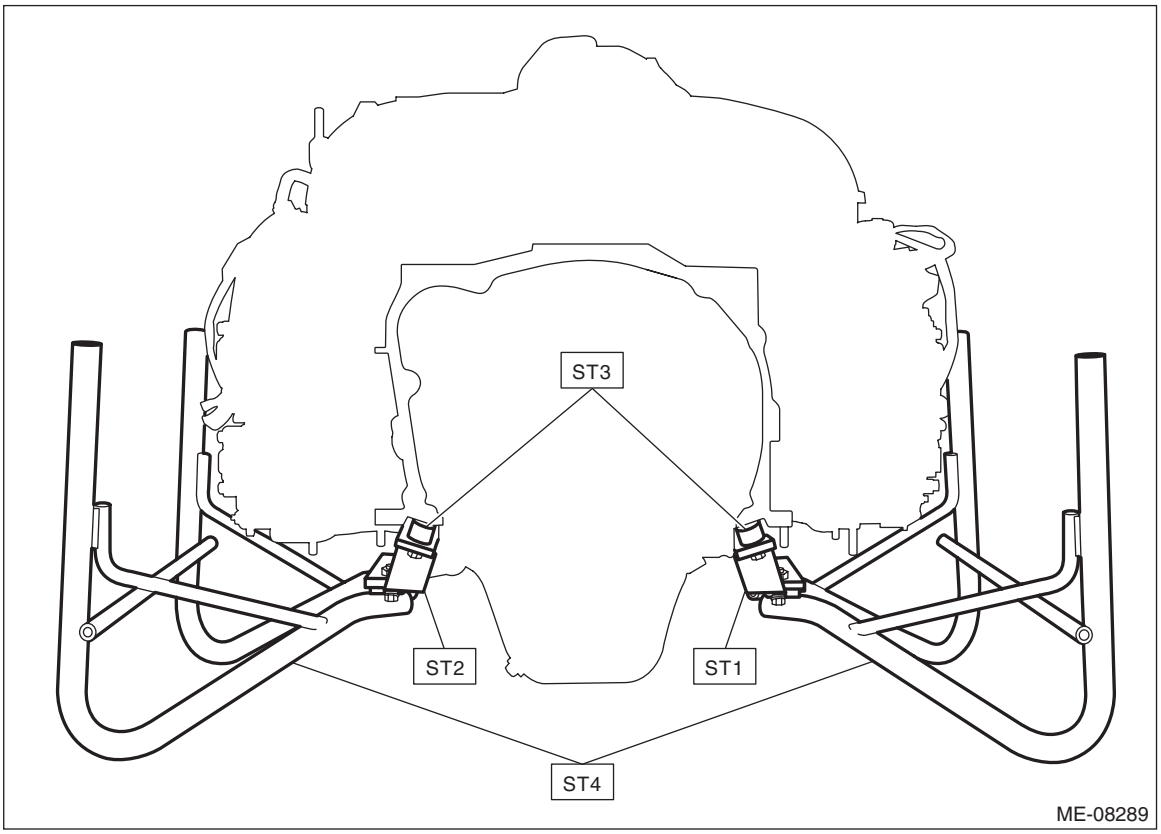
A: PROCEDURE

1) After removing the engine from the vehicle body, attach the ST to the engine as shown in the figure.

NOTE:
When using a commercially sold engine stand, follow the instructions of engine stand used.

Tightening torque:
35 N·m (3.6 kgf-m, 25.8 ft-lb)

ST1	498457000	ENGINE STAND ADAPTER RH
ST2	498457100	ENGINE STAND ADAPTER LH
ST3	18362AA020	ADAPTER
ST4	499817100	ENGINE STAND



2) In this section the procedures described under each index are all connected and stated in order. The procedure for overhauling of the engine will be completed when you go through all steps in the process. Therefore, in this section, to conduct the particular procedure within the flow of a section, you need to go back and conduct the procedure described previously in order to do that particular procedure.

12.V-belt

A: REMOVAL

NOTE:
When replacing a single part, perform the work with the engine assembly installed to body.

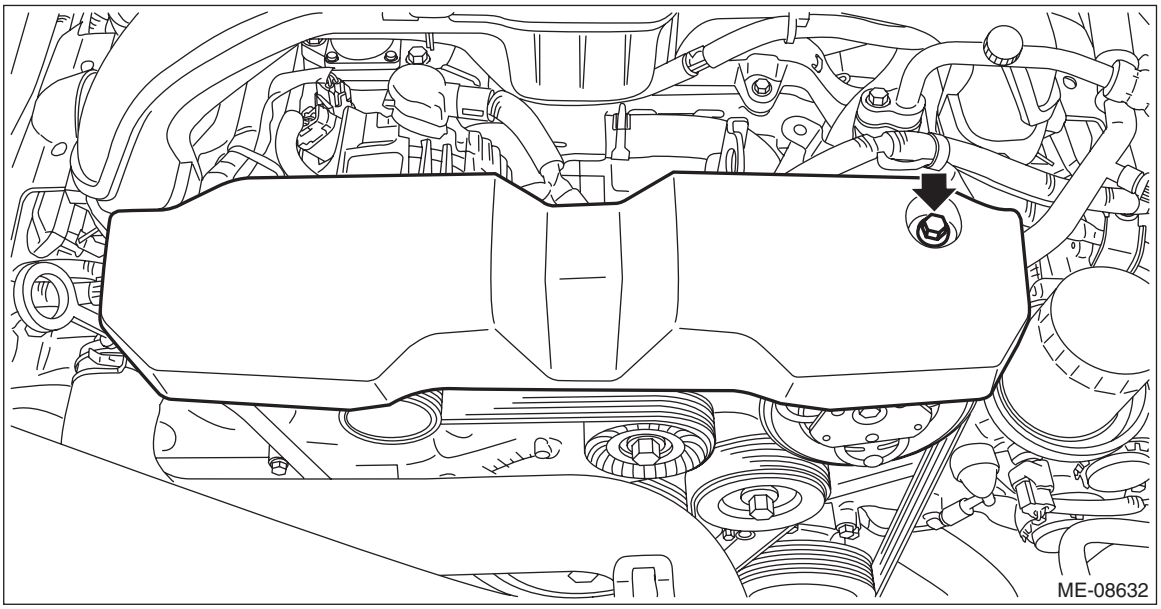
1. GASOLINE ENGINE MODEL

- **V-belt**

1) When working on the vehicle

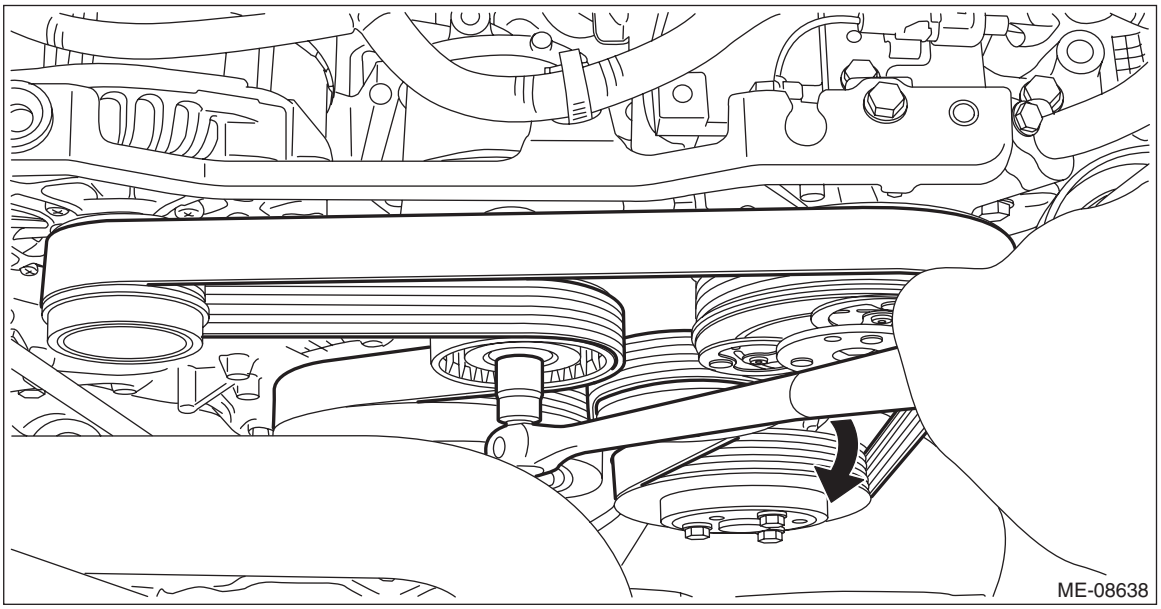
NOTE:
When working on the vehicle, perform the following steps also.

(1) Remove the V-belt covers.



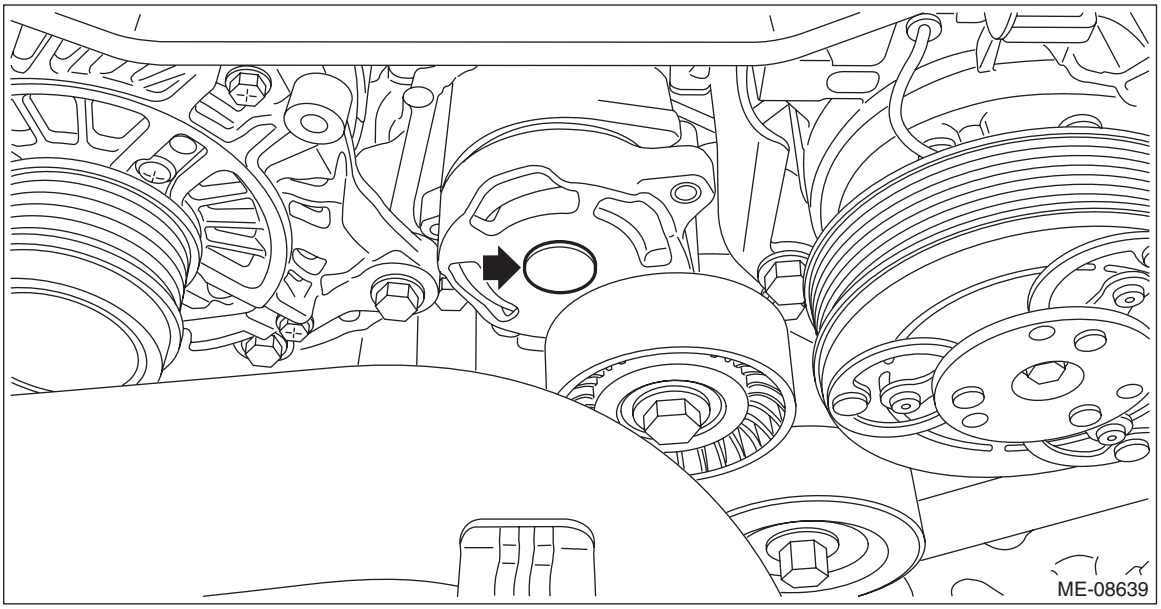
(2) Remove the air intake duct. <Ref. to IN(H4DO(w/o HEV))-13, REMOVAL, Air Intake Duct.>

2) Attach the tool to the V-belt tensioner assembly, and rotate the tool clockwise to loosen and remove the V-belt.

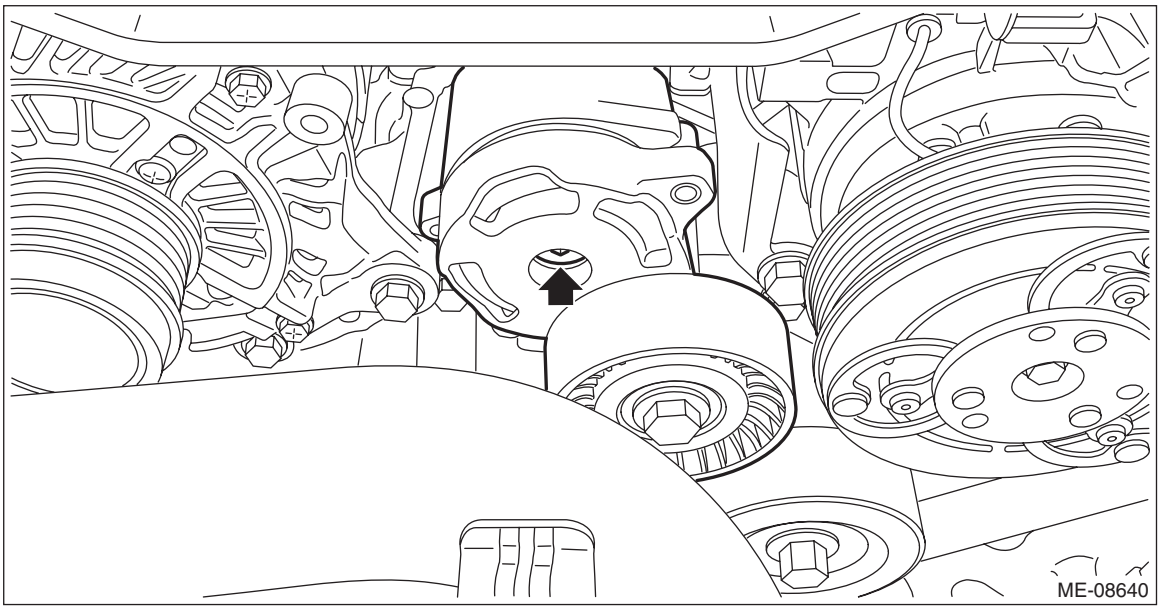


- **V-belt tensioner assembly and idler pulley**

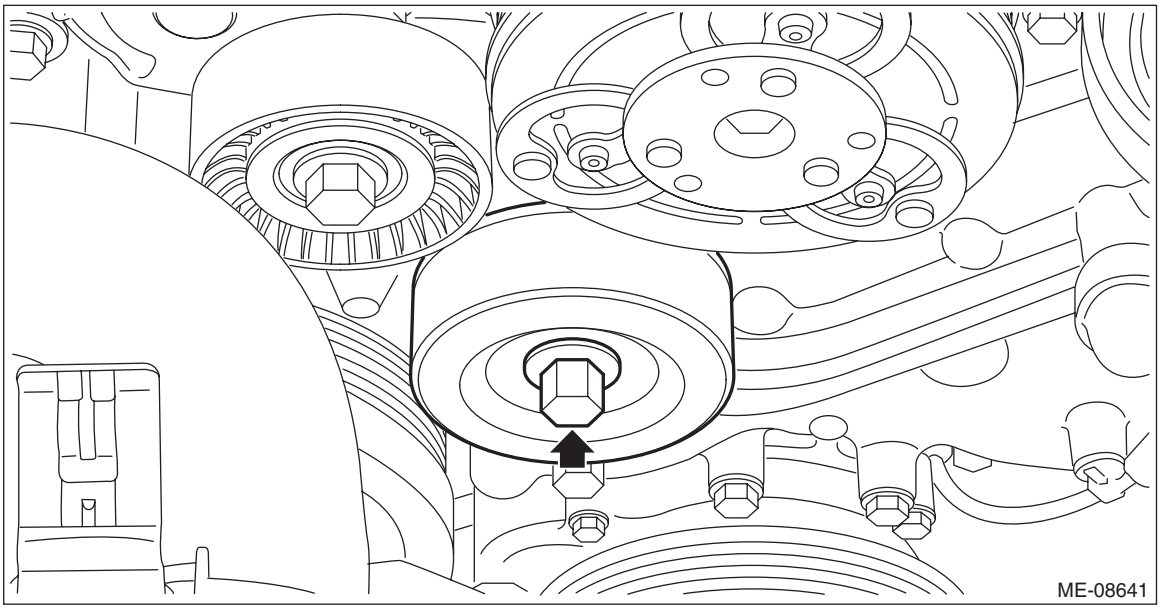
1) Remove the V-belts.
2) Remove the cap from V-belt tensioner assembly.



3) Remove the bolt securing the V-belt tensioner assembly to the generator bracket, and remove the V-belt tensioner assembly.



4) Remove the bolts which secure the idler pulley to the chain cover, and remove the idler pulley.



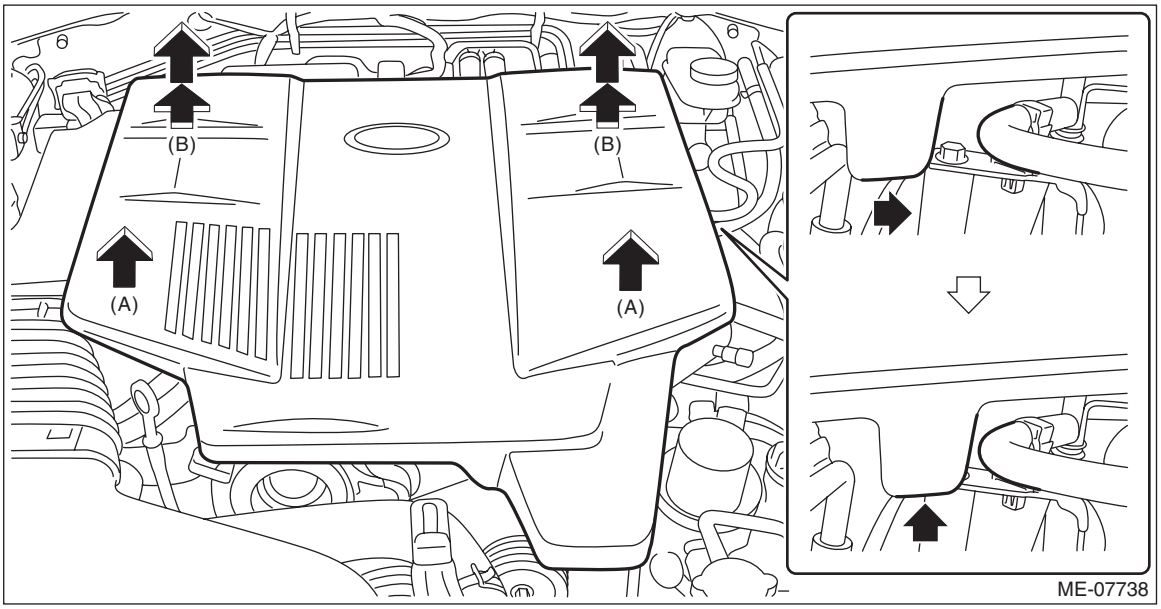
2. HEV MODEL

• V-belt tensioner assembly and V-belt

1) When working on the vehicle

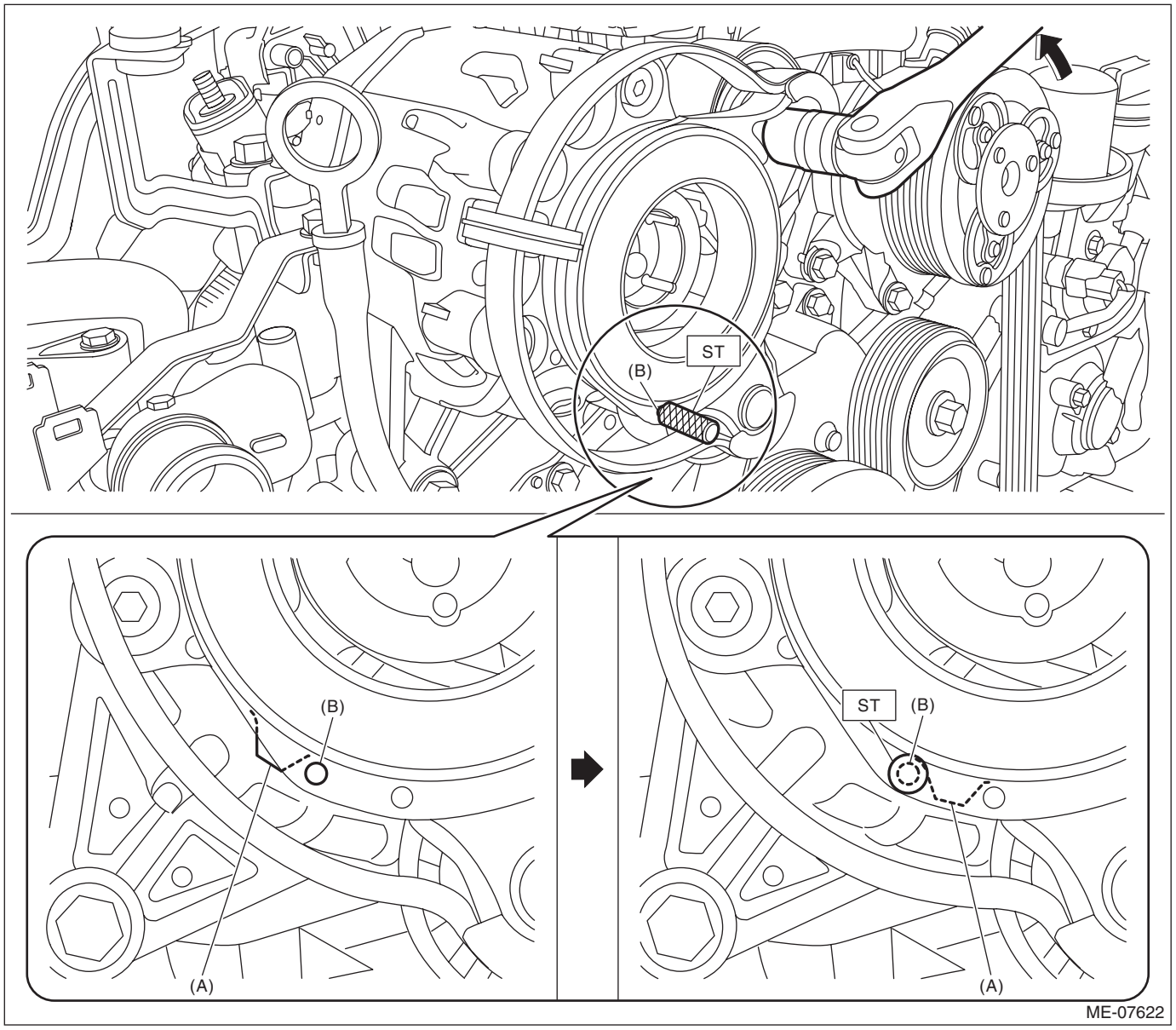
NOTE:
When working on the vehicle, perform the following steps also.
(1) Turn the ignition switch to OFF.
(2) Remove the collector cover.
1. Carefully pull up the front of collector cover at two positions (A).
2. Carefully pull up the rear of collector cover at two positions (B) while moving it backward.

NOTE:
Be careful not to contact the fuel delivery tube when moving the collector cover rearward.



2) Prepare for removing the V-belt tensioner assembly. (The V-belt is not damaged.)
(1) Set the tool on the arm lever No. 1, turn the tool counterclockwise until the protrusion (A) of the arm lever No. 1 moves to the position shown in the figure, and insert the ST into the stopper pin hole (B) on the arm lever No. 2.

ST 499267300 STOPPER PIN

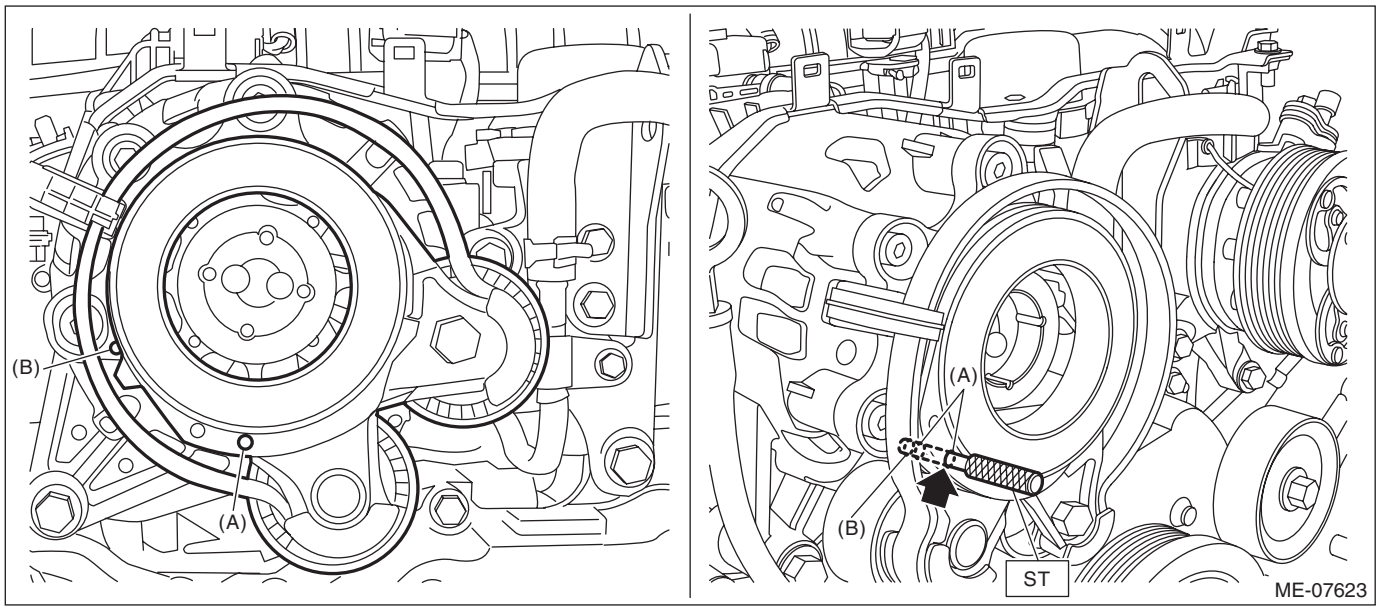


3) Prepare for removing the V-belt tensioner assembly. (The V-belt is damaged.)

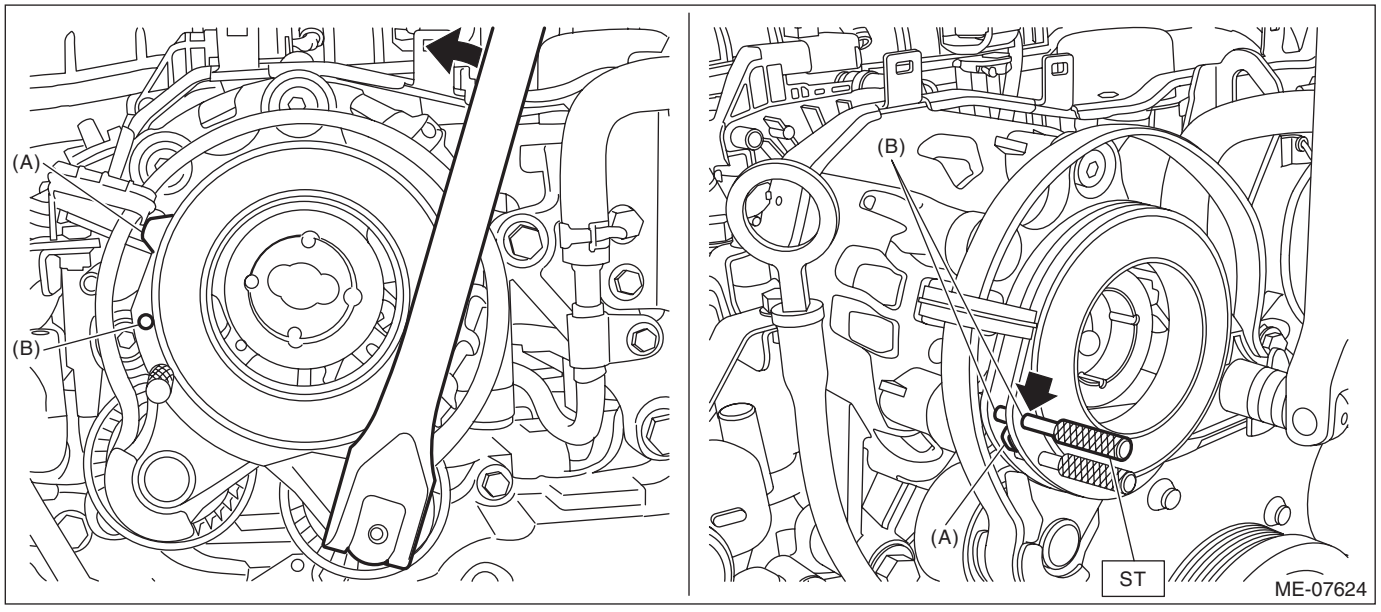
NOTE:
This operation requires 2 pieces of ST: STOPPER PIN (499267300).

(1) Turn the arm lever until the stopper pin hole (A) of the arm lever No. 2 is aligned with the stopper pin hole (B) of the housing, and insert the ST through the stopper pin hole (A) of the arm lever No. 2 into the end of the stopper pin hole (B) of the housing.

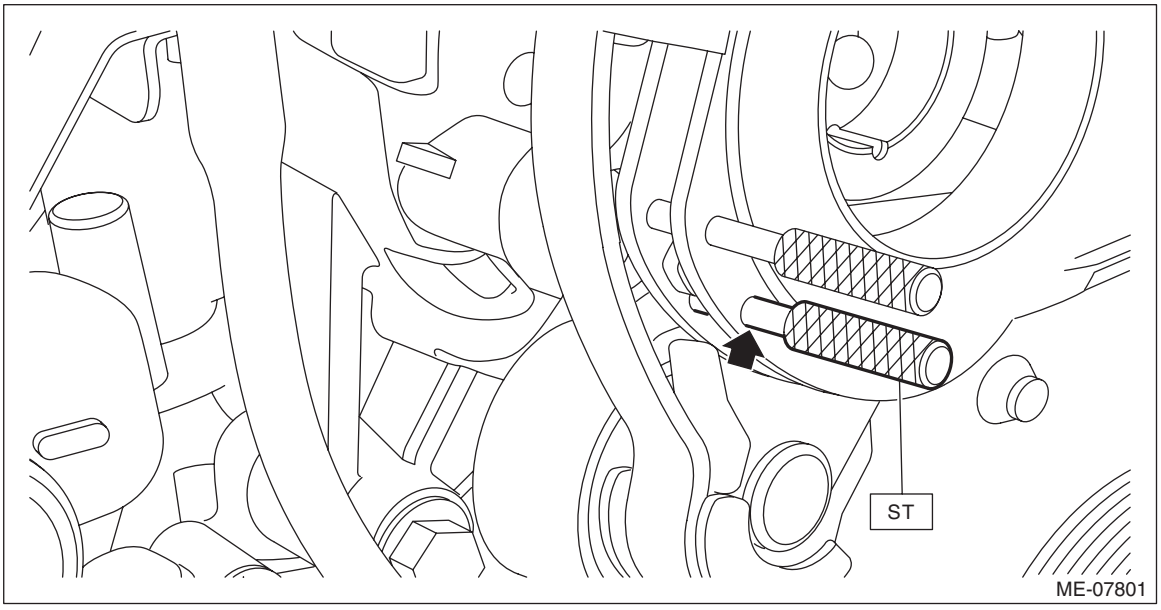
CAUTION:
Be sure to insert the ST into the end of the stopper pin hole (B) of the housing. If the ST is not inserted to the end, the ST may accidentally come off in the next procedure, resulting in an injury.
ST 499267300 STOPPER PIN



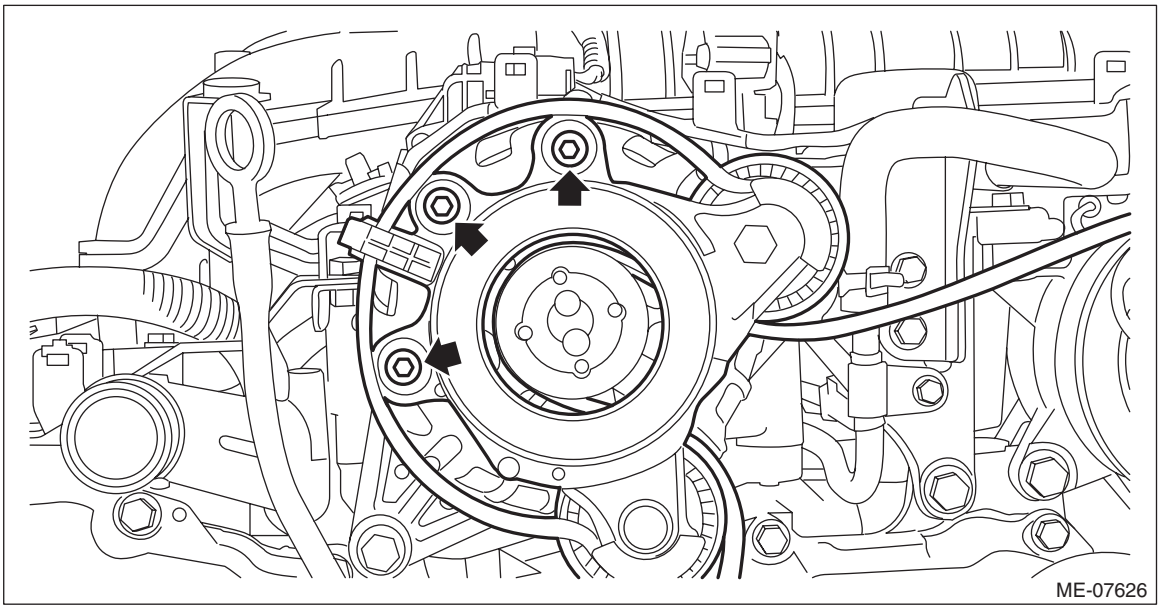
(2) Set the tool on the arm lever No. 1, turn the tool counterclockwise until the protrusion (A) of the arm lever No. 1 moves to the position shown in the figure, and insert the ST into the stopper pin hole (B) on the arm lever No. 2.
ST 499267300 STOPPER PIN



(3) Remove the ST inserted in procedure (1).
ST 499267300 STOPPER PIN



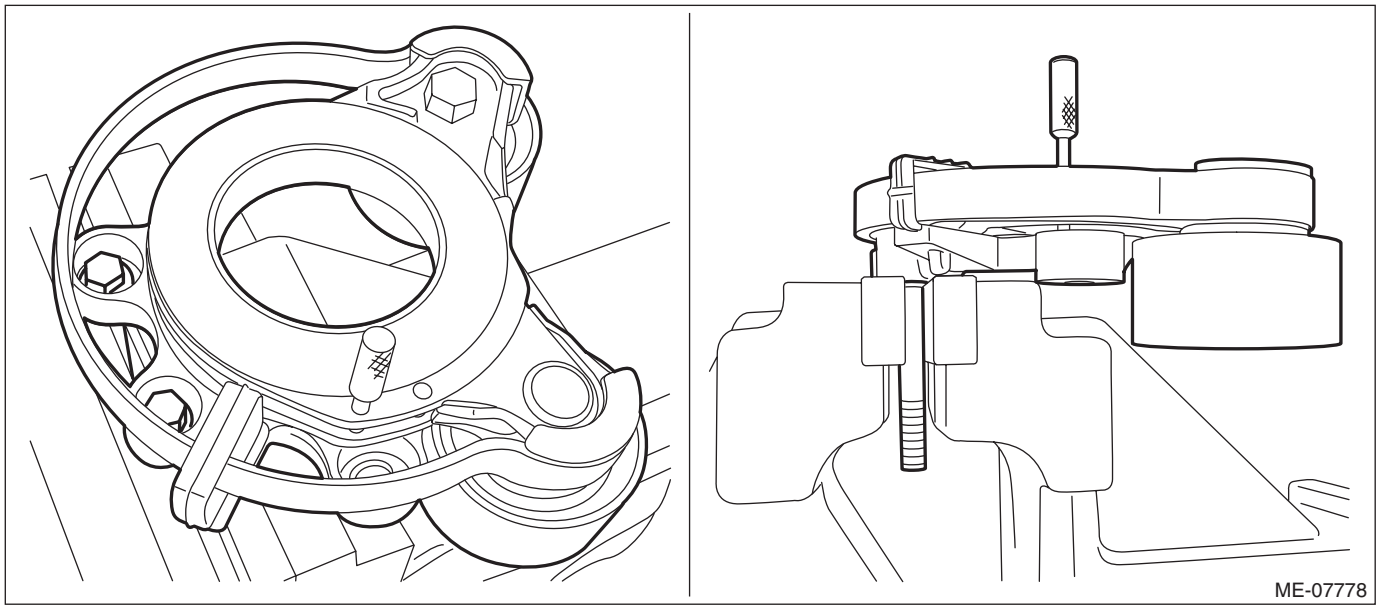
4) Remove the V-belt tensioner assembly and remove the V-belt.



5) The V-belt tensioner assembly is replaced.

NOTE:
- When replacing the V-belt tensioner assembly, also perform the following steps.
- This procedure is required to prepare 1 more piece of ST: STOPPER PIN (499267300).

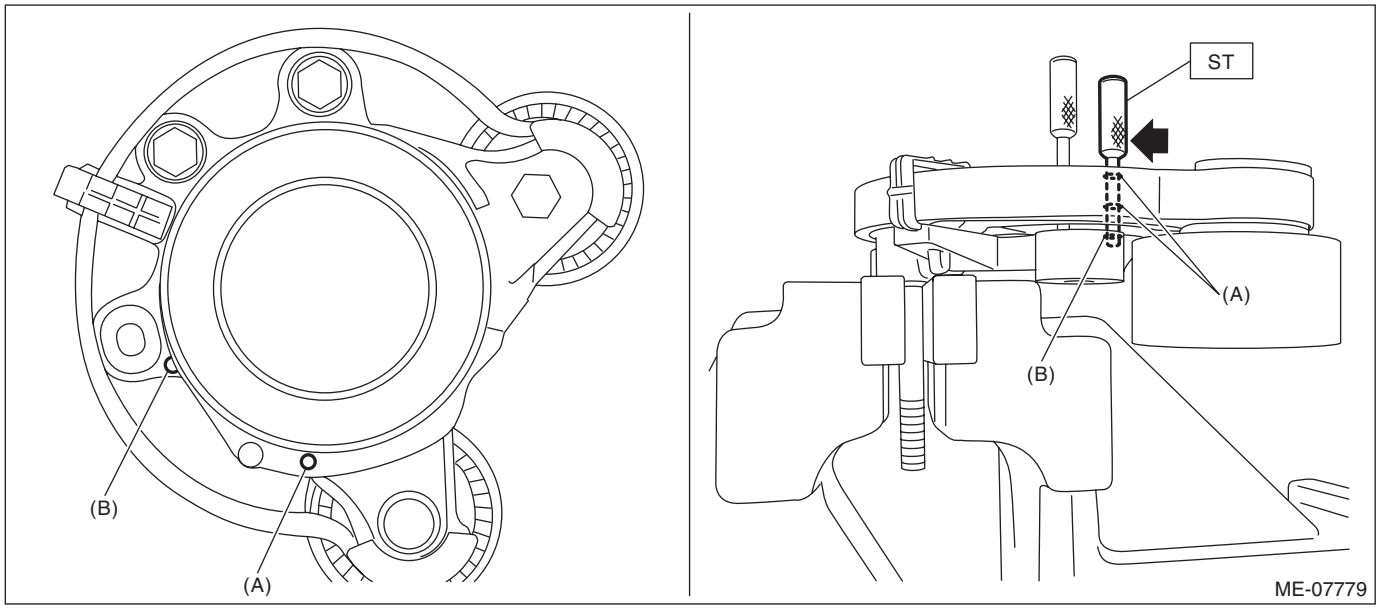
(1) Using a bolt (M8) of suitable length, secure the V-belt tensioner assembly on a vise.



(2) Turn the arm lever until the stopper pin hole (A) of the arm lever No. 2 is aligned with the stopper pin hole (B) of the housing, and insert the ST through the stopper pin hole (A) of the arm lever No. 2 into the end of the stopper pin hole (B) of the housing.

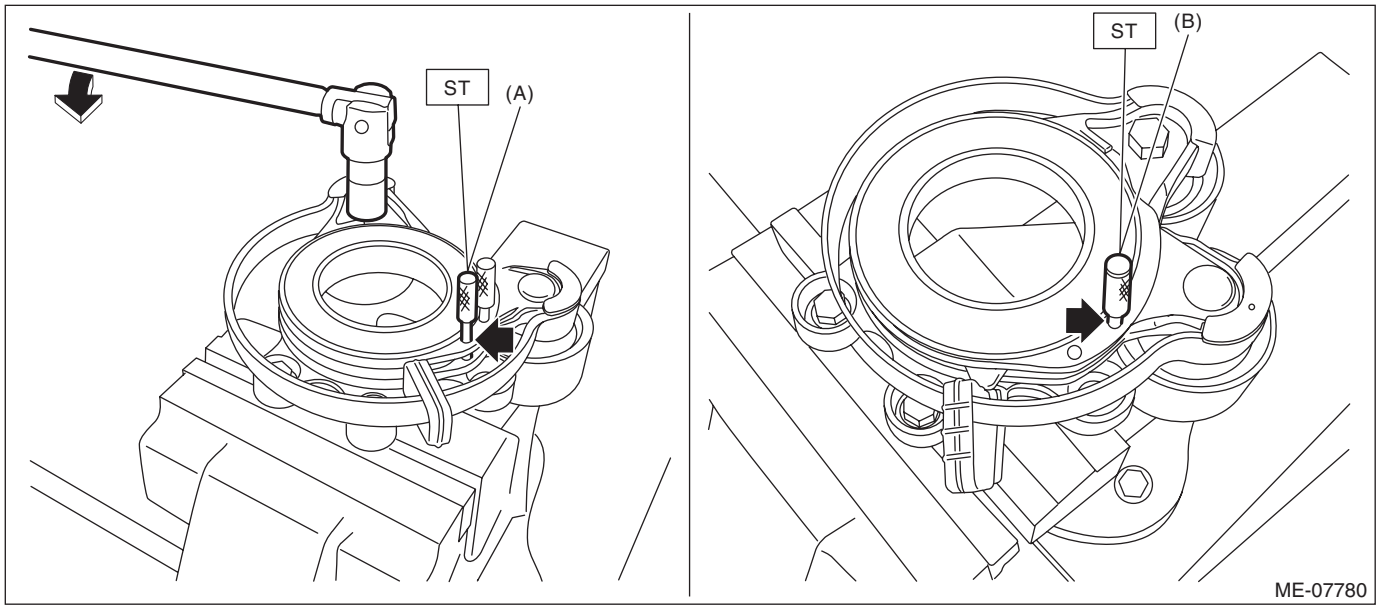
CAUTION:
Be sure to insert the ST into the end of the stopper pin hole (B) of the housing. If the ST is not inserted to the end, the ST may accidentally come off in the next procedure, resulting in an injury.

ST 499267300 STOPPER PIN



(3) Set the tool on the arm lever No. 1, turn the tool counterclockwise a little, remove the ST (A) from the arm lever No. 2, and remove the ST (B) inserted in step (2).

ST 499267300 STOPPER PIN

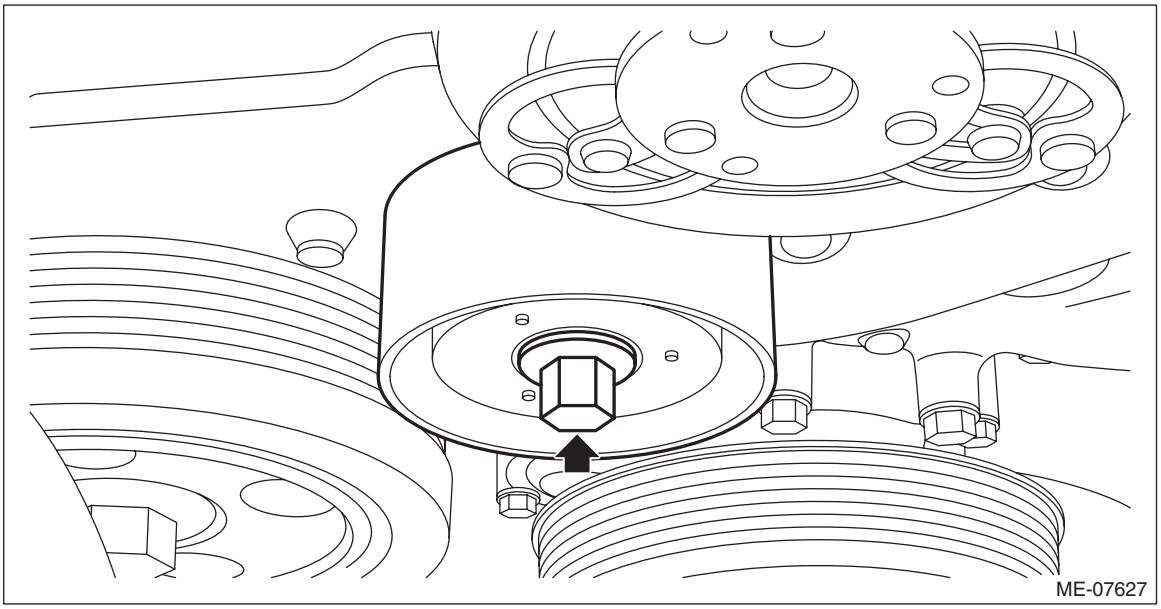


- **Idler pulley**

1) Loosen the V-belt, and remove the V-belt from the idler pulley.

NOTE:
- Refer to “V-belt tensioner assembly and V-belt” for the loosening procedure of V-belt.
- It is not necessary to remove the V-belt tensioner assembly and the V-belt from ISG.

2) Remove the bolts which secure the idler pulley to the chain cover, and remove the idler pulley.



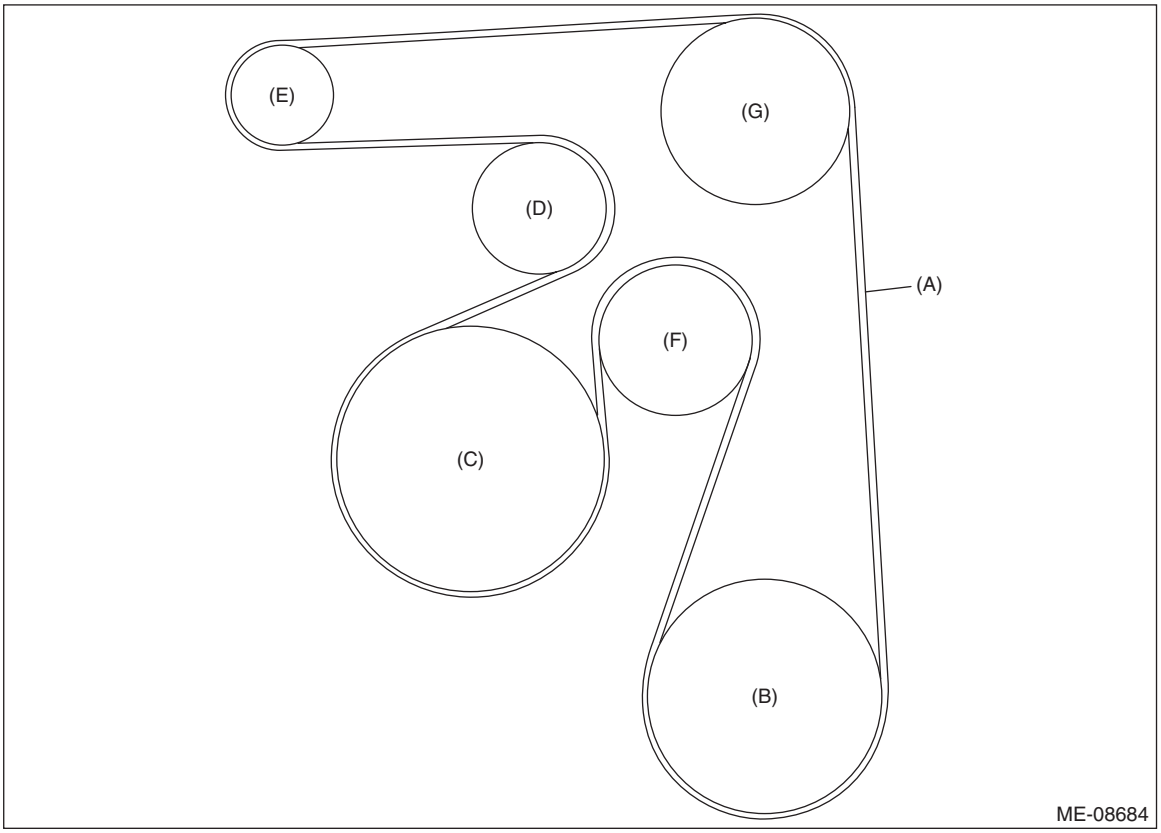
B: INSTALLATION

1. GASOLINE ENGINE MODEL

- **V-belt**

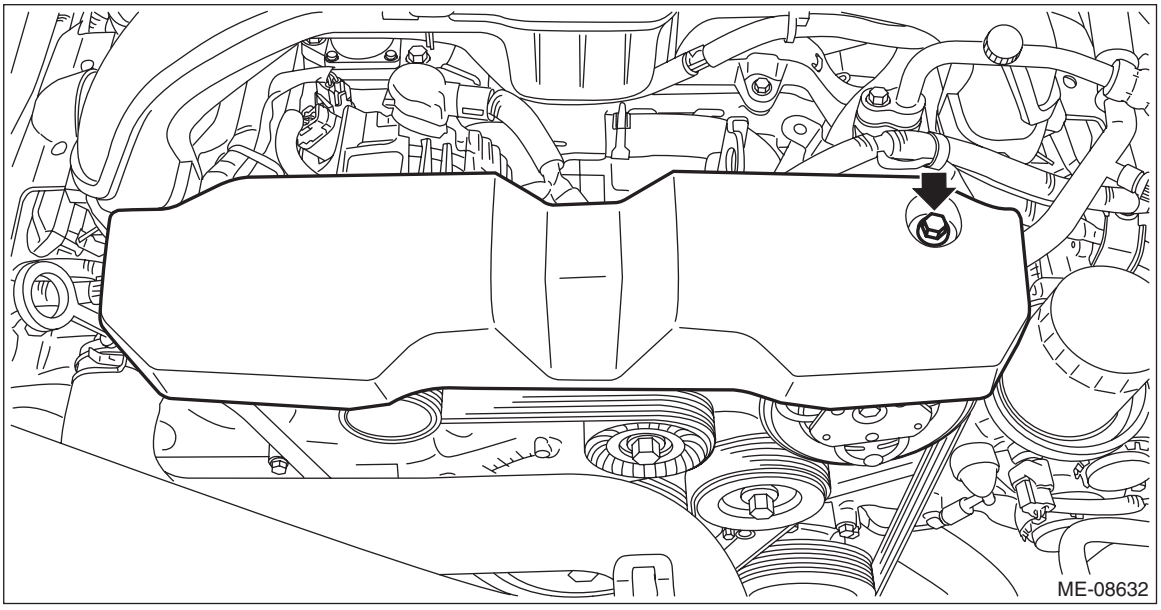
Install in the reverse order of removal.

CAUTION:
- **When reusing the V-belt, wipe off dust and water with cloth.**
- **Do not use the V-belt if there is any oil, grease or coolant on the belt.**
- **Be careful not to rub the V-belt end surface with bare hands; exposed core may cause injury.**
- **Wipe off any dust, oil and water on the groove of each pulley with cloth.**



(A) V-belt
(B) Water pump pulley
(C) Crank pulley
(D) V-belt tensioner ASSY
(E) Generator pulley
(F) Idler pulley
(G) A/C compressor pulley

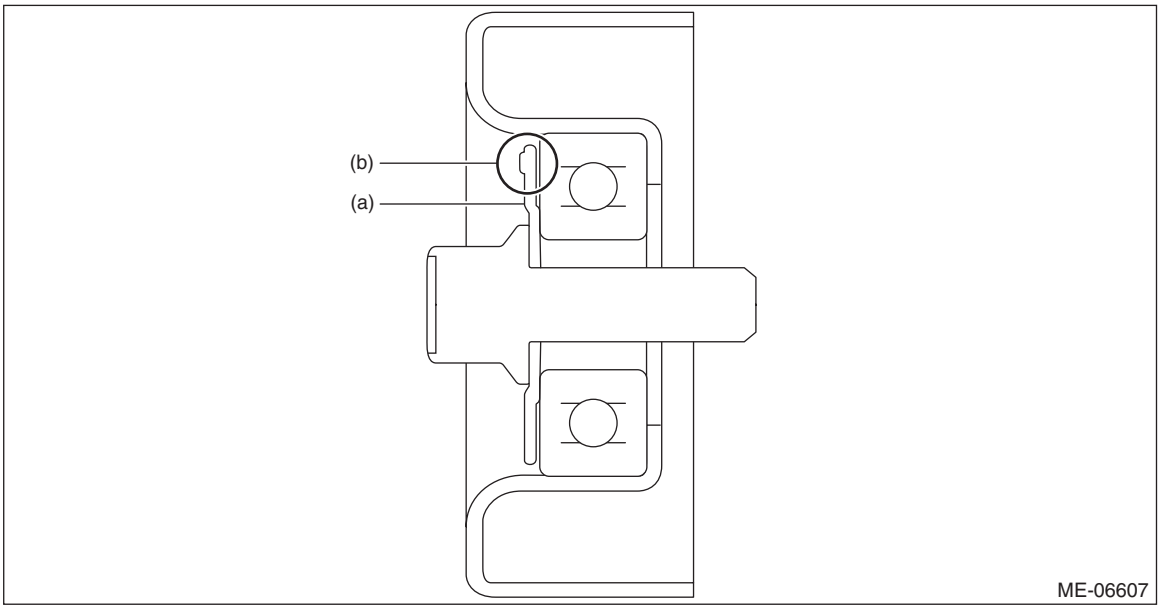
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



- **V-belt tensioner assembly and idler pulley**

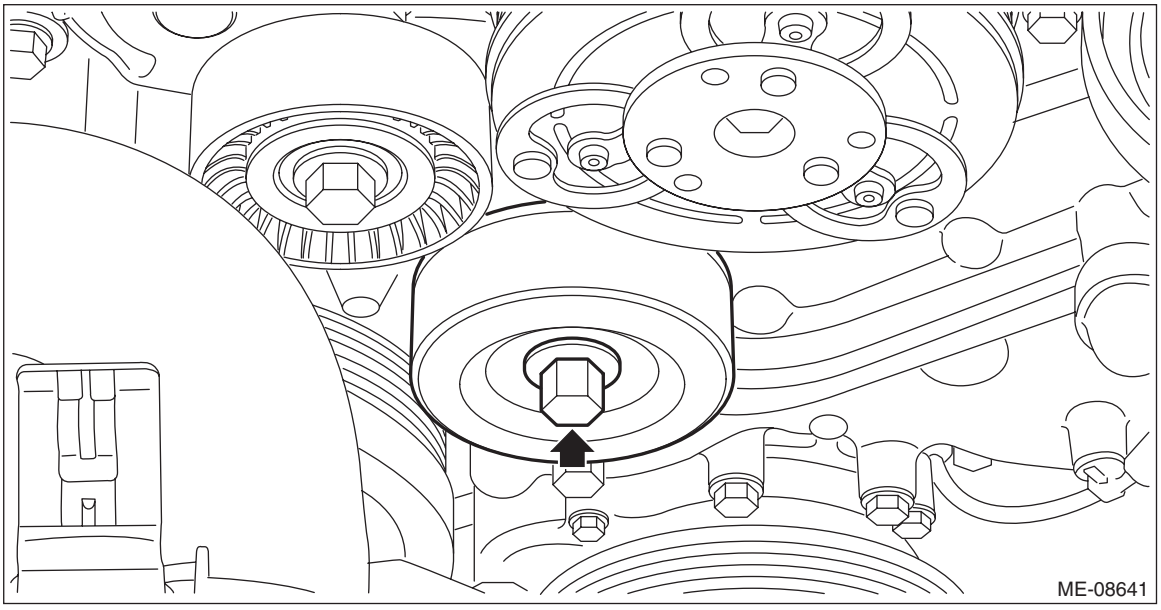
1) Install the idler pulley to the chain cover.

NOTE:
When installing the idler pulley, be careful of the idler pulley cover direction.



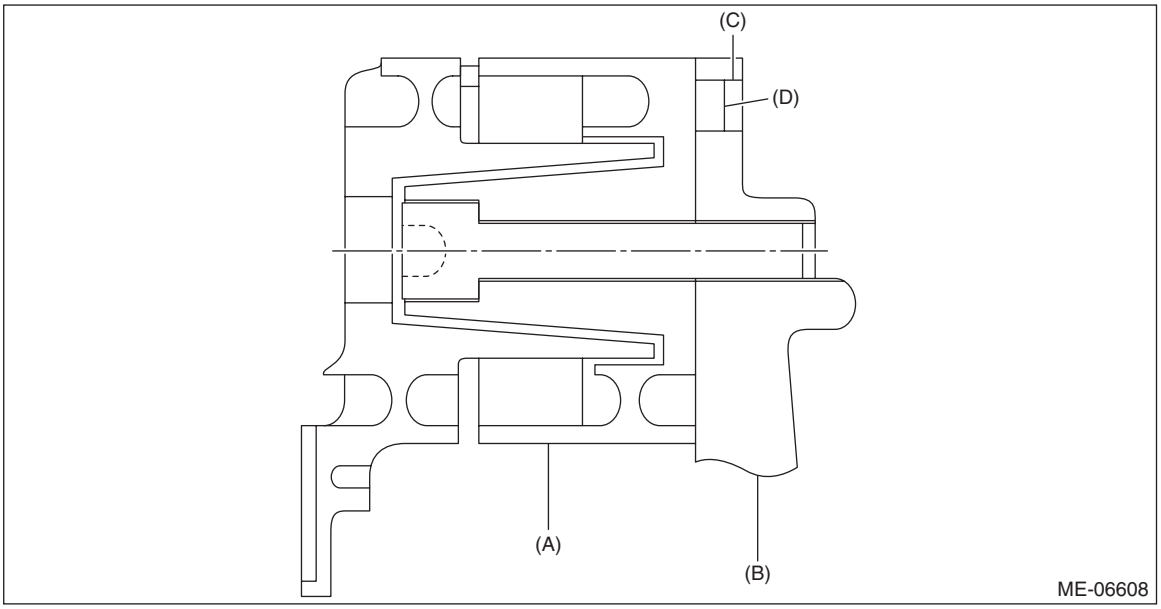
(a) Idler pulley cover (b) Protrusion (3 places)

Tightening torque:
36 N·m (3.7 kgf-m, 26.6 ft-lb)



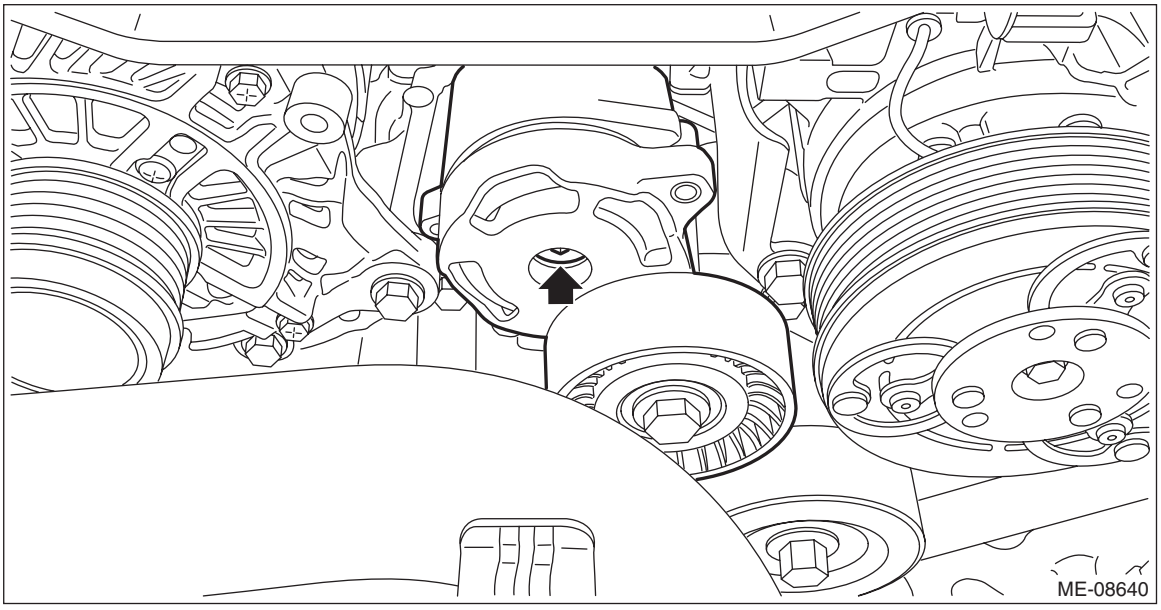
2) Install the V-belt tensioner assembly onto the generator bracket.

NOTE:
When installing the V-belt tensioner assembly, insert the protrusion of V-belt tensioner assembly into the hole for preventing rotation at the generator bracket.

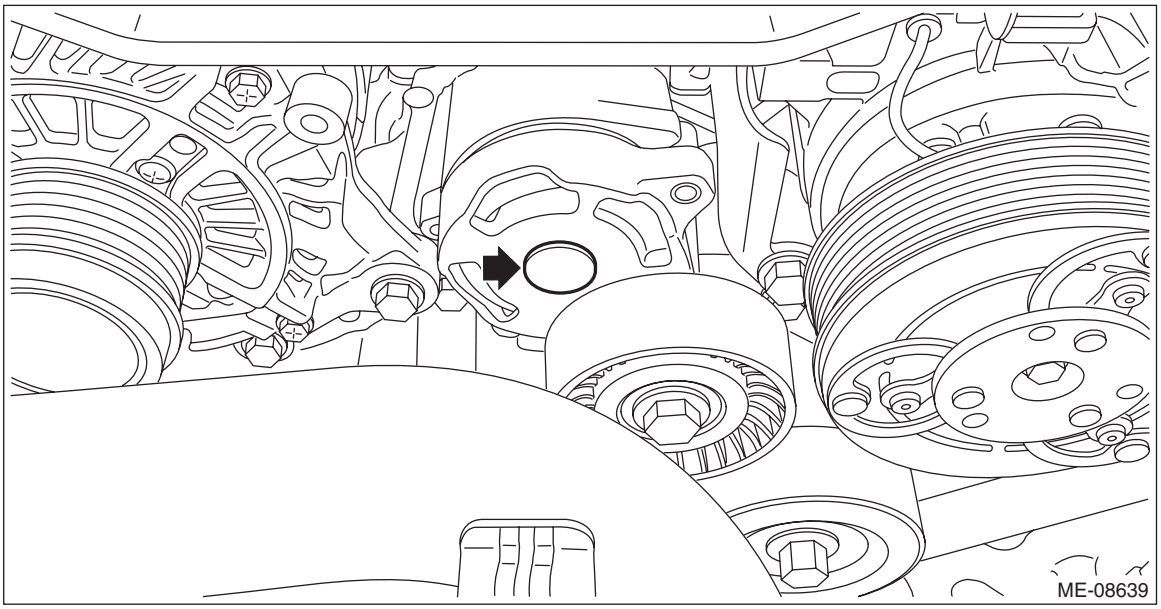


(A) V-belt tensioner ASSY
(B) Generator bracket
(C) Hole to prevent rotation
(D) Protrusion portion

Tightening torque:
25 N·m (2.5 kgf-m, 18.4 ft-lb)



3) Install the cap to the V-belt tensioner assembly.



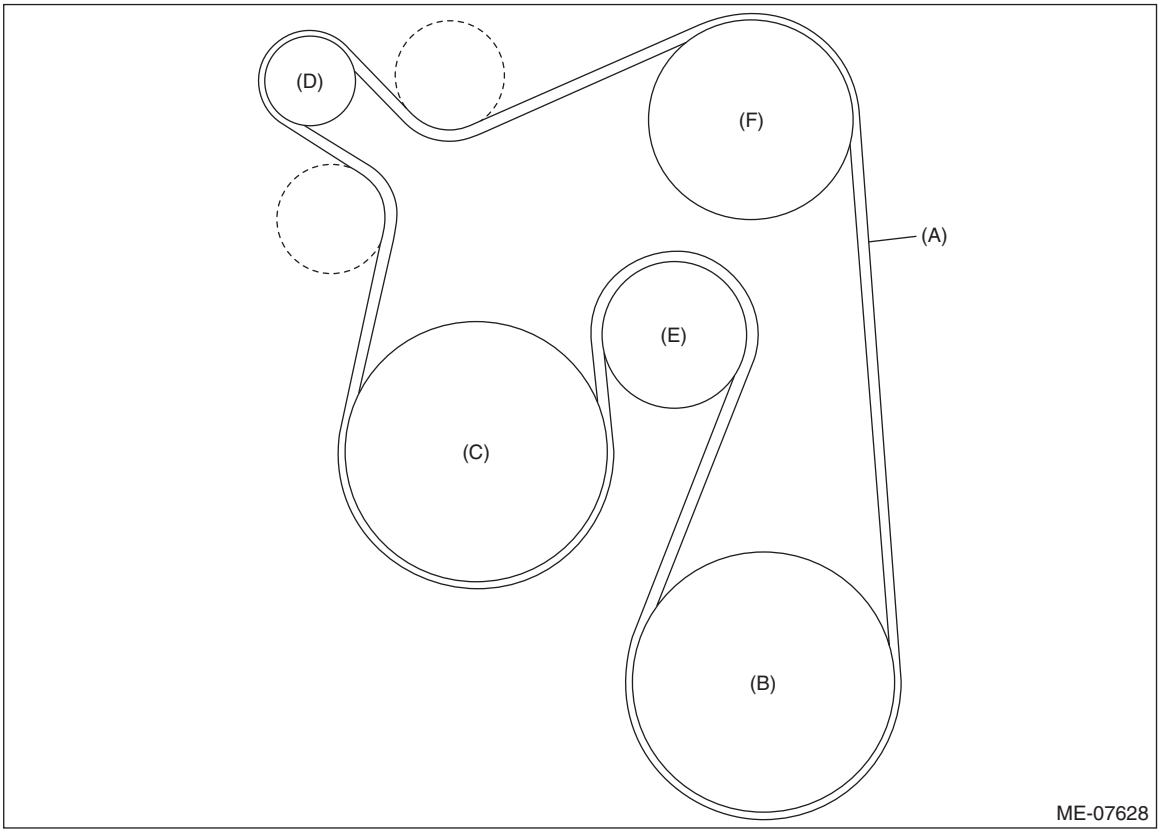
4) Install the V-belts.

2. HEV MODEL

• V-belt tensioner assembly and V-belt

1) Set the V-belt as shown in the figure.

CAUTION:
- **When reusing the V-belt, wipe off dust and water with cloth.**
- **Do not use the V-belt if there is any oil, grease or coolant on the belt.**
- **Be careful not to rub the V-belt end surface with bare hands; exposed core may cause injury.**
- **Wipe off any dust, oil and water on the groove of each pulley with cloth.**

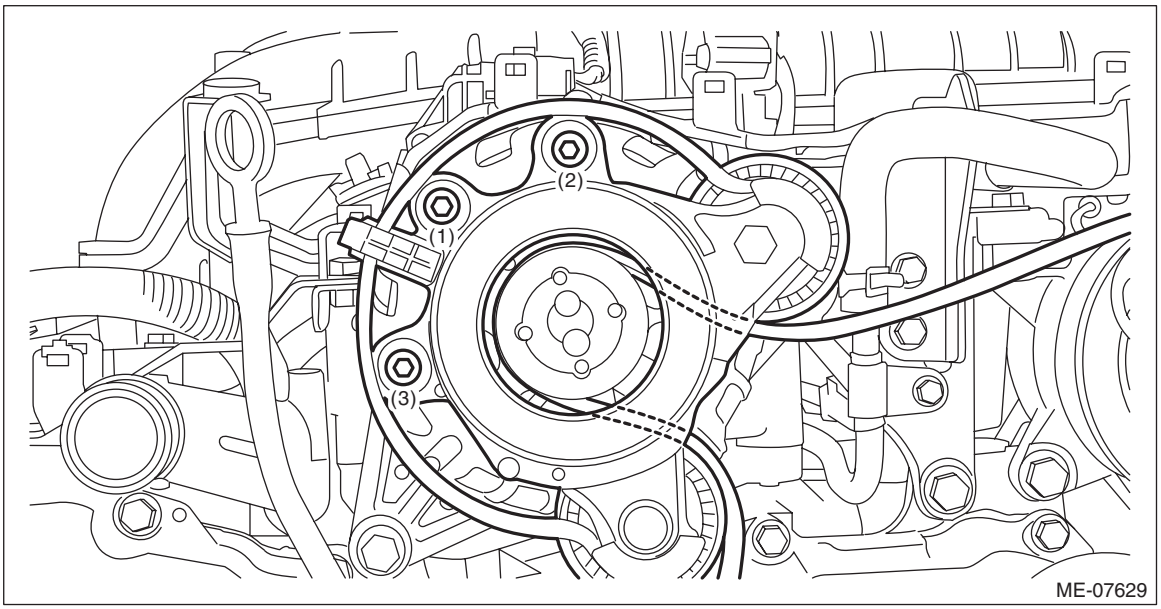


(A)	V-belt	(C)	Crank pulley	(E)	Idler pulley
(B)	Water pump pulley	(D)	ISG pulley	(F)	A/C compressor pulley

2) Set the V-belt tensioner assembly in the position shown in the figure, and temporarily tighten the bolts that hold the V-belt tensioner assembly.

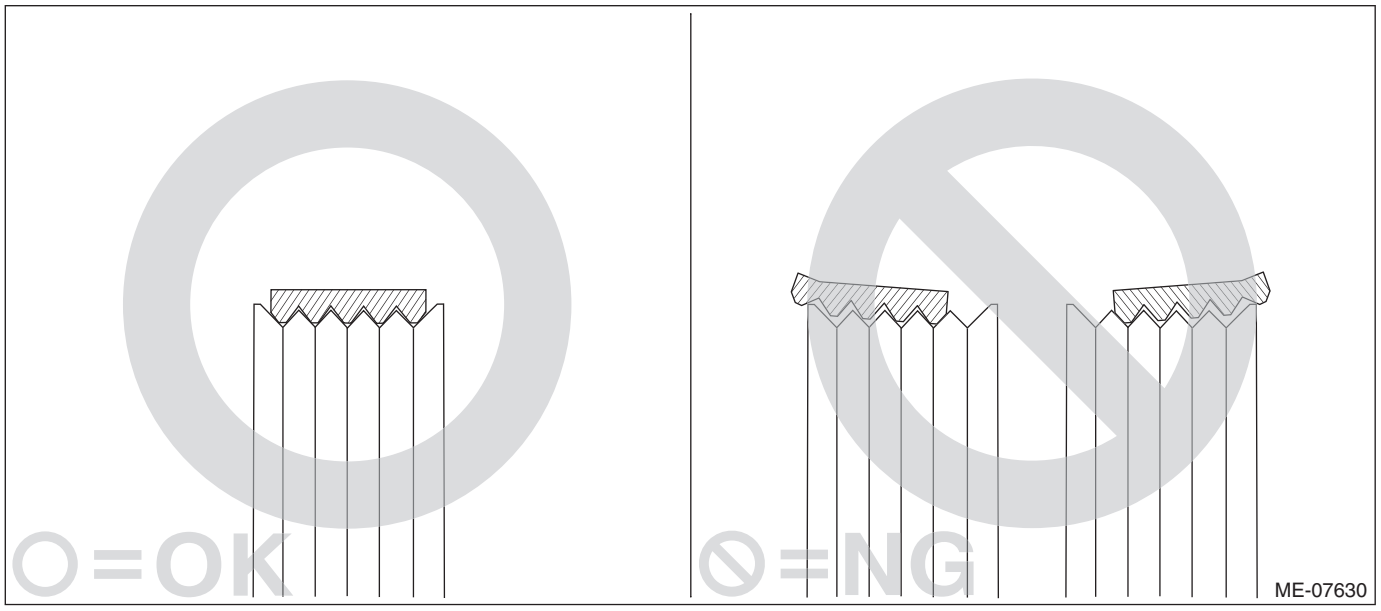
3) Tighten the bolts which hold the V-belt tensioner assembly in the numerical order shown in the figure.

Tightening torque:
25 N·m (2.5 kgf-m, 18.4 ft-lb)

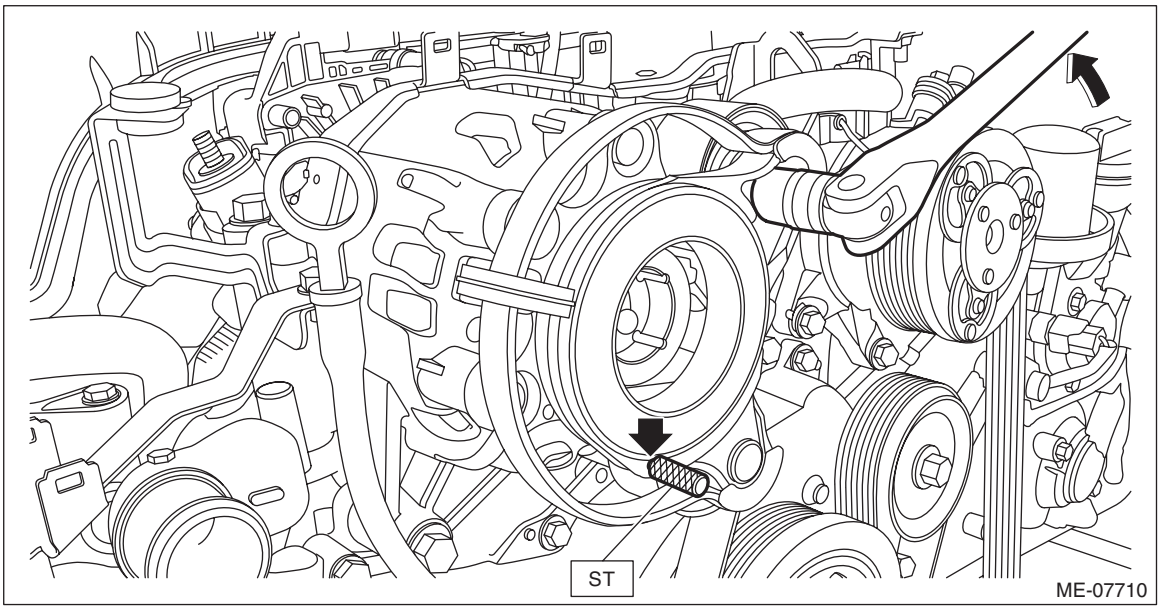


4) Set the tool on the arm lever No. 1, turn the tool counterclockwise a little, and remove the ST from the arm lever No. 2.

NOTE:
Before removing the ST, check that the V-belt ribs are securely placed on the rib grooves for each pulley.



ST 499267300 STOPPER PIN



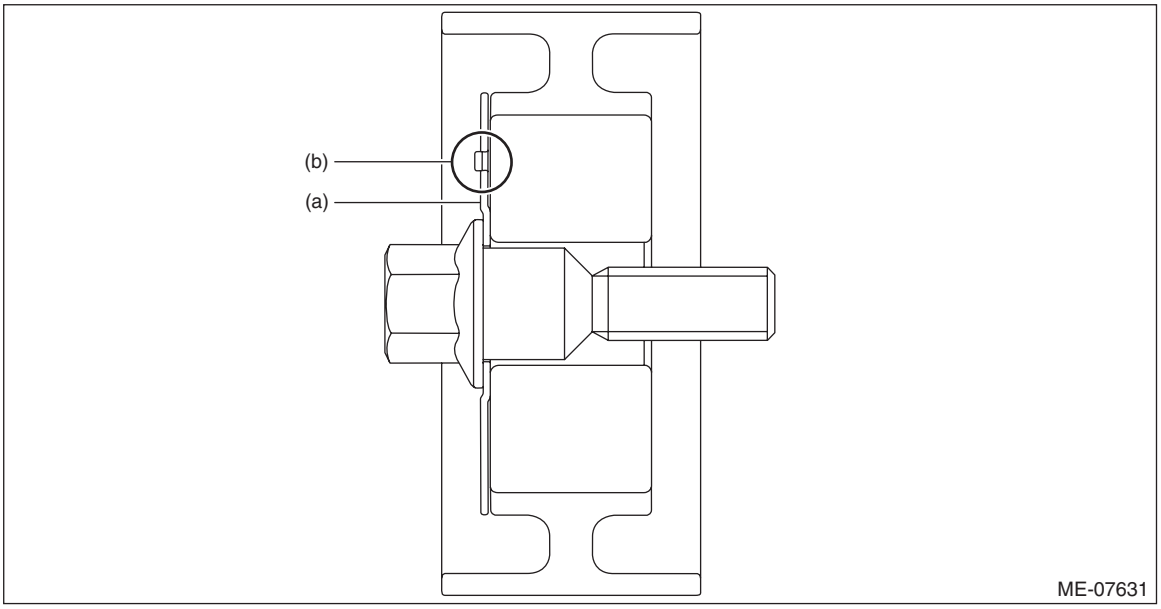
5) When working on the vehicle

NOTE:
When working on the vehicle, perform the following steps also.
(1) Install the collector cover.

- **Idler pulley**

Install in the reverse order of removal.

NOTE:
When installing the idler pulley, be careful of the idler pulley cover direction.



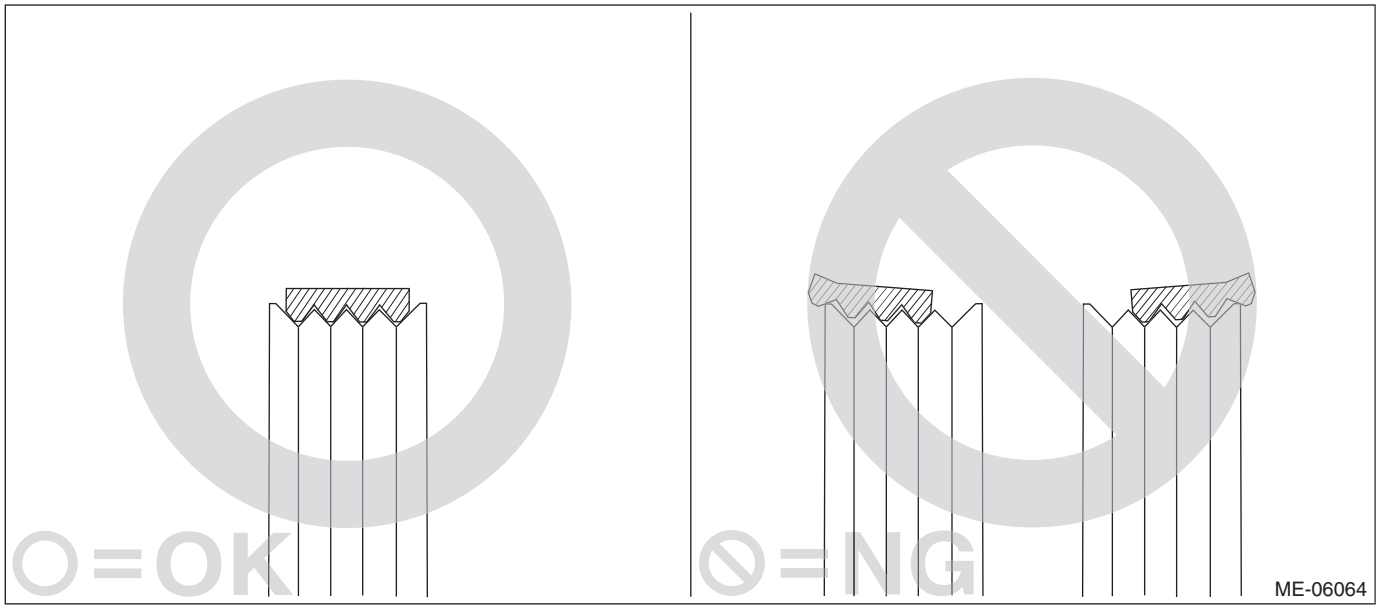
(a) Idler pulley cover (b) Protrusion (3 places)

Tightening torque:
36 N·m (3.7 kgf-m, 26.6 ft-lb)

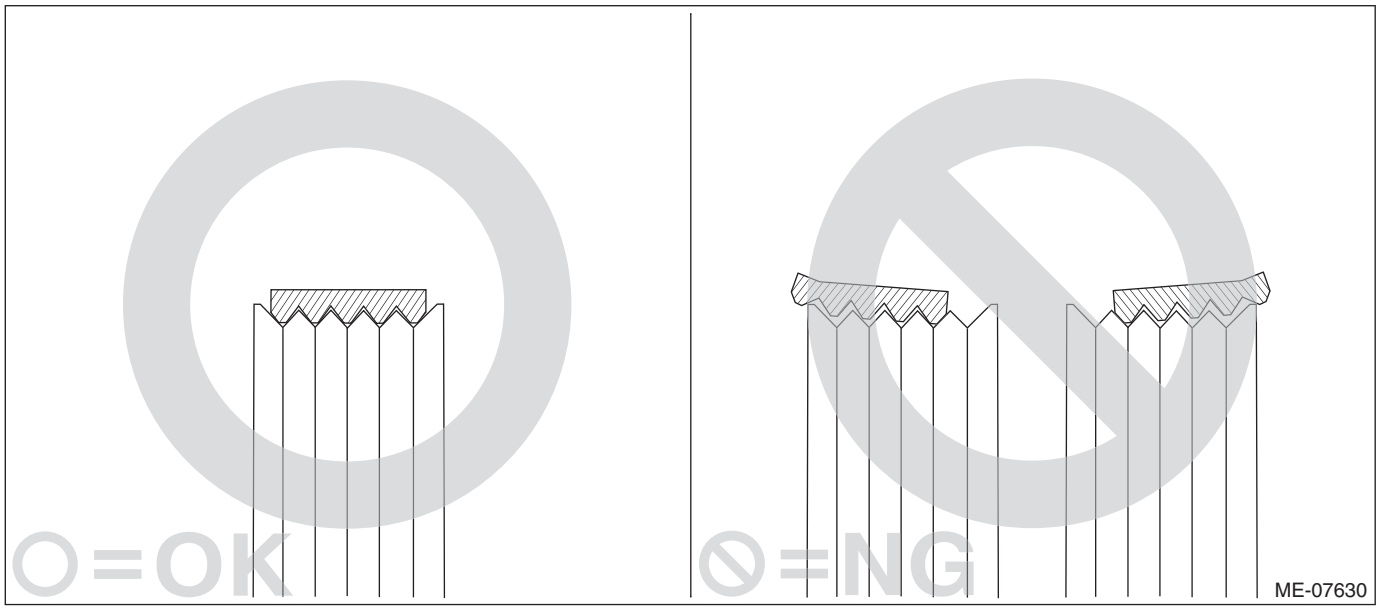
C: INSPECTION

1) Check the V-belt for cracks, tear or wear.
2) Check the V-belt tensioner assembly and idler pulley for deformation, cracks or other damages.
3) Check that the V-belt ribs are securely placed on the rib grooves for each pulley.

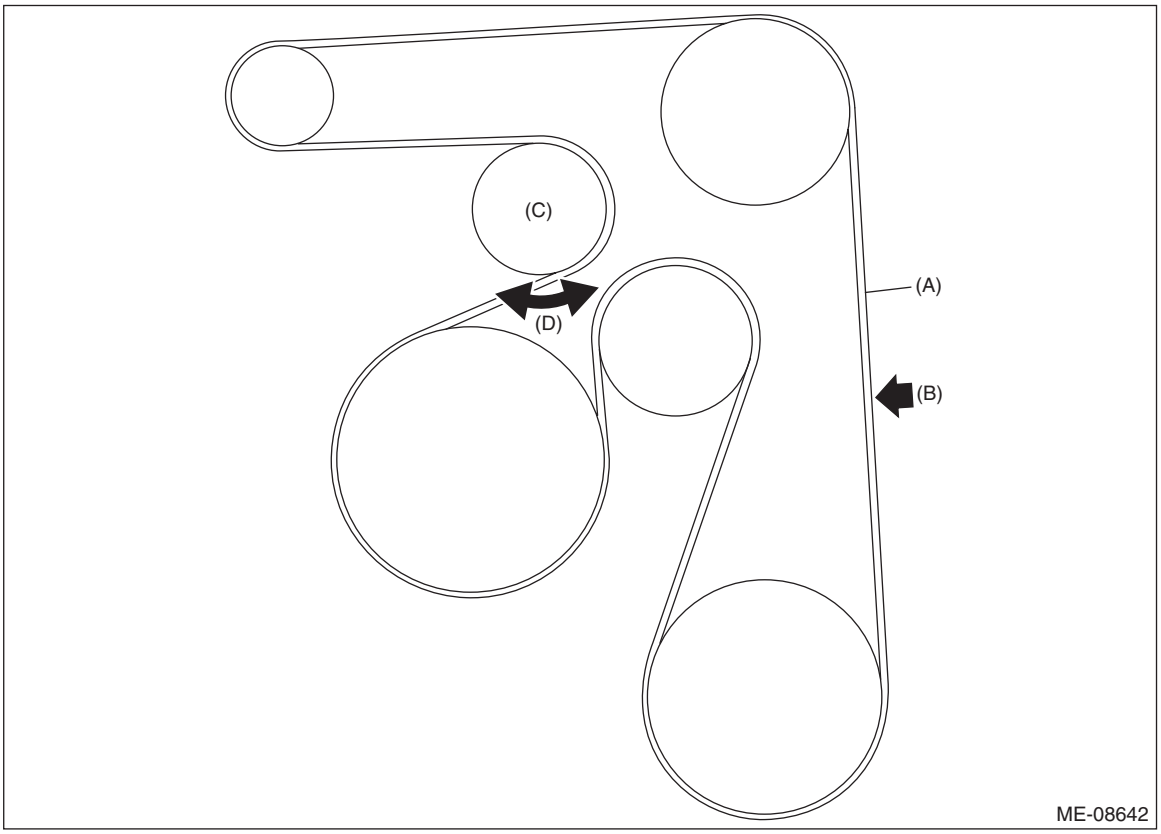
- Gasoline engine model



- HEV model



4) Check that the V-belt tensioner assembly (C) moves in the direction of arrow (D), when the V-belt (A) is pushed and released by the area indicated by the arrow (B). (Gasoline engine model)



5) Start the engine and confirm that the V-belt rotates smoothly and no abnormal noise is emitted.

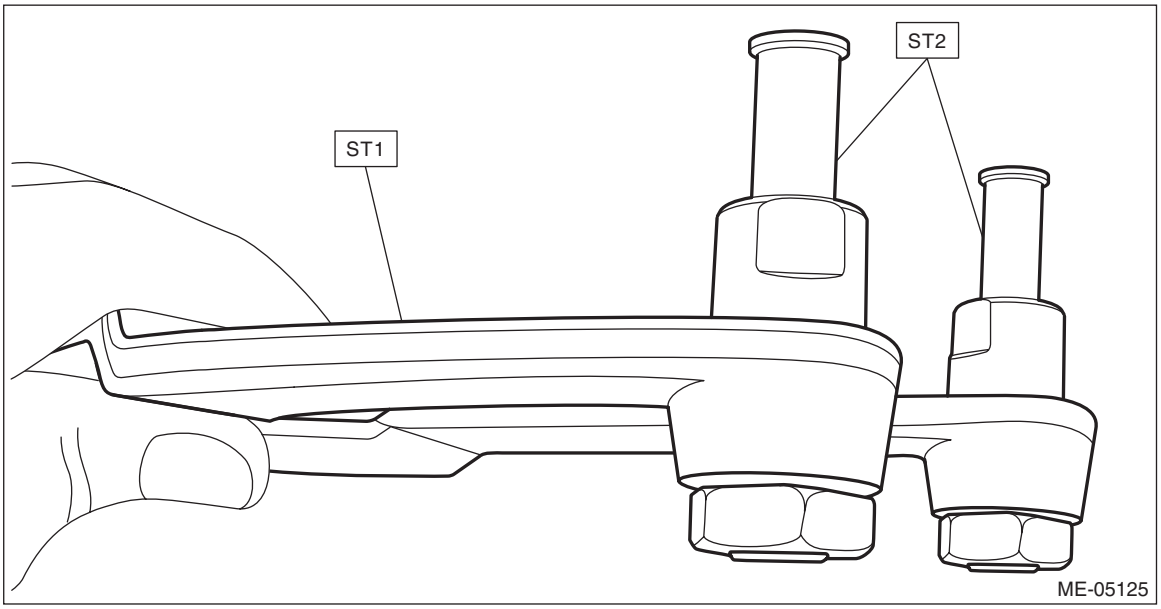
13.Crank Pulley

A: REMOVAL

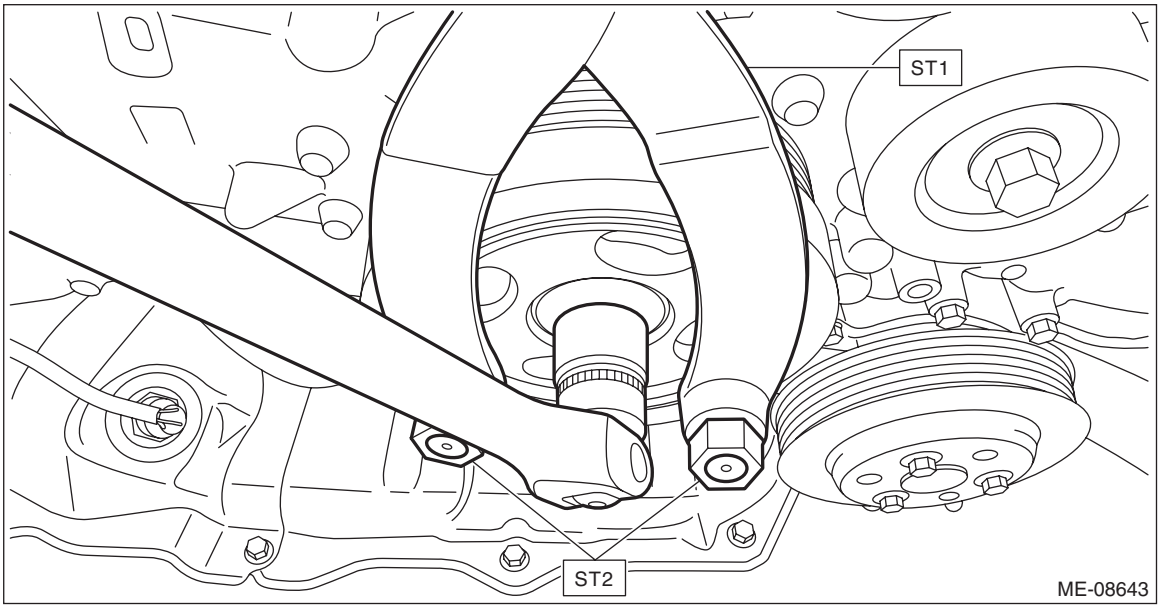
NOTE:
When replacing a single part, perform the work with the engine assembly installed to body.
1) When working on the vehicle

NOTE:
When working on the vehicle, perform the following steps also.
(1) Remove the radiator main fan & fan motor assembly and radiator sub fan & fan motor assembly. <Ref. to CO(H4DO(w/o HEV))-89, REMOVAL, Radiator Main Fan and Fan Motor.> <Ref. to CO(H4DO(w/o HEV))-93, REMOVAL, Radiator Sub Fan and Fan Motor.>
2) Remove the V-belts. <Ref. to ME(H4DO(w/o HEV))-122, REMOVAL, V-belt.>
3) Use the ST to lock the crank pulley, and remove the crank pulley bolt.

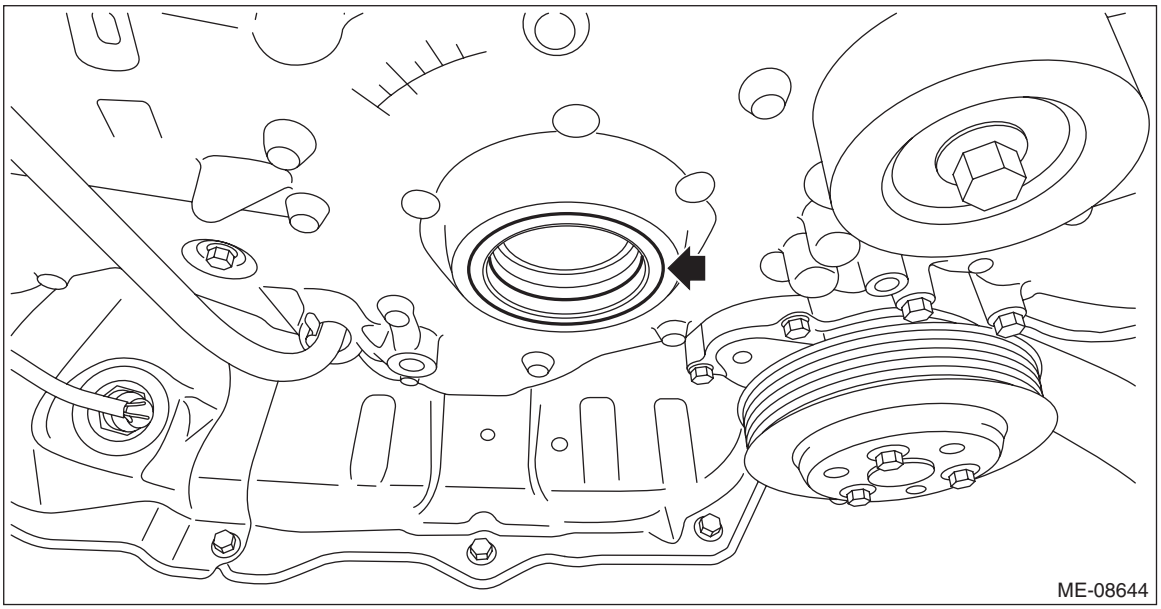
NOTE:
To prevent damaging ST1, attach the ST2 onto the ST1 as shown.
ST1 18355AA000 PULLEY WRENCH
ST2 18334AA000 PULLEY WRENCH PIN SET



ST1 18355AA000 PULLEY WRENCH
ST2 18334AA000 PULLEY WRENCH PIN SET



4) Remove the crank pulley.
5) Remove the front oil seal. (Gasoline engine model)



B: INSTALLATION

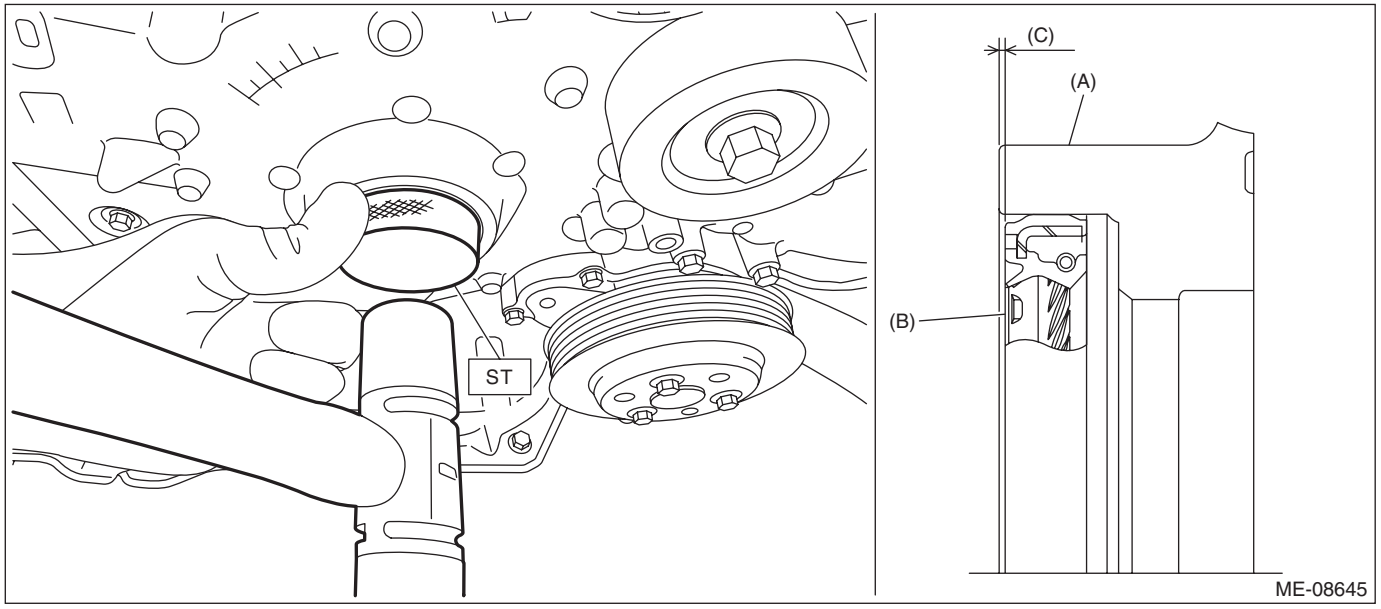
1) Degrease the press-fit section for the chain cover front oil seal, and install the front oil seal to the chain cover using ST. (Gasoline engine model)

CAUTION:
Do not apply fluid such as engine oil to the front oil seal and the chain cover; otherwise engine oil leakage may occur.

NOTE:
- Use a new front oil seal.
- When tapping the front oil seal in, protect the radiator fin with cardboards etc. so as not to damage the radiator fin by the plastic hammer.

ST 41399FG020 SPECIAL TOOL B

Front oil seal press-fit position:
1^{+0}_{-1} mm ($0.0039^{+0}_{-0.0039}$ in) position from chain cover end face

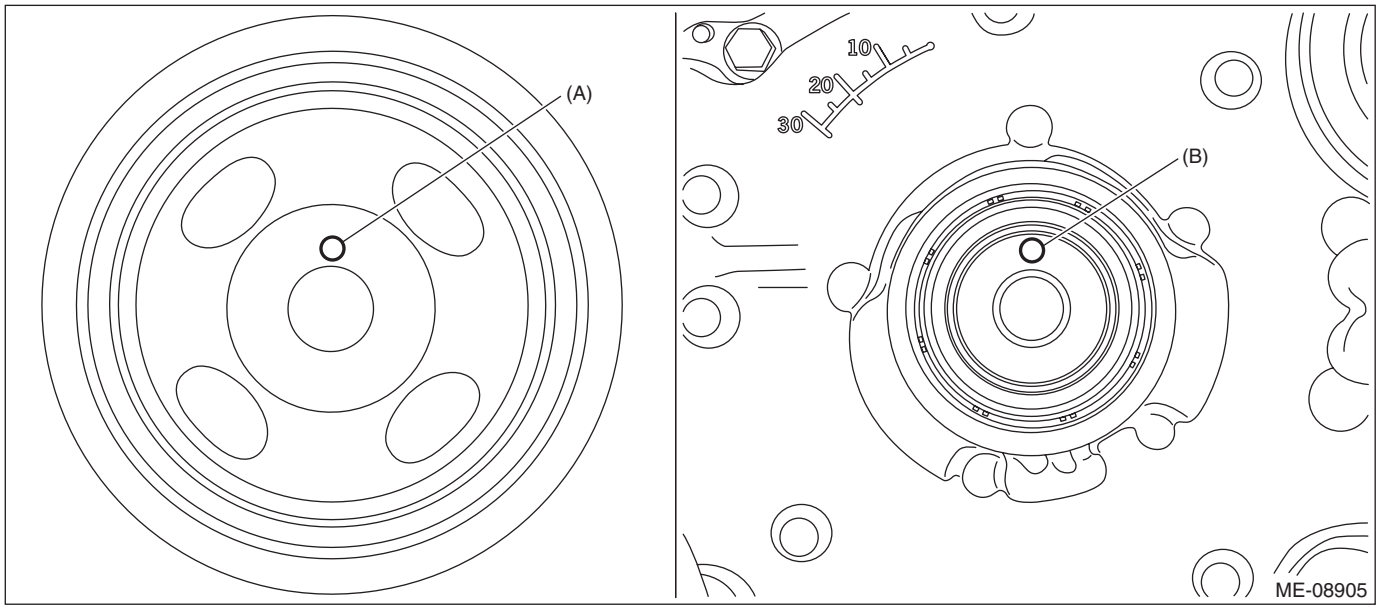


(A) Chain cover
(B) Oil seal
(C) Front oil seal press-fit position (1^{+0}_{-1} mm ($0.0039^{+0}_{-0.0039}$ in) position from chain cover end face)

2) Clean the crankshaft thread using compressed air.
3) Apply engine oil to the crank pulley bolt seat and thread.

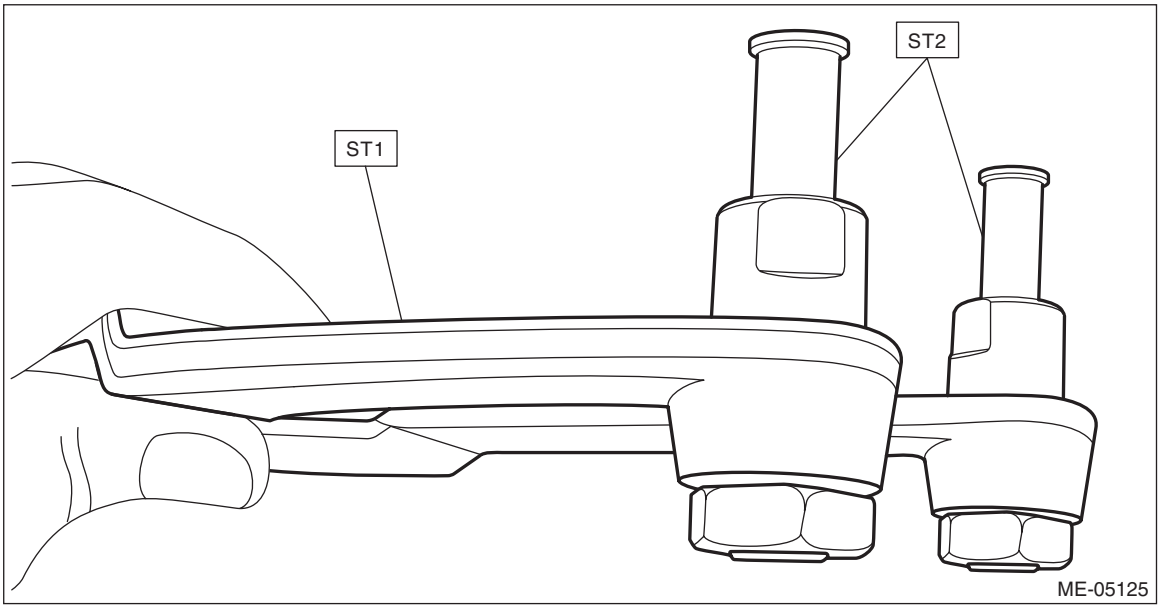
4) Install the crank pulley.
(1) Install the crank pulley to the crank pulley boss. (HEV model)

NOTE:
- Use new O-rings.
- Install the crank pulley by aligning the crank pulley knock hole (A) and crank pulley boss knock pin (B).



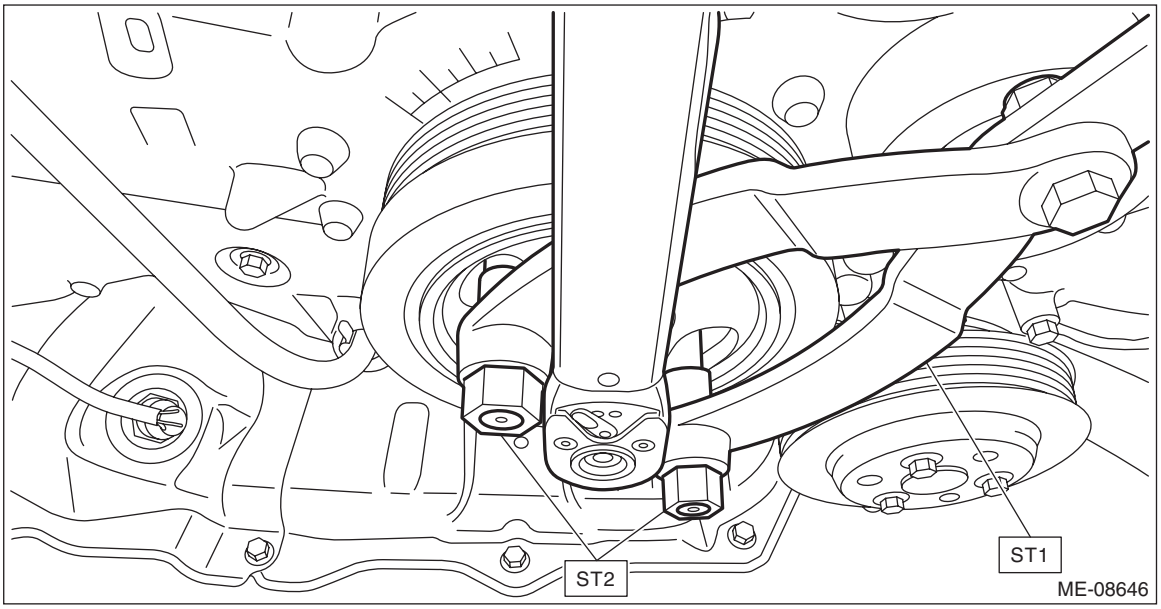
(2) Use the ST to lock the crank pulley, and temporarily tighten the crank pulley bolt.

NOTE:
To prevent damaging ST1, attach the ST2 onto the ST1 as shown.
ST1 18355AA000 PULLEY WRENCH
ST2 18334AA000 PULLEY WRENCH PIN SET

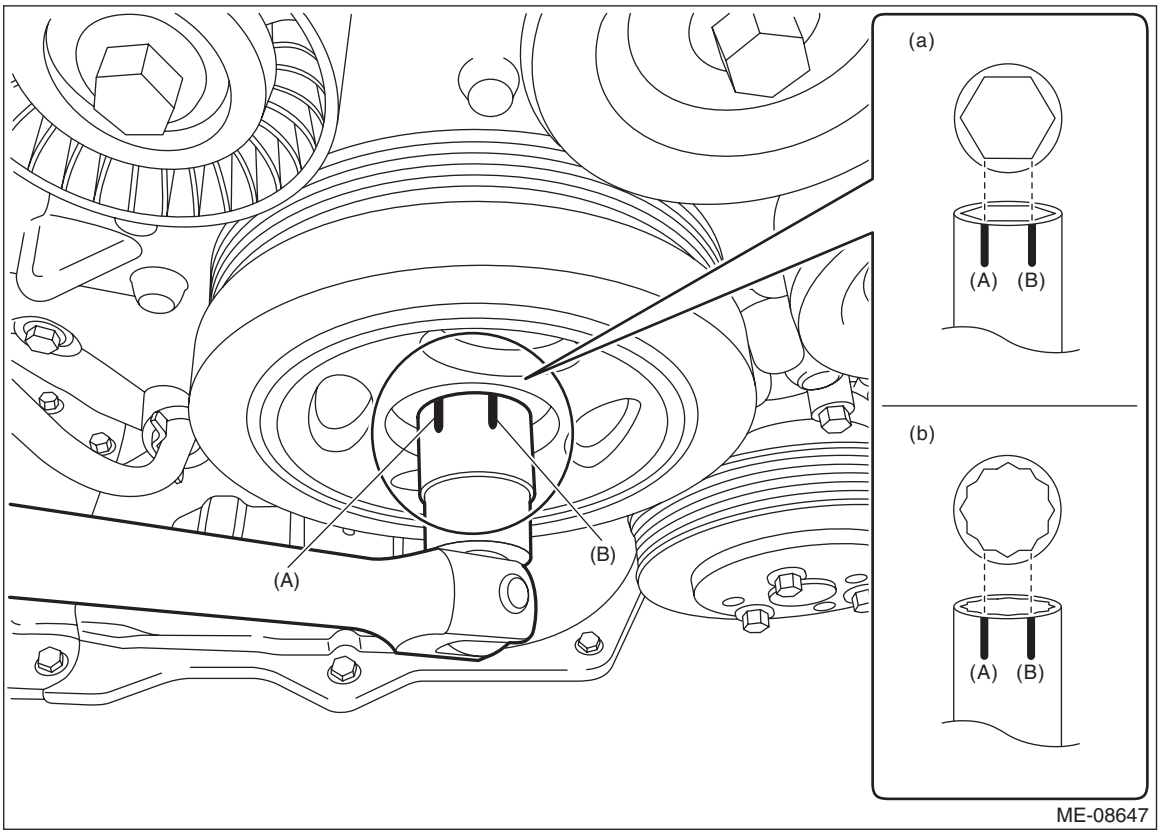


ST1 18355AA000 PULLEY WRENCH
ST2 18334AA000 PULLEY WRENCH PIN SET

Tightening torque:
60 N·m (6.1 kgf-m, 44.3 ft-lb)

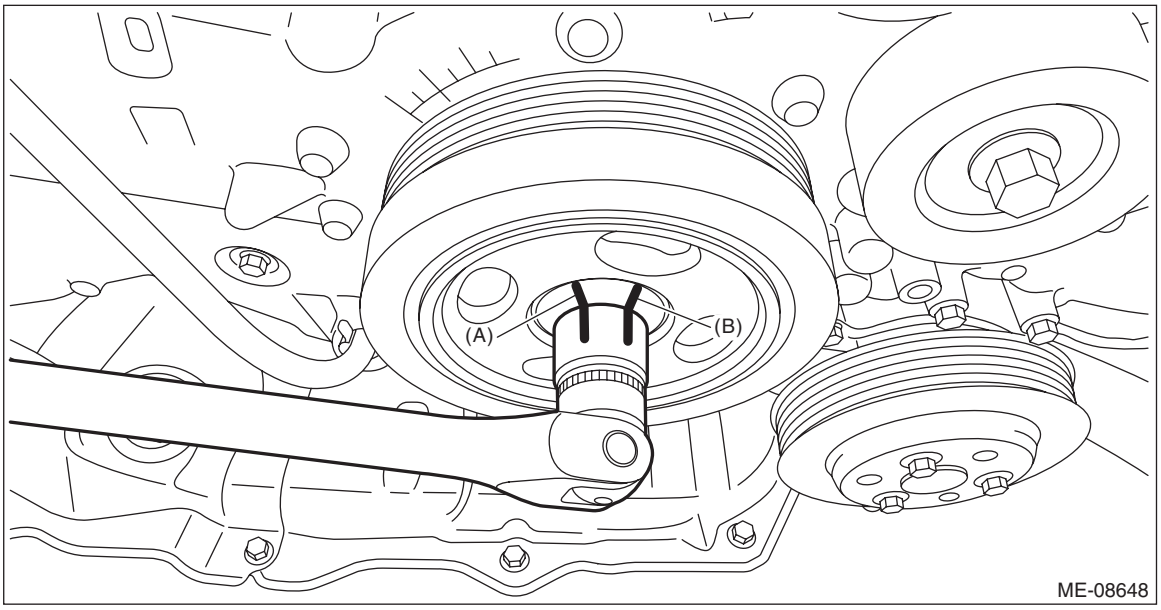


(3) Draw reference lines (A) and (B) using a marker to set the socket to the crank pulley bolt as shown in the figure.

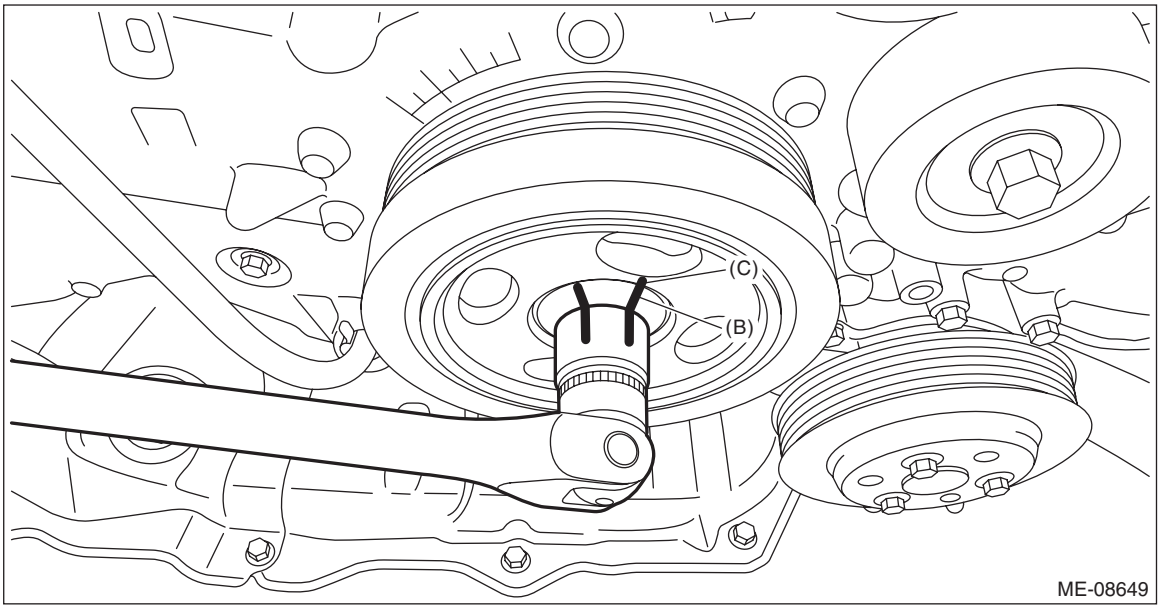


(a) When using 6-point socket (b) When using 12-point socket

(4) Draw reference lines (A) and (B) on the crank pulley bolt using a marker as shown in the figure.



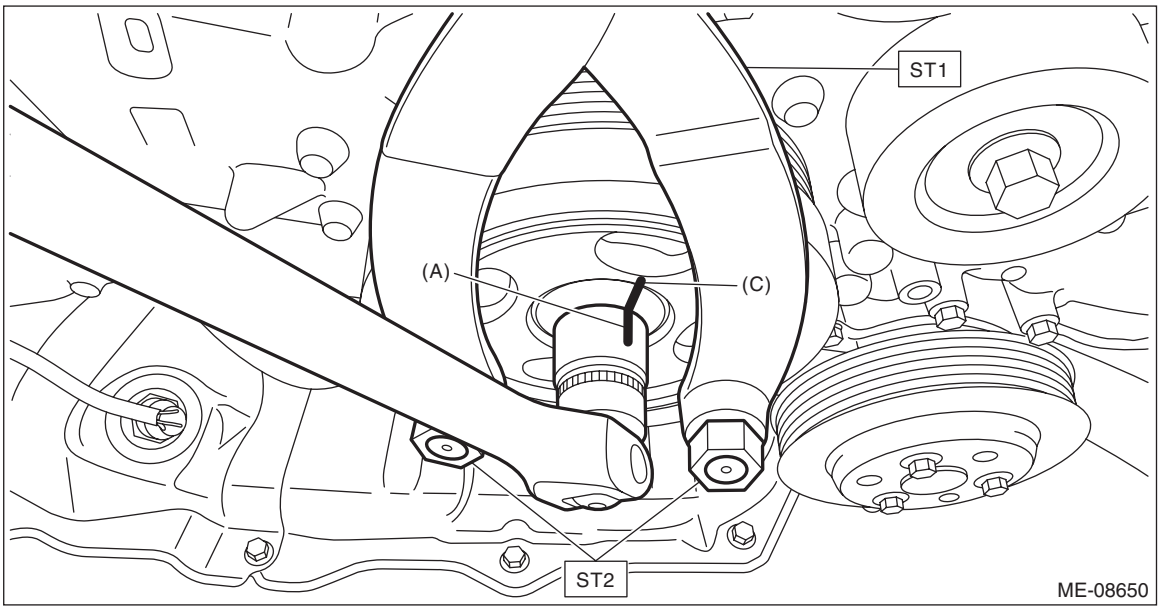
(5) Draw end line (C) on crank pulley using a marker at the same position as reference line (B) drawn on the crank pulley bolt in step (3).



(6) Use the ST to lock the crank pulley, and tighten the crank pulley bolt to the angle where reference line (A) and end line (C) are aligned.

NOTE:
It should be approx. 60° when reference line (A) and end line (C) are aligned.
ST1 18355AA000 PULLEY WRENCH
ST2 18334AA000 PULLEY WRENCH PIN SET

Tightening angle:
60°±5°

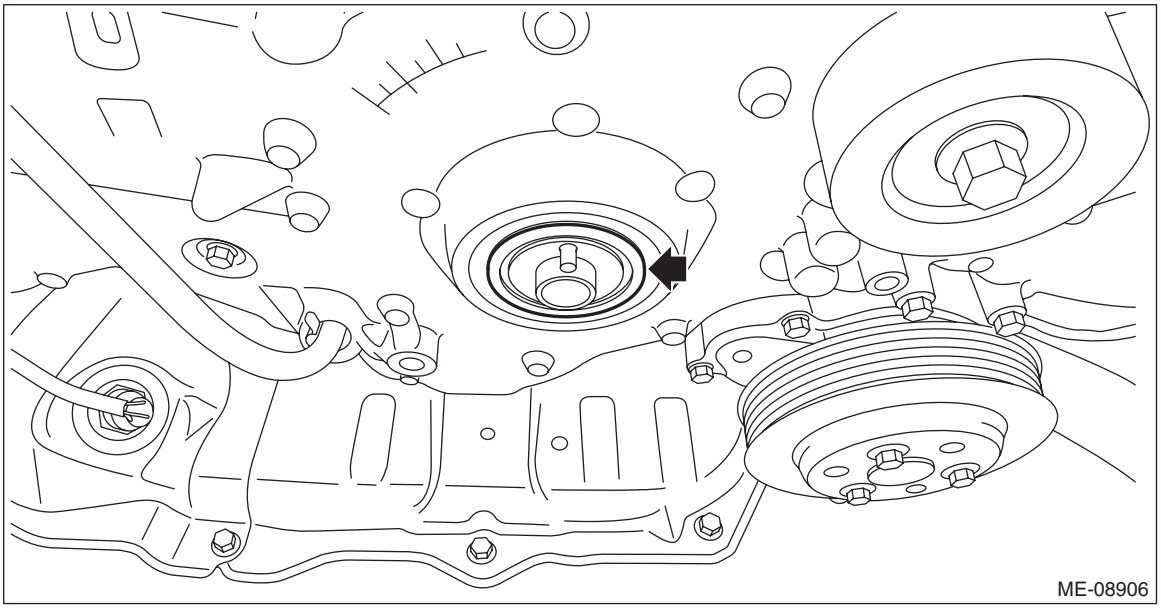


5) Install the V-belts. <Ref. to ME(H4DO(w/o HEV))-130, GASOLINE ENGINE MODEL, INSTALLATION, V-belt.>
6) When working on the vehicle

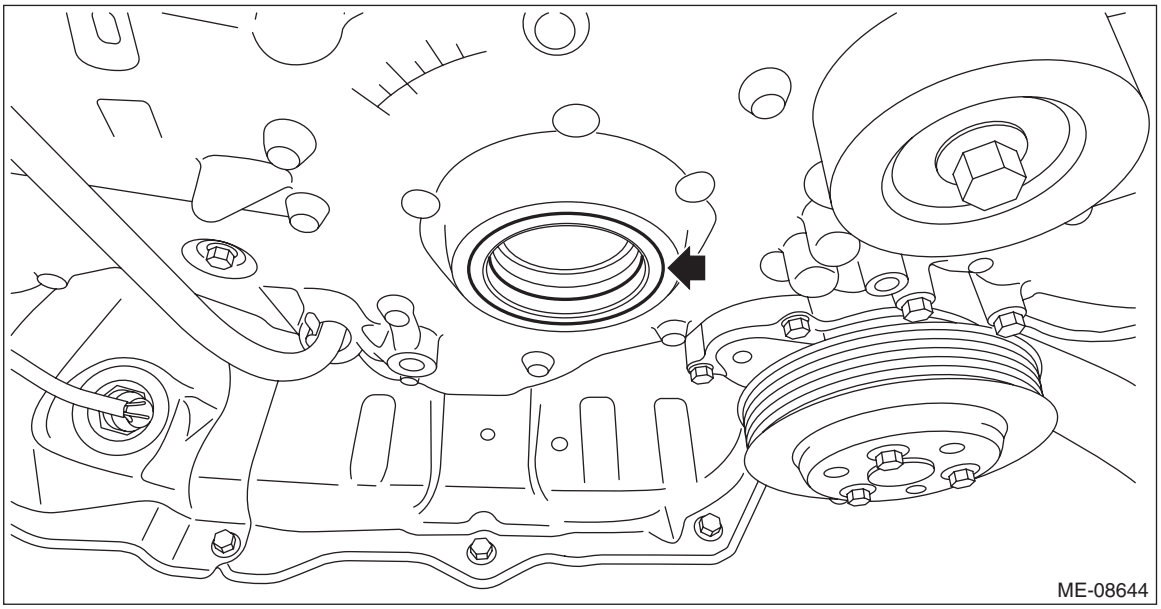
NOTE:
When working on the vehicle, perform the following steps also.
(1) Install the radiator main fan & fan motor assembly and radiator sub fan & fan motor assembly. <Ref. to CO(H4DO(w/o HEV))-90, INSTALLATION, Radiator Main Fan and Fan Motor.> <Ref. to CO(H4DO(w/o HEV))-94, INSTALLATION, Radiator Sub Fan and Fan Motor.>

C: INSPECTION

1) Check that the crank pulley has no deformation, cracks or other damages.
2) Inspect for oil leakage from the front oil seal. If there is an oil leak, replace the front oil seal with a new one. (Gasoline engine model) <Ref. to ME(H4DO(w/o HEV))-140, REMOVAL, Crank Pulley.>
3) Inspect for oil leakage from the front oil seal. If there is an oil leak, replace the front oil seal with a new part according to the following procedures. (HEV model)
   (1) Remove the crank pulley. <Ref. to ME(H4DO(w/o HEV))-140, REMOVAL, Crank Pulley.>
   (2) Remove the crank pulley boss from the chain cover.



   (3) Remove the front oil seal from the chain cover.

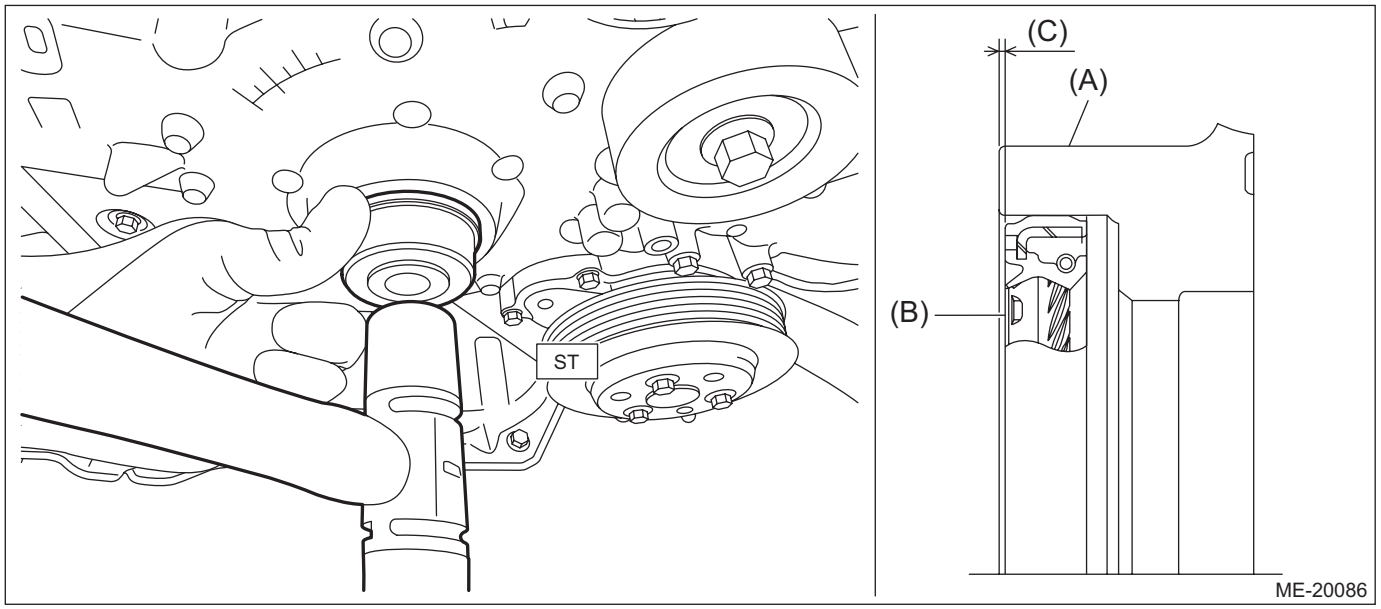


(4) Degrease the press-fit section for the chain cover front oil seal, and install the front oil seal to the chain cover using ST.

CAUTION:
Do not apply fluid such as engine oil to the front oil seal and the chain cover; otherwise engine oil leakage may occur.

NOTE:
When tapping the front oil seal in, protect the radiator fin with cardboards etc. so as not to damage the radiator fin by the plastic hammer.
ST 41399FG020 SPECIAL TOOL B

Front oil seal press-fit position:
1^{+0}_{-1} mm ($0.0039^{+0}_{-0.0039}$ in) position from chain cover end face



(A) Chain cover
(B) Oil seal
(C) Front oil seal press-fit position (1^{+0}_{-1} mm ($0.0039^{+0}_{-0.0039}$ in) position from chain cover end face)

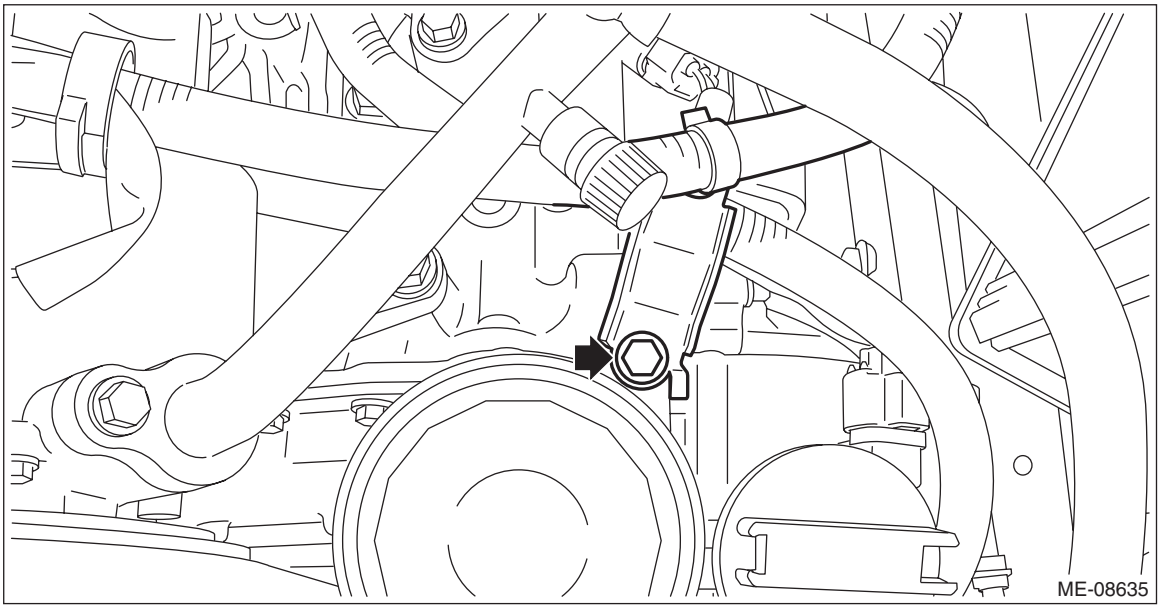
(5) Install in the reverse order of removal after replacement.

14.Chain Cover

A: REMOVAL

NOTE:
When replacing a single part, perform the work with the engine assembly installed to body.
1) When working on the vehicle

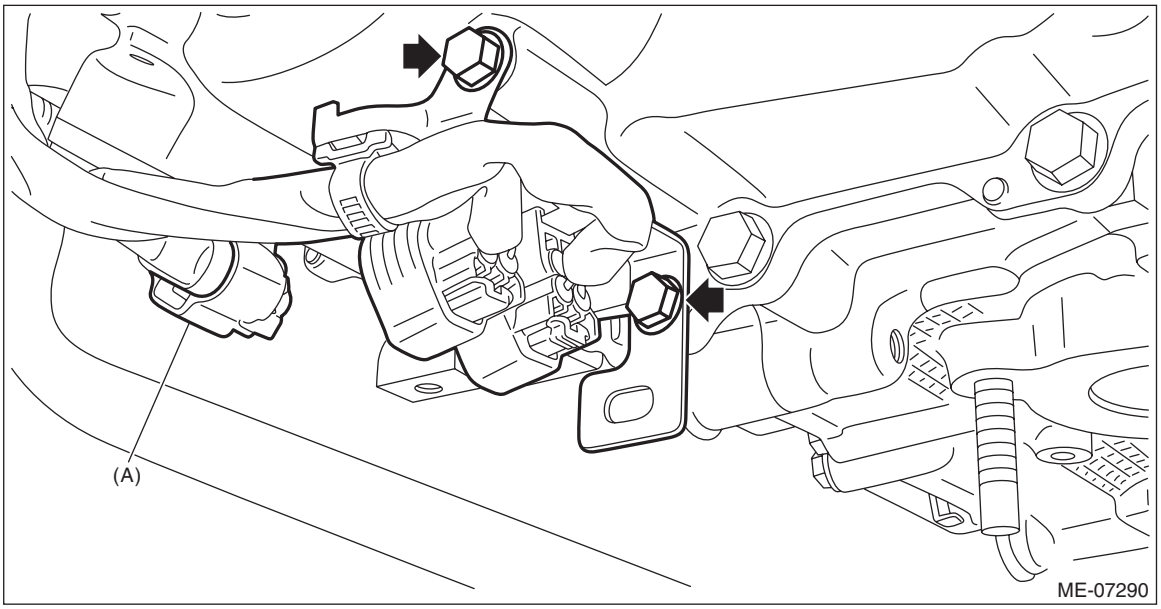
NOTE:
When working on the vehicle, perform the following steps also.
(1) Remove the radiator. <Ref. to CO(H4DO(w/o HEV))-78, REMOVAL, Radiator.>
(2) Remove the front exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-6, REMOVAL, Front Exhaust Pipe.>
(3) Remove the bolts which secure the generator cord stay to the chain cover. (Gasoline engine model)



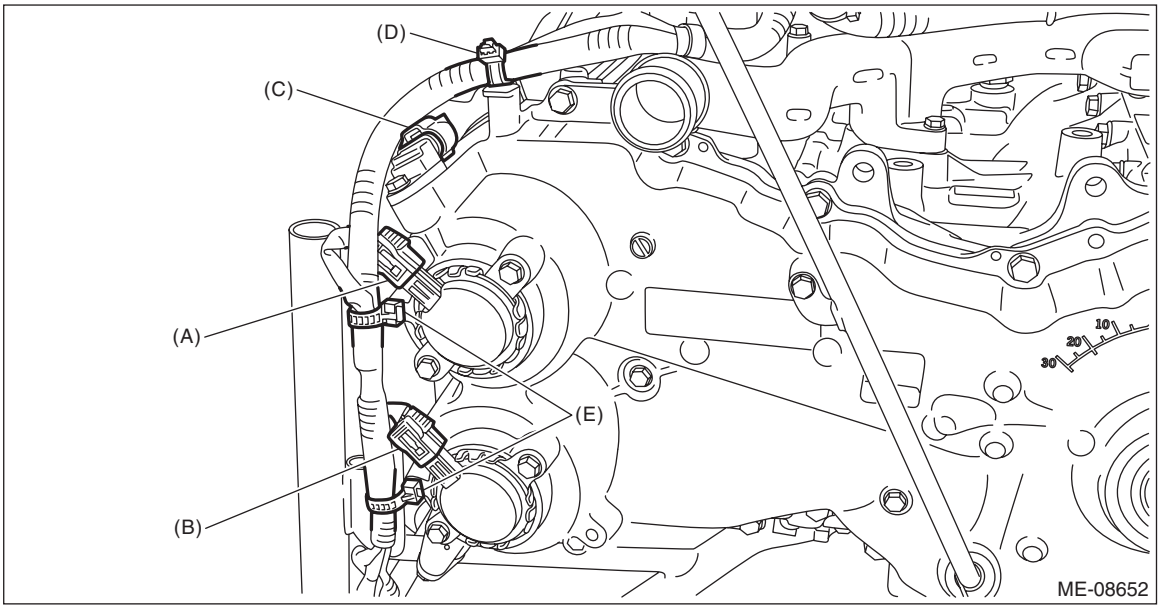
2) Remove the ISG. (HEV model) <Ref. to SC(H4DO(HEV))-32, REMOVAL, Integrated Starter Generator (ISG).>

NOTE:
When working on the vehicle, move the battery cable assembly at the locations that do not interfere operation after the ISG is removed.
3) Remove the generator. (Gasoline engine model) <Ref. to SC(H4DO(w/o HEV))-32, REMOVAL, Generator.>
4) Drain the engine oil. <Ref. to LU(H4DO(w/o HEV))-13, REPLACEMENT, Engine Oil.>
5) Remove the water pump pulley. <Ref. to CO(H4DO(w/o HEV))-20, WATER PUMP, REMOVAL, Water Pump.>
6) Remove the crank pulley. <Ref. to ME(H4DO(w/o HEV))-140, REMOVAL, Crank Pulley.>

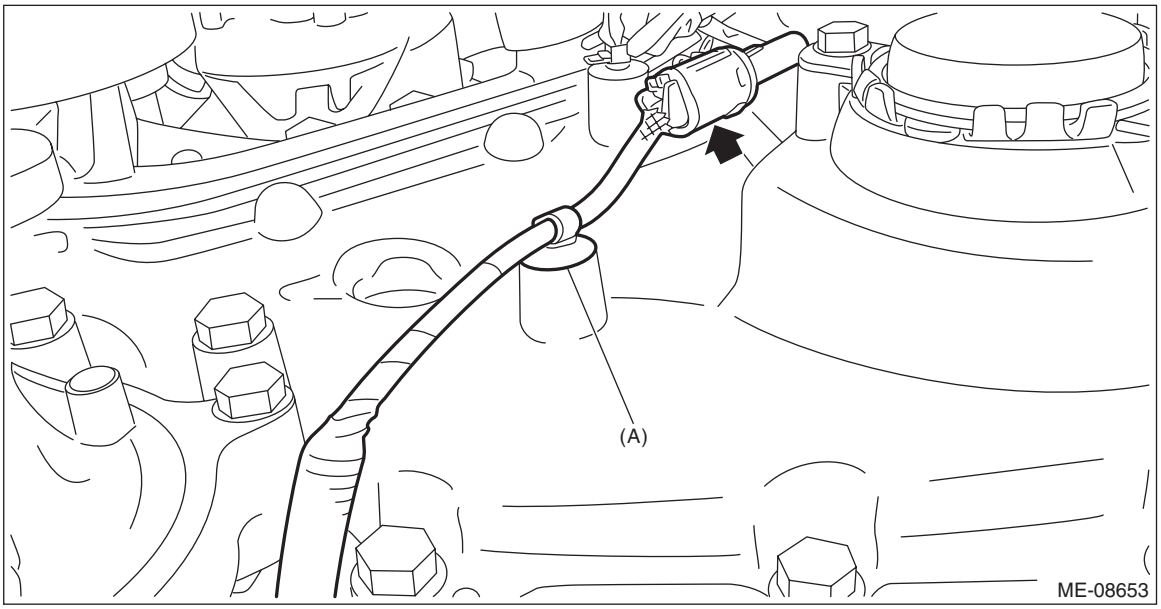
7) Disconnect the connector (A) from the exhaust camshaft position sensor RH, and remove the engine harness stay from the chain cover.



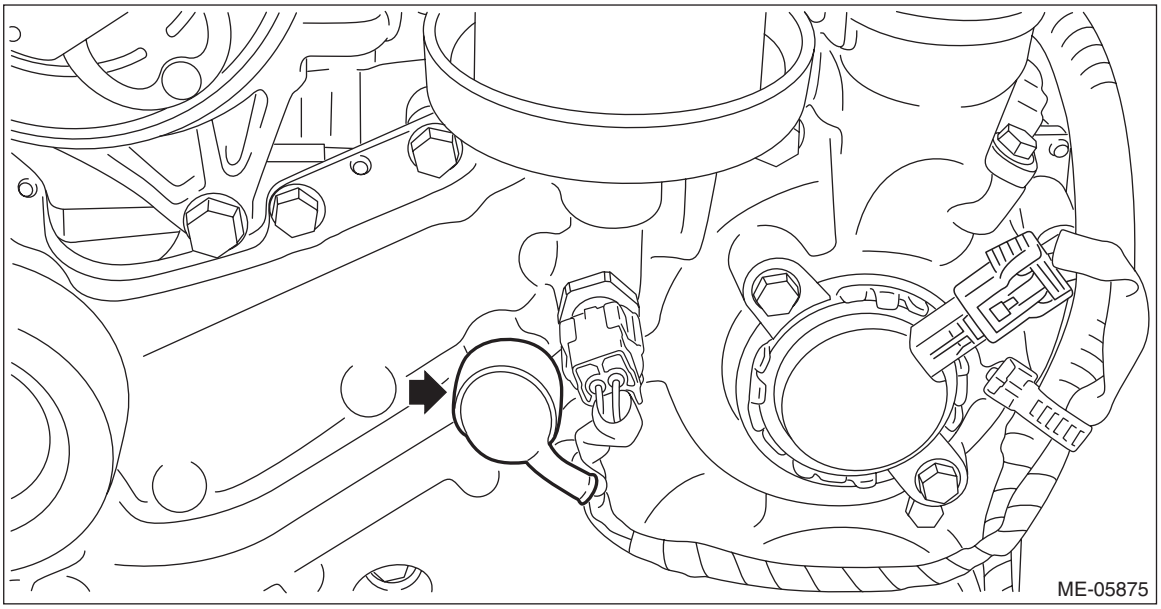
8) Disconnect the connector (A) from the intake oil control solenoid RH, connector (B) from the exhaust oil control solenoid RH, and the connector (C) from the intake camshaft position sensor RH, and then remove the clips (D) (gasoline engine model) and the clips (E) which secure the engine harness.



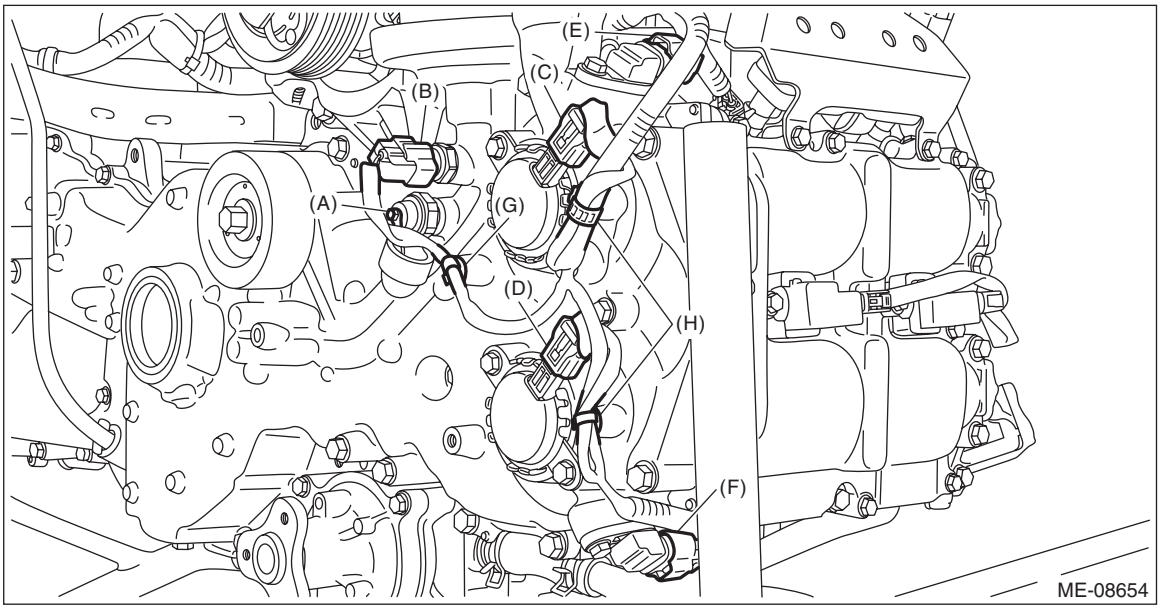
9) Disconnect the connectors from the oil level switch, and remove the clip (A) which secure the oil level switch harness.



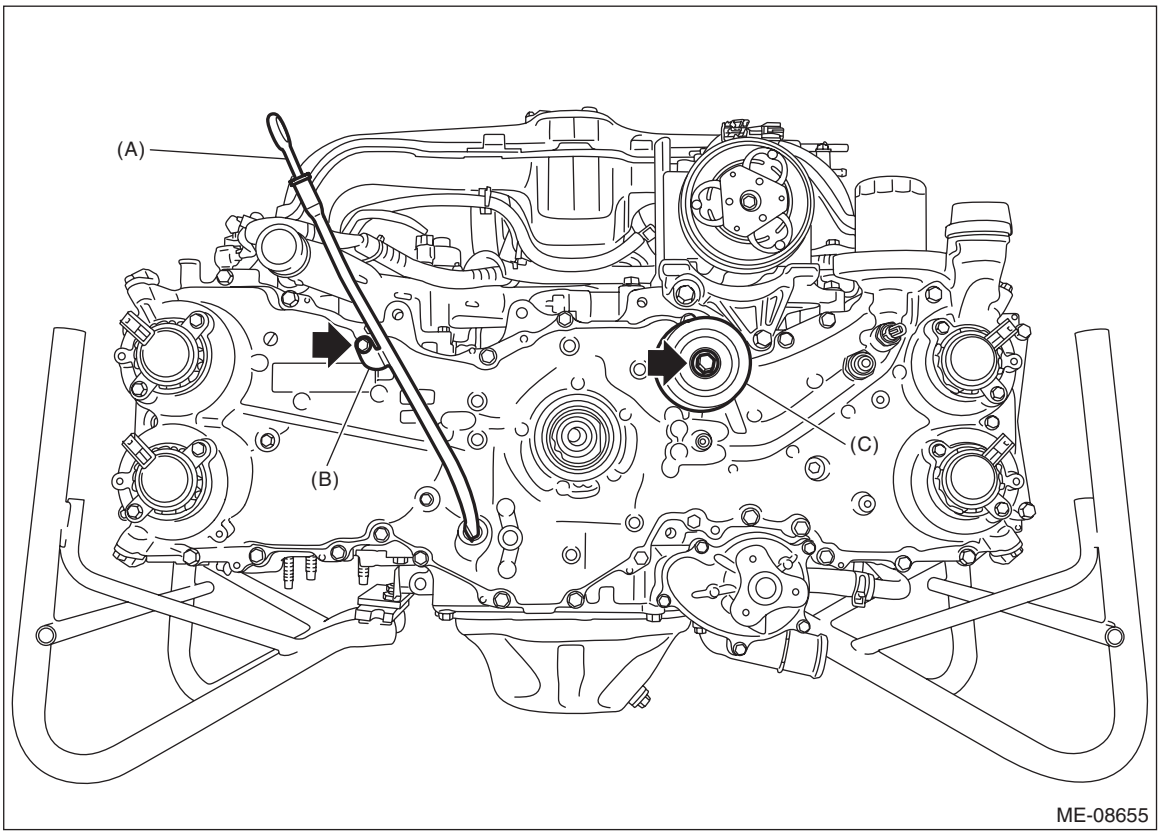
10) Remove the rubber cap from the oil pressure switch.



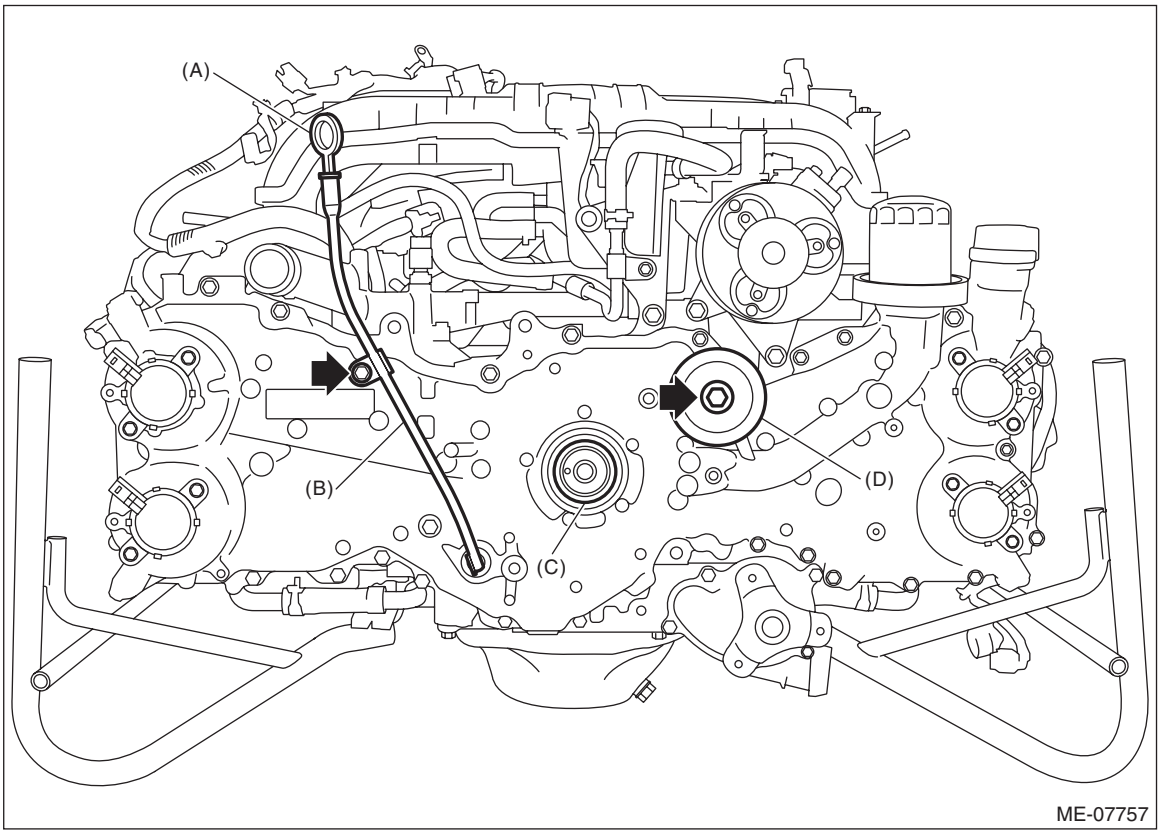
11) Disconnect the terminal (A) from the oil pressure switch, connector (B) from the engine oil temperature sensor, connector (C) from the intake oil control solenoid LH, connector (D) from the exhaust oil control solenoid LH, connector (E) from the intake camshaft position sensor LH, and connector (F) from the exhaust camshaft position sensor LH, and remove the clips (G) and (H) which secure the engine harness.



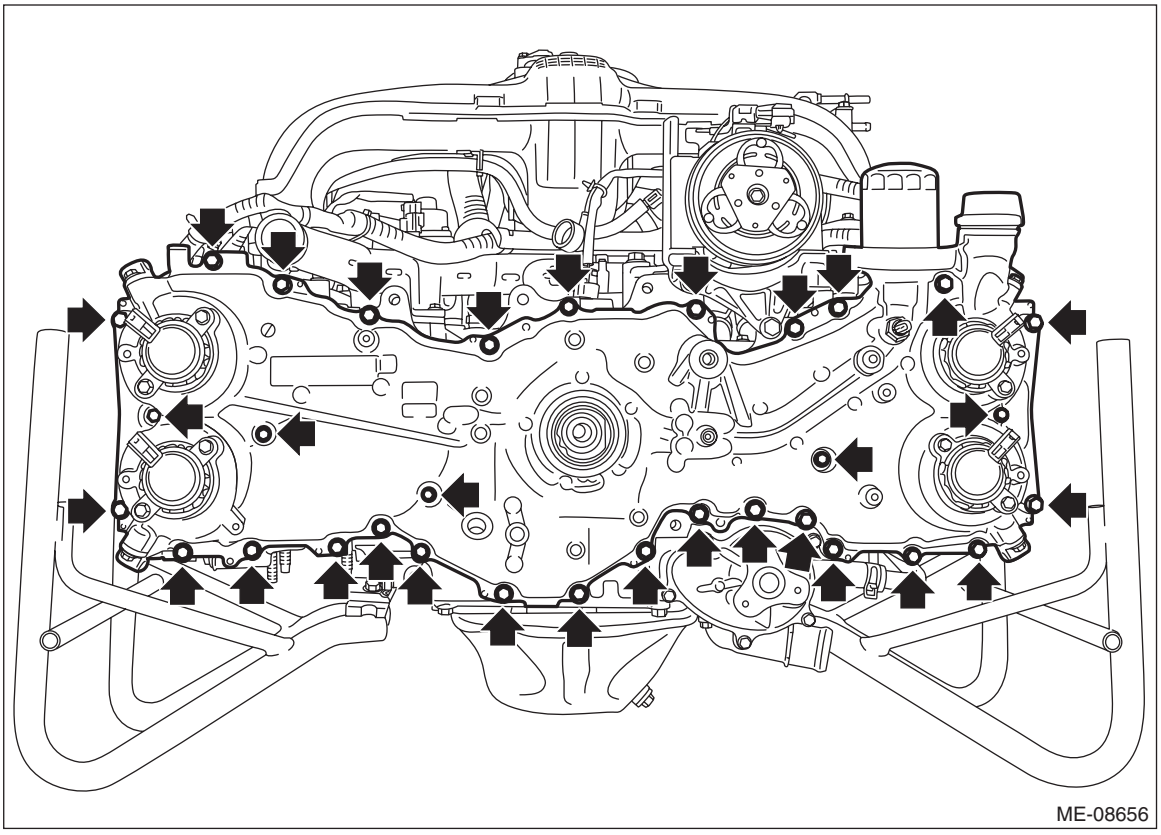
12) Pull out the oil level gauge (A), and remove the oil level gauge guide (B) and idler pulley (C). (Gasoline engine model)



13) Pull out the oil level gauge (A), and remove the oil level gauge guide (B), crank pulley boss (C), and idler pulley (D). (HEV model)

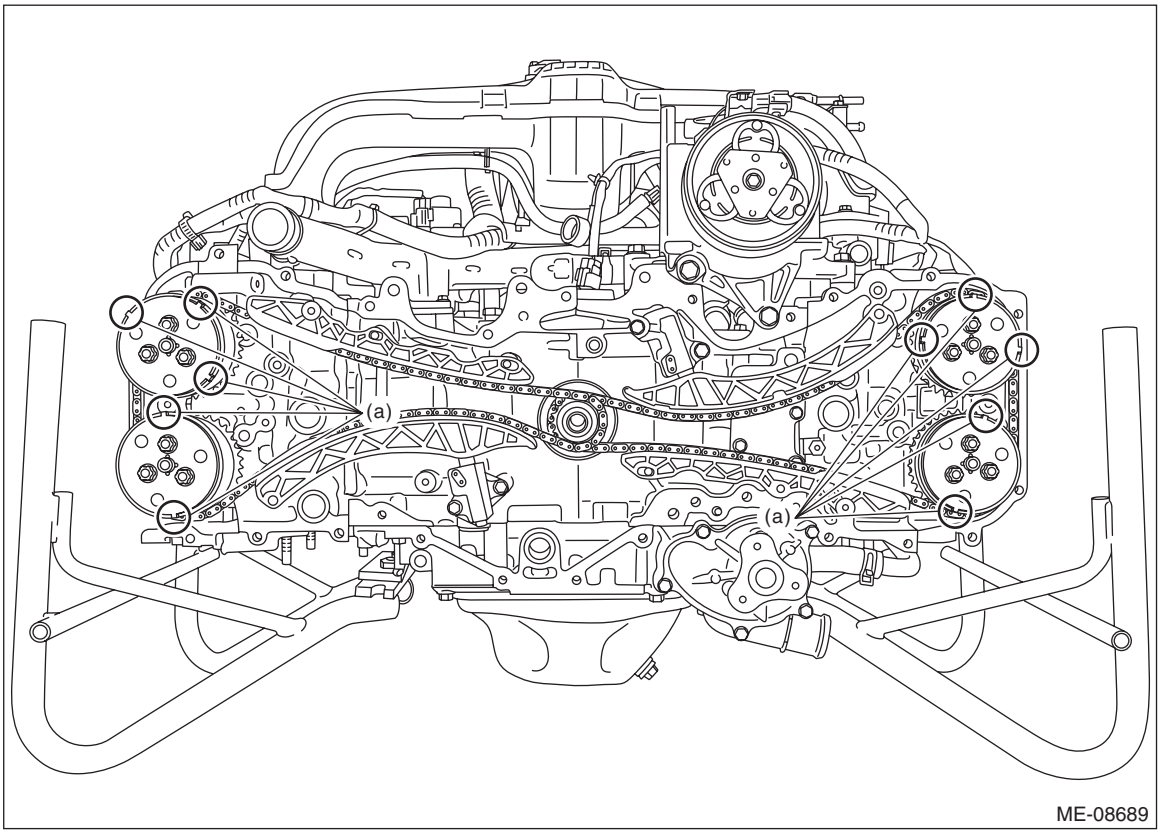


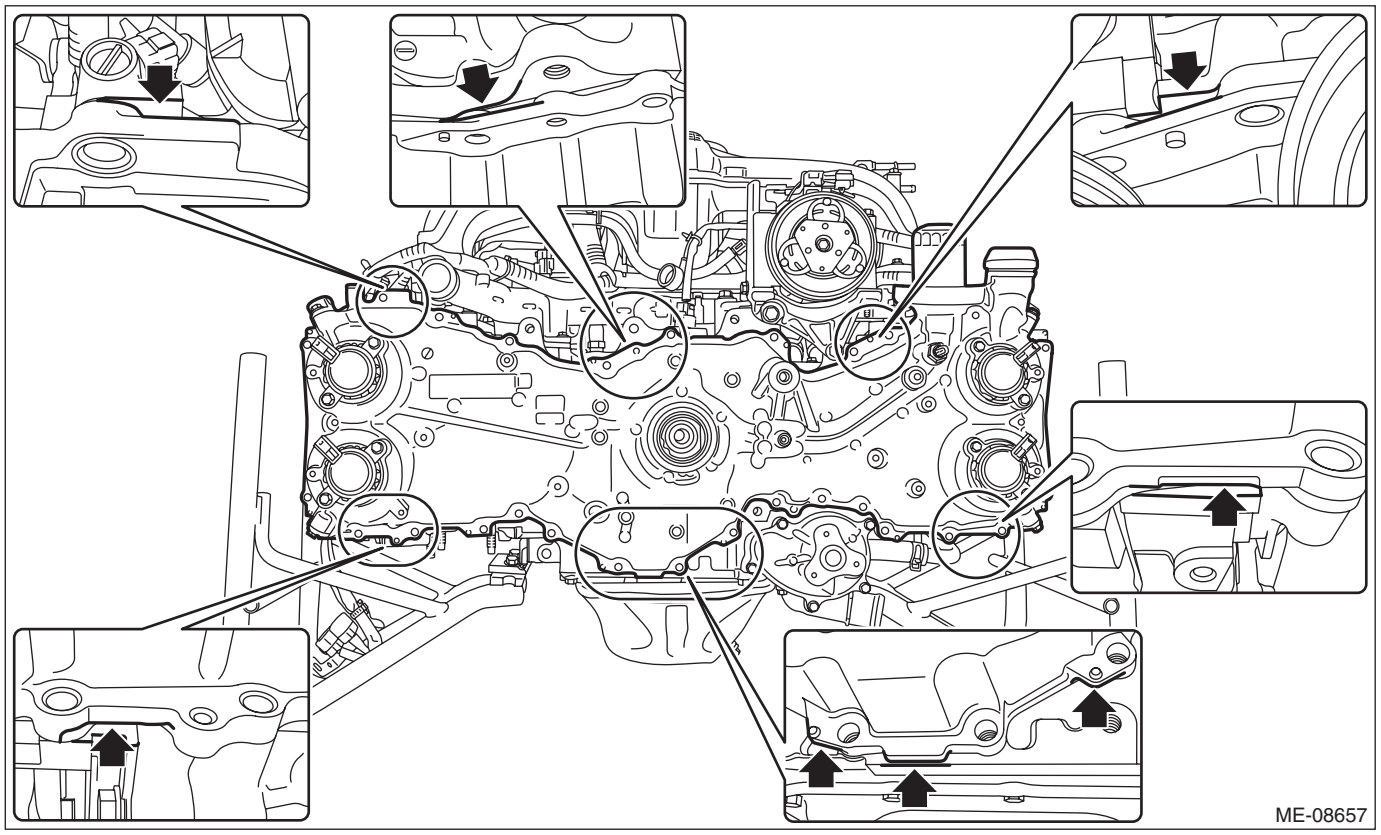
14) Remove the bolts securing the chain cover to the engine.



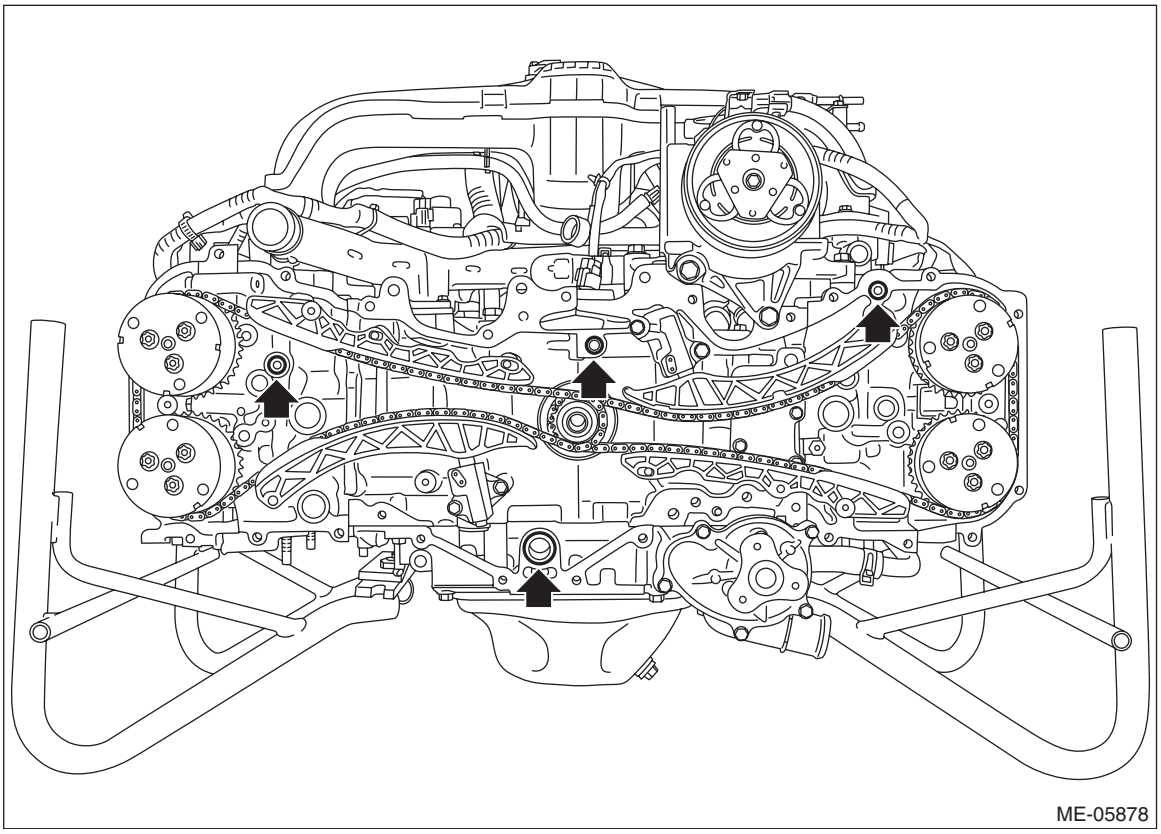
15) Expand the area shown in the figure using a crowbar or a similar tool wrapped in tape for protection, and remove the chain cover from the engine.

CAUTION:
For gasoline engine models, the chain cover may contact the protrusion (a) of cam sprocket sensor plate and cause damage. When removing the chain cover, move the chain cover horizontally until it cannot contact with the cam sprocket, and then remove it carefully.



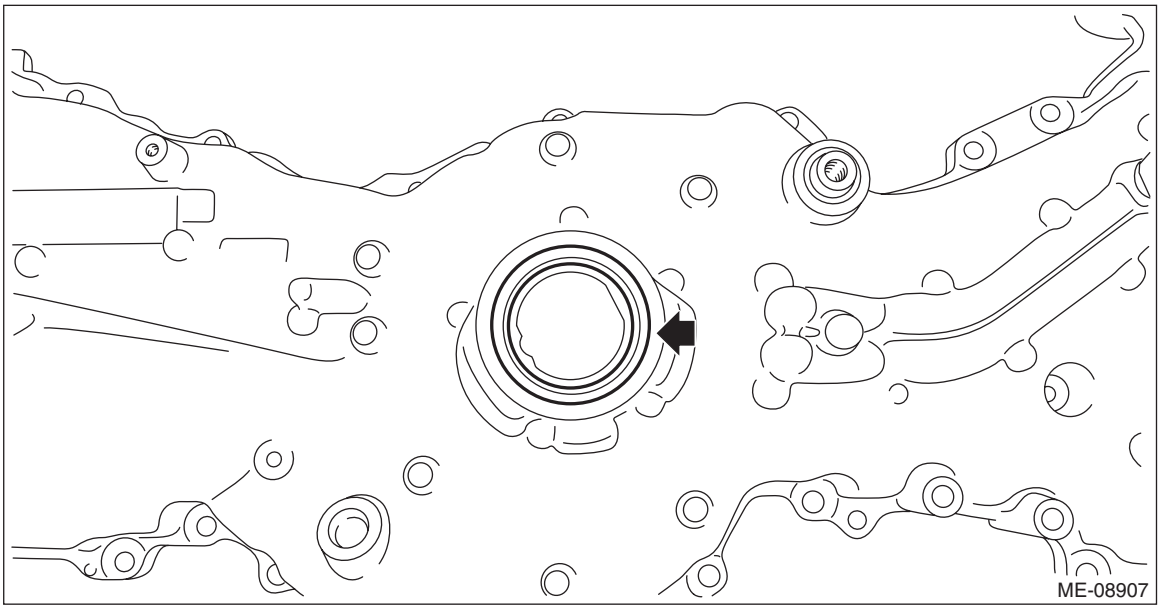


16) Remove the O-rings from cylinder head RH, cylinder head LH, cylinder block LH and oil pan upper.



17) Remove the liquid gasket from the chain cover and engine unit.

18) Remove the front oil seal from the chain cover. (HEV model)



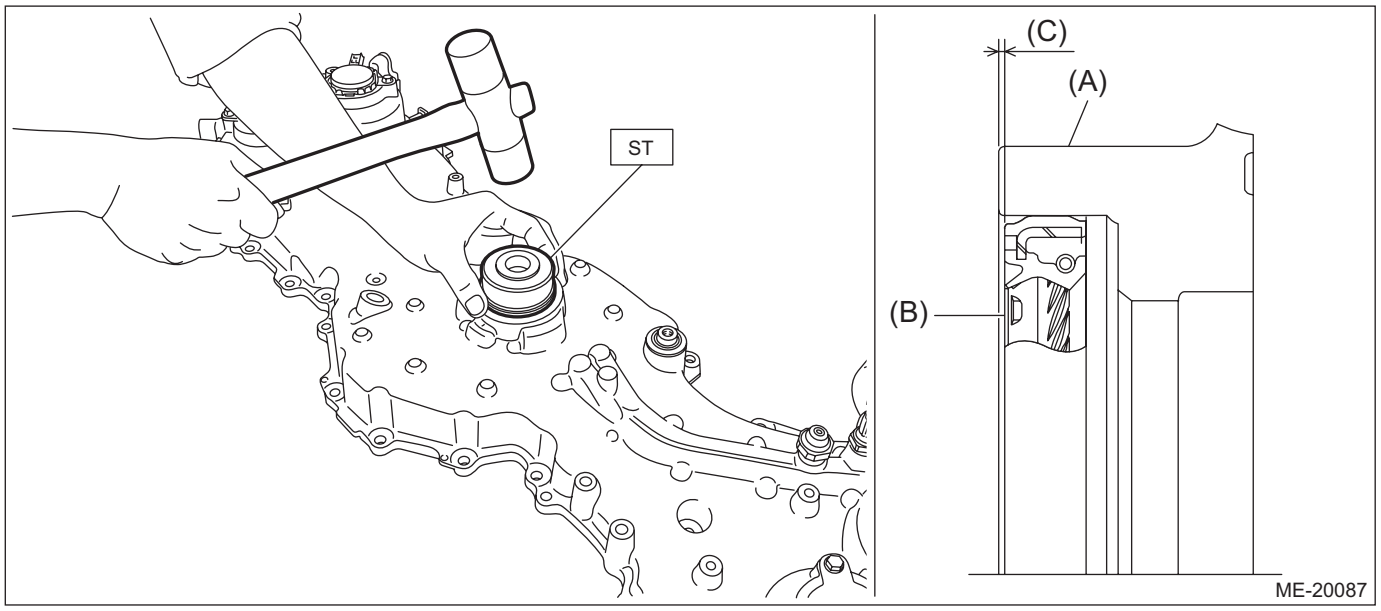
B: INSTALLATION

1) Degrease the press-fit section for the chain cover front oil seal, and install the front oil seal to the chain cover using ST. (HEV model)

CAUTION:
Do not apply fluid such as engine oil to the front oil seal and the chain cover; otherwise engine oil leakage may occur.

NOTE:
Use a new front oil seal.
ST 41399FG020 SPECIAL TOOL B

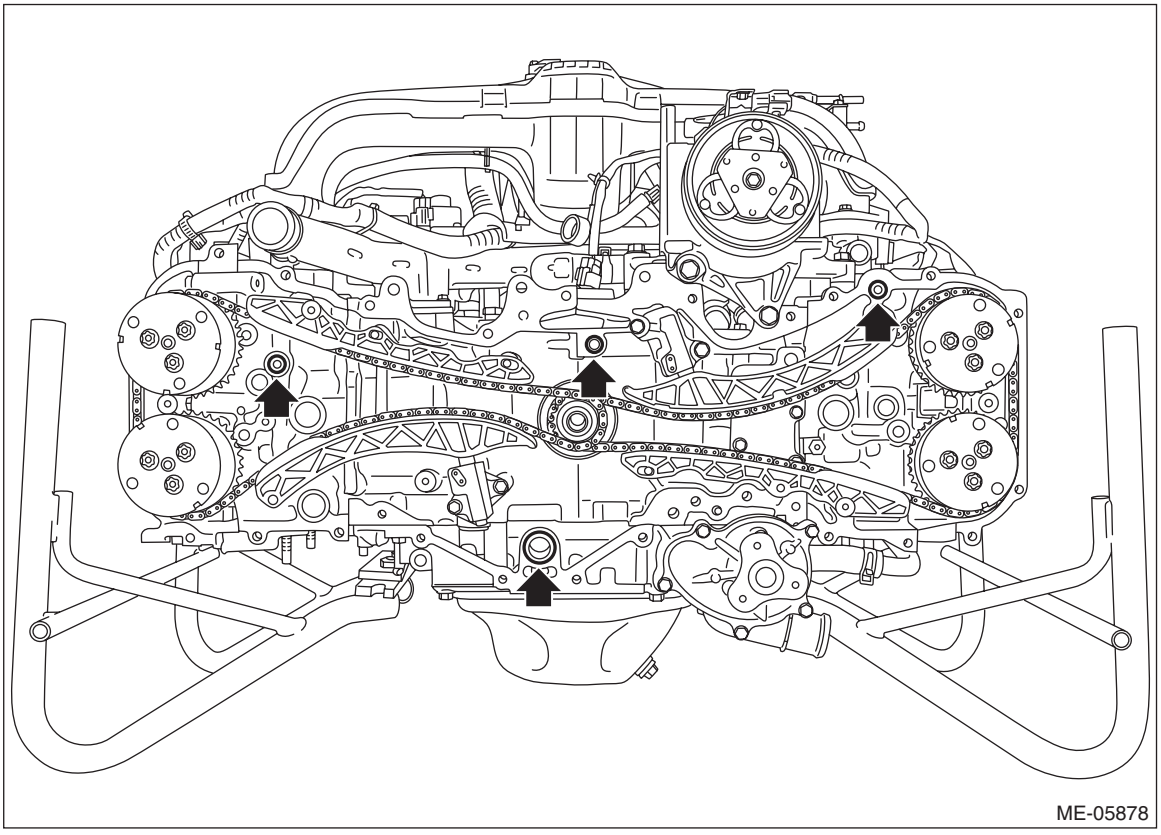
Front oil seal press-fit position:
1^{+0}_{-1} mm ($0.0039^{+0}_{-0.0039}$ in) position from chain cover end face



(A) Chain cover
(B) Oil seal
(C) Front oil seal press-fit position (1^{+0}_{-1} mm ($0.0039^{+0}_{-0.0039}$ in) position from chain cover end face)

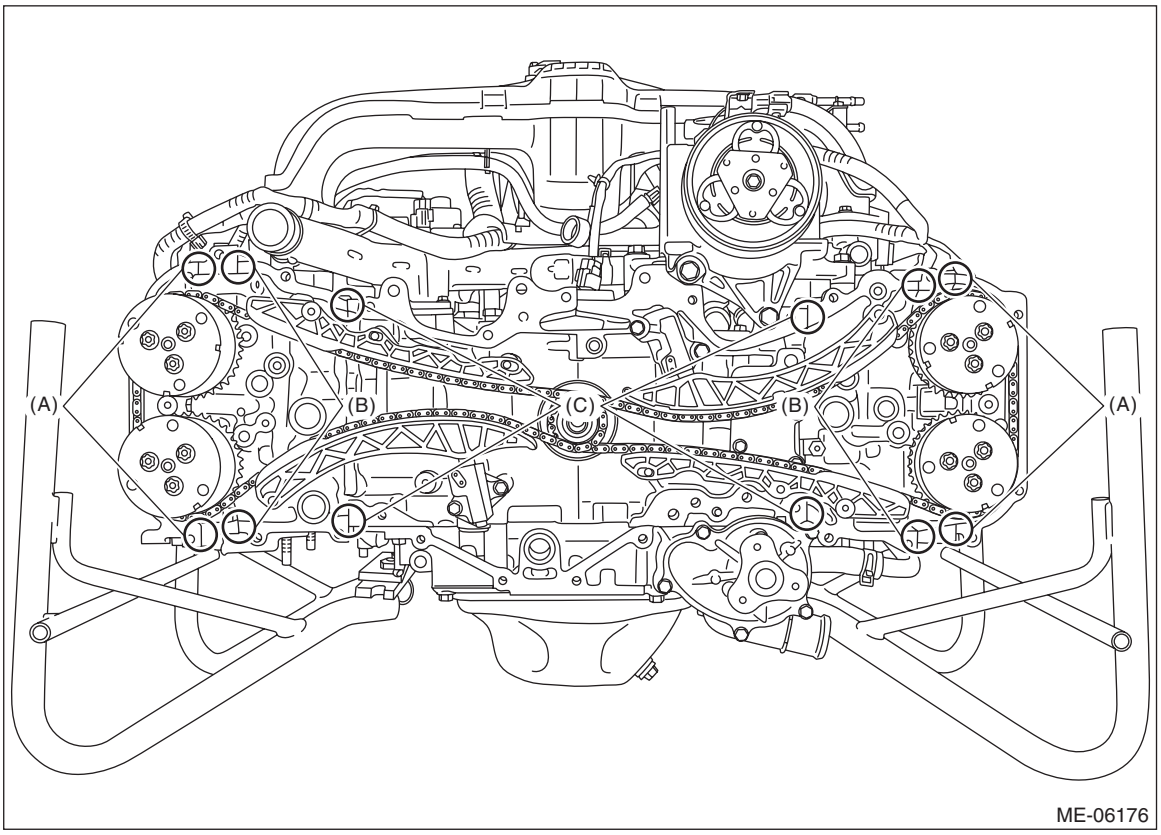
2) Install the O-rings to cylinder head RH, cylinder head LH, cylinder block LH and oil pan upper.

NOTE:
- Use new O-rings.
- Apply a coat of engine oil to the O-rings.



3) Apply liquid gasket if there are gaps between front camshaft cap and cam carrier (A), cam carrier and cylinder head (B), and cylinder head and cylinder block (C) as shown in the figure.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

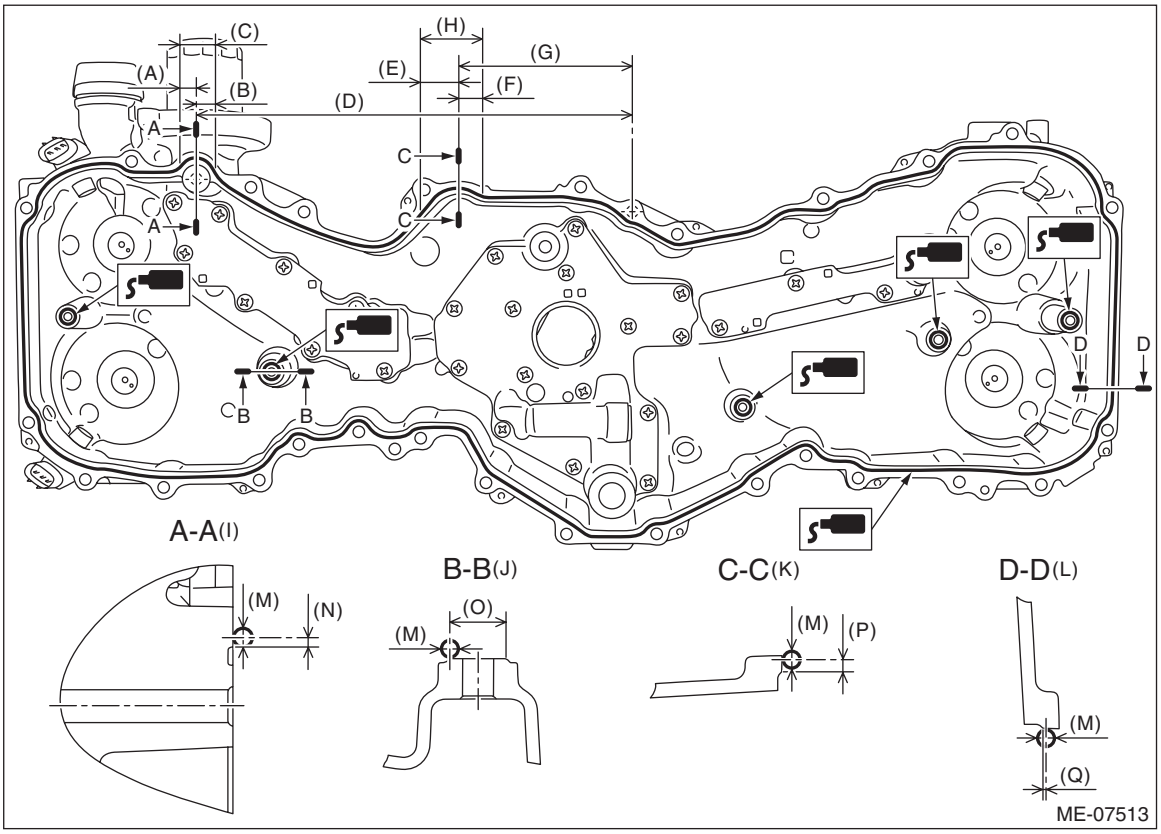


4) Apply liquid gasket to the chain cover mating surface and center boss (5 places) as shown in the figure.

NOTE:
- Before applying liquid gasket, degrease the old liquid gasket seal surface of the engine and chain cover.
- Install within 5 min. after applying liquid gasket.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

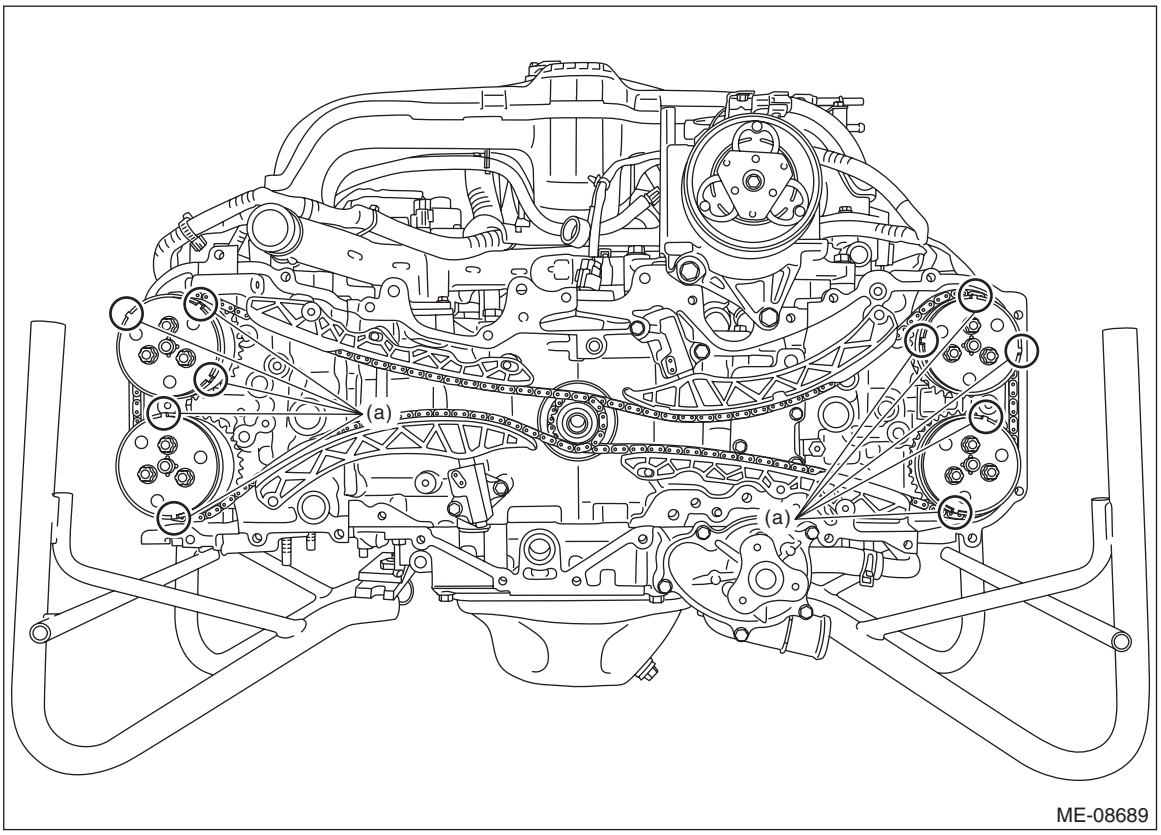
Liquid gasket applying diameter:
4±0.5 mm (0.1575±0.0197 in)



(A)	14.5 mm (0.5709 in)	(G)	127 mm (5.0000 in)	(M)	ϕ4±0.5 mm (0.1575±0.0197 in)
(B)	17.5 mm (0.6890 in)	(H)	Range B	(N)	2 mm (0.0787 in)
(C)	Range A	(I)	Liquid gasket applying position of mating surfaces of range A	(O)	ϕ12 mm (0.4724 in)
(D)	316.2 mm (12.4488 in)	(J)	Liquid gasket applying position of center boss (5 places)	(P)	2.5 mm (0.0984 in)
(E)	24.5 mm (0.9646 in)	(K)	Liquid gasket applying position of mating surfaces of range B	(Q)	0.5 mm (0.0197 in)
(F)	18.5 mm (0.7283 in)	(L)	Liquid gasket applying position of mating surfaces other than range A and range B		

5) Set the chain cover, and tighten the bolts in numerical order as shown in the figure.

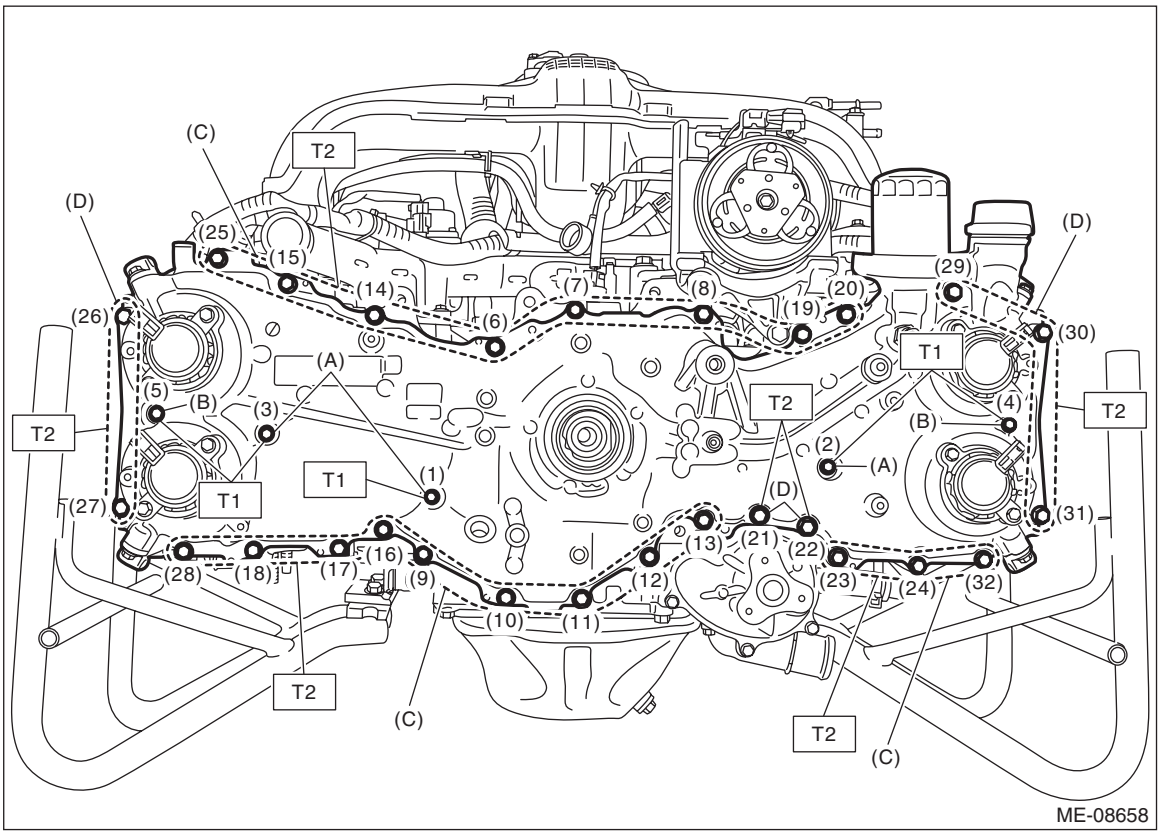
CAUTION:
For gasoline engine models, the chain cover may contact the protrusion (a) of cam sprocket sensor plate and cause damage. When setting the chain cover, move the chain cover horizontally and set it while taking care not to contact with the cam sprocket.



Tightening torque:

T1: 10 N·m (1.0 kgf-m, 7.4 ft-lb)

T2: 25 N·m (2.5 kgf-m, 7.4 ft-lb)



(A) M6 × 20

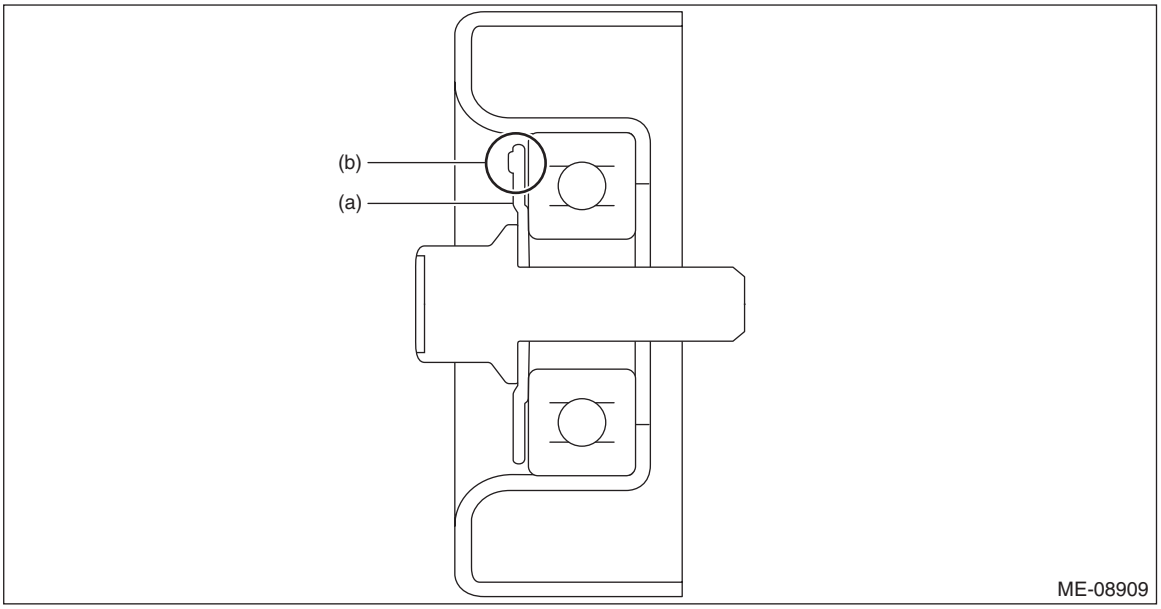
(B) M6 × 50

(C) M8 × 25

(D) M8 × 60

6) Install the idler pulley (C) and oil level gauge guide (B), and insert the oil level gauge (A). (Gasoline engine model)

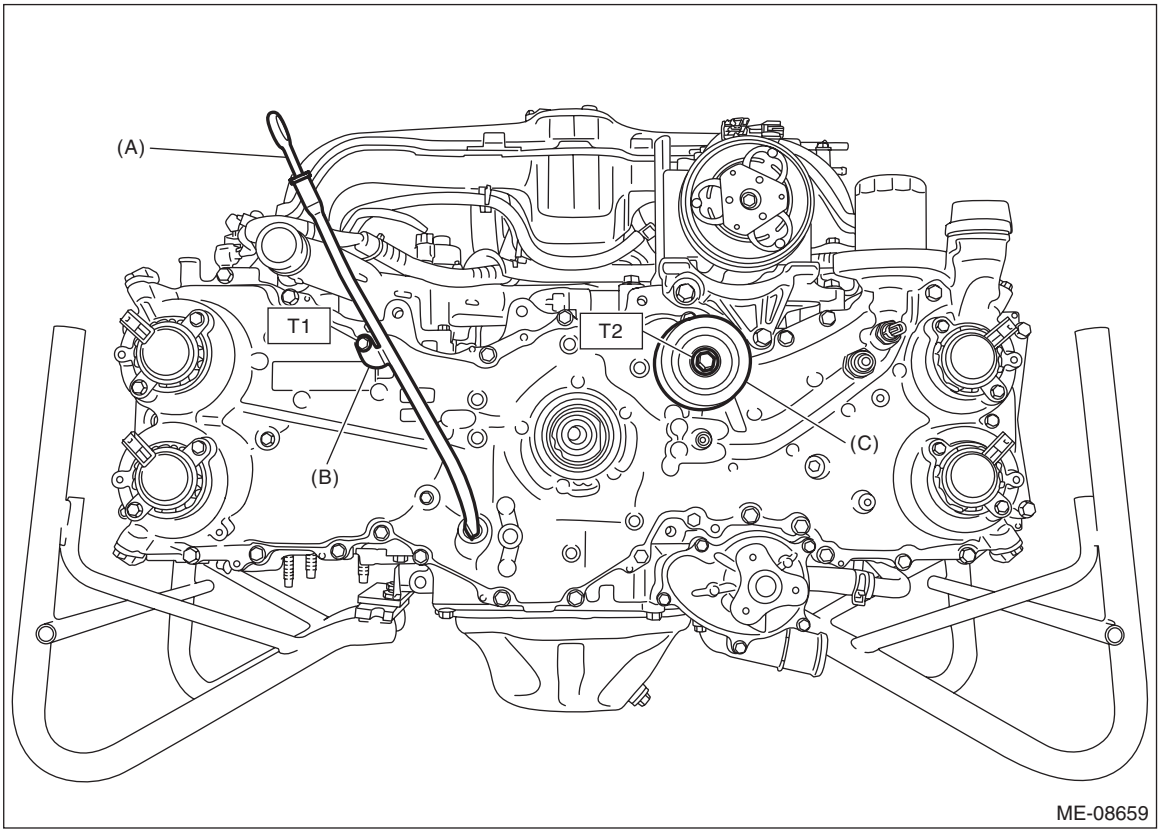
NOTE:
- When installing the idler pulley, be careful of the idler pulley cover direction.



(a) Idler pulley cover (b) Protrusion (3 places)

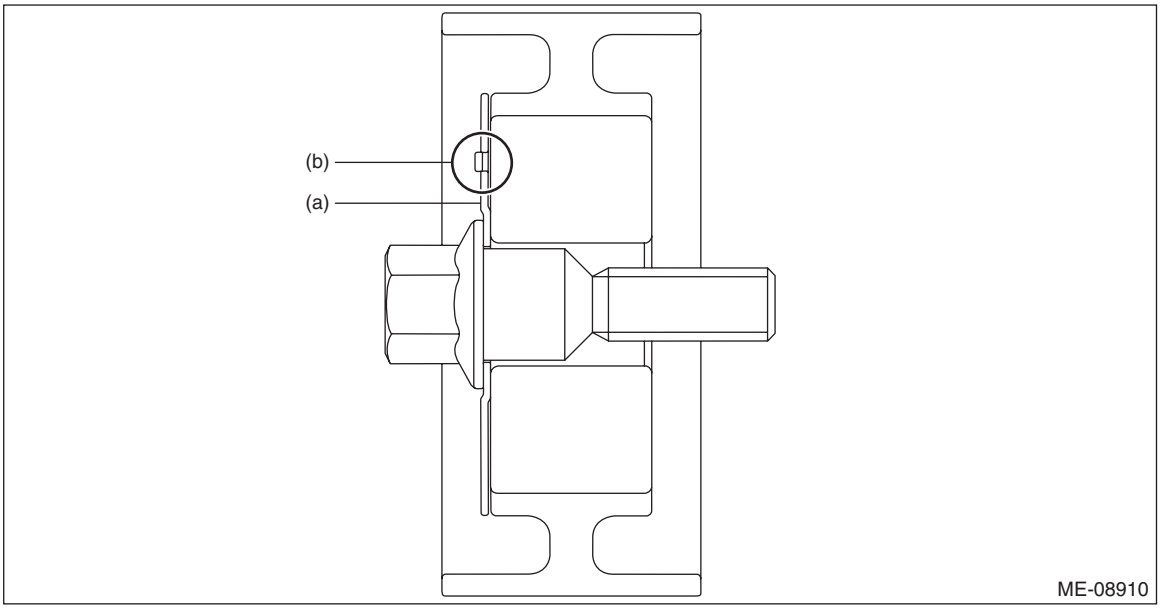
- Use a new O-ring to the oil level gauge guide.
- Apply a light coat of engine oil to the O-rings of the oil level gauge guide and the oil level gauge.

Tightening torque:
T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
T2: 36 N·m (3.7 kgf-m, 26.6 ft-lb)



7) Install the idler pulley (D), crank pulley boss (C) and oil level gauge guide (B), and insert the oil level gauge (A). (HEV model)

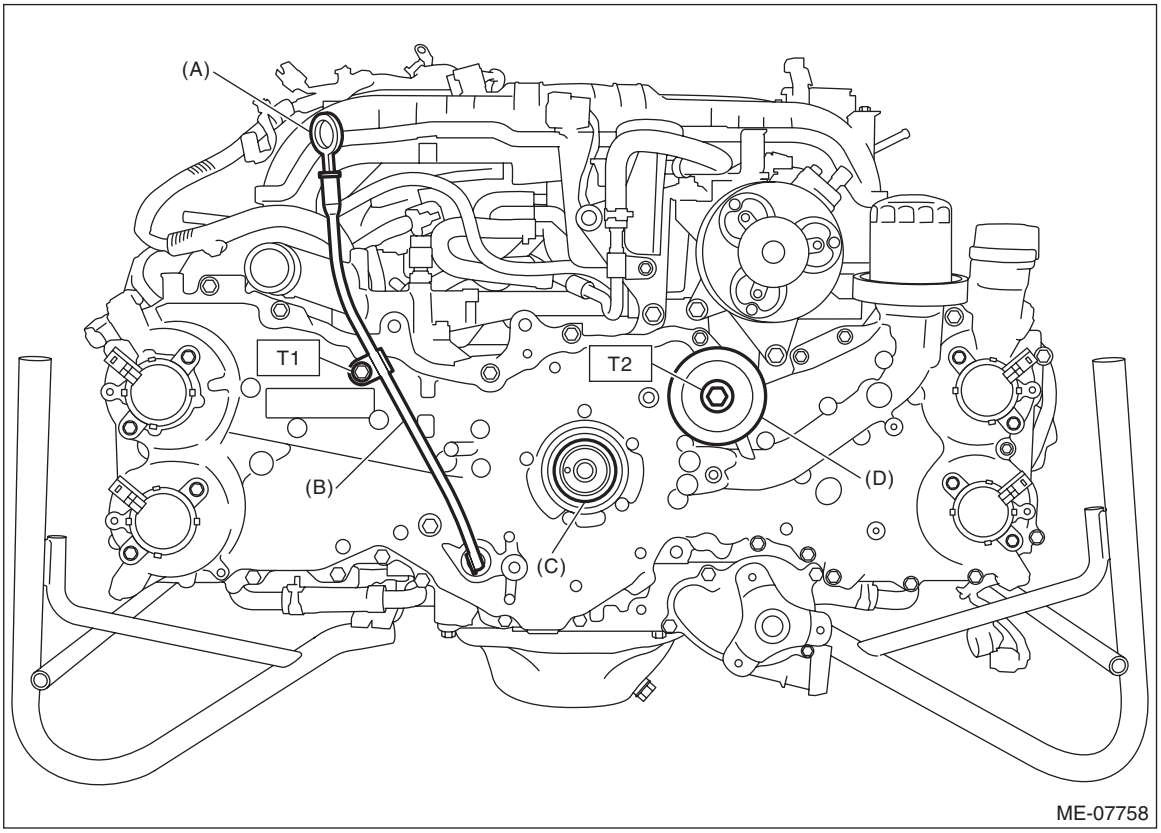
NOTE:
- When installing the idler pulley, be careful of the idler pulley cover direction.



(a) Idler pulley cover (b) Protrusion (3 places)

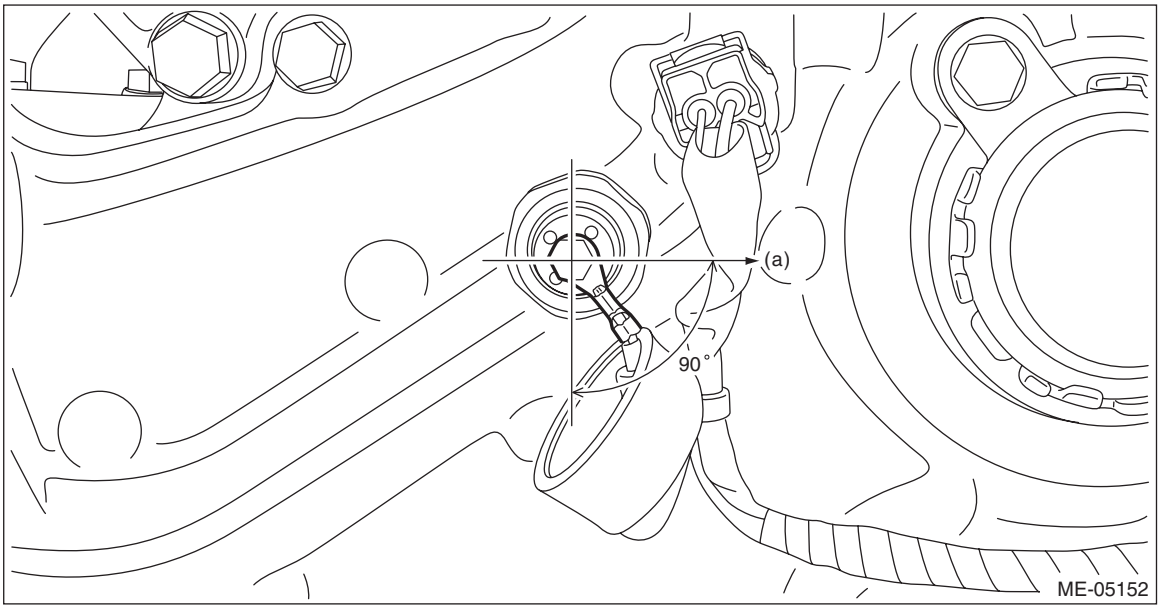
- Use a new O-ring to the oil level gauge guide.
- Apply a light coat of engine oil to the O-rings of the oil level gauge guide and the oil level gauge.

Tightening torque:
T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
T2: 36 N·m (3.7 kgf-m, 26.6 ft-lb)



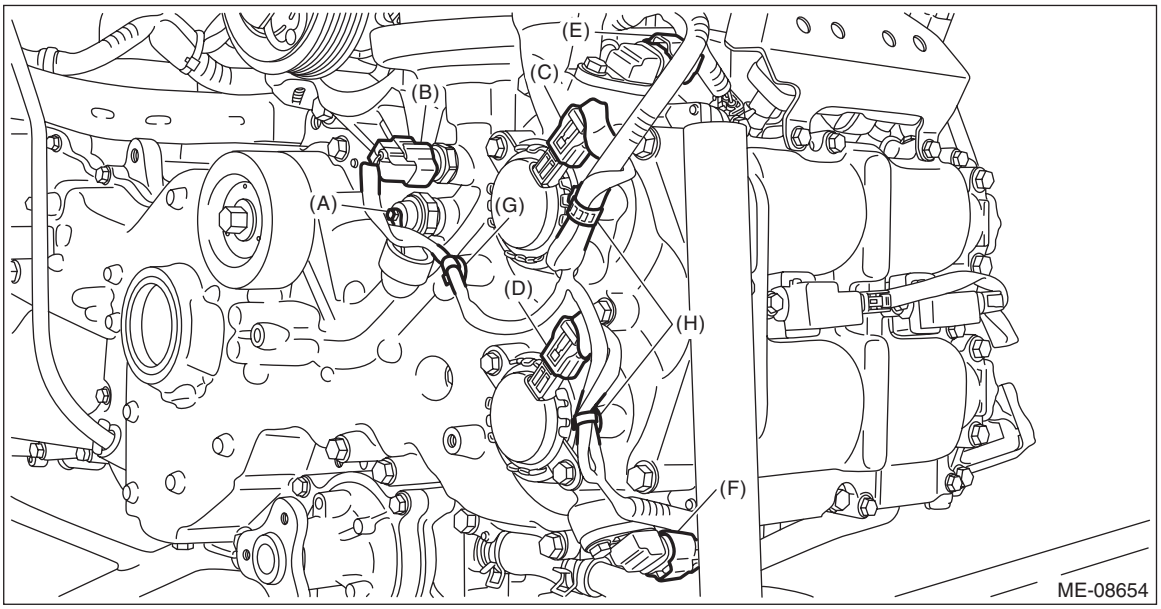
8) Connect the terminal (A) to the oil pressure switch, connector (B) to the engine oil temperature sensor, connector (C) to the intake oil control solenoid LH, connector (D) to the exhaust oil control solenoid LH, connector (E) to the intake camshaft position sensor LH, and connector (F) to the exhaust camshaft position sensor LH, and secure the engine harness with the clips (G) and (H).

NOTE:
The oil pressure switch harness must be positioned toward the left lower side of the vehicle within the range of 90°.

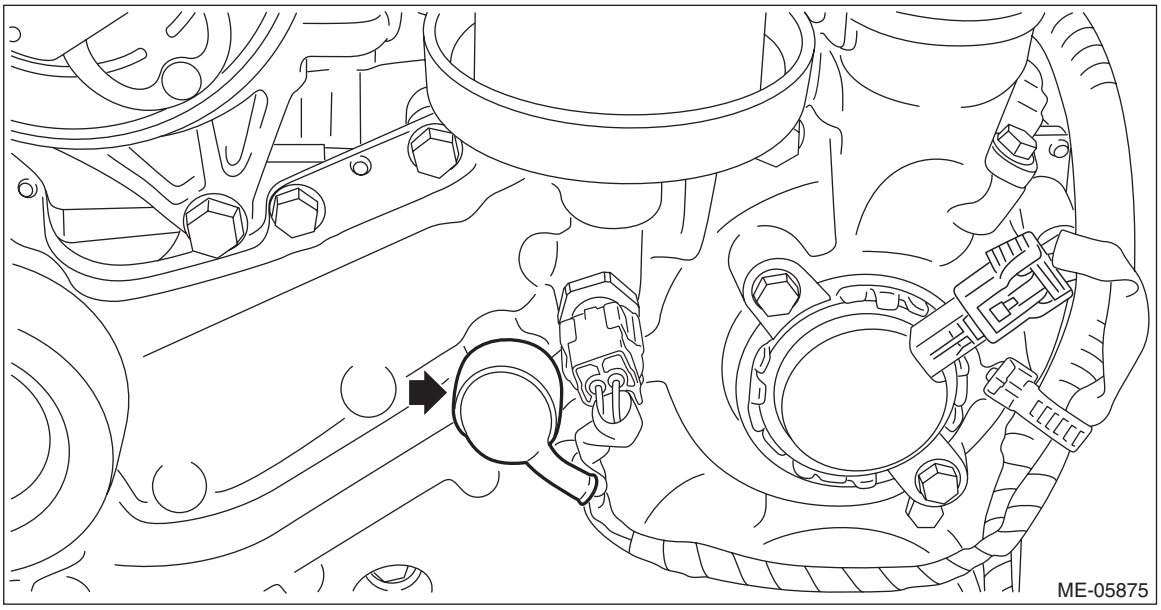


(a) Left side of vehicle

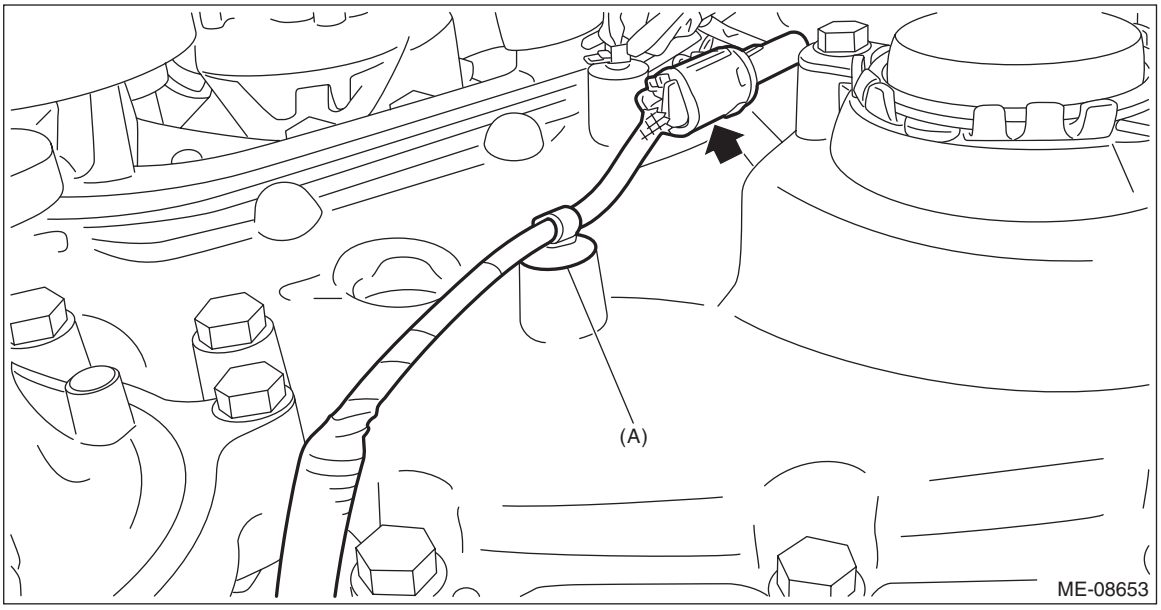
Tightening torque:
1.5 N·m (0.2 kgf-m, 1.1 ft-lb)



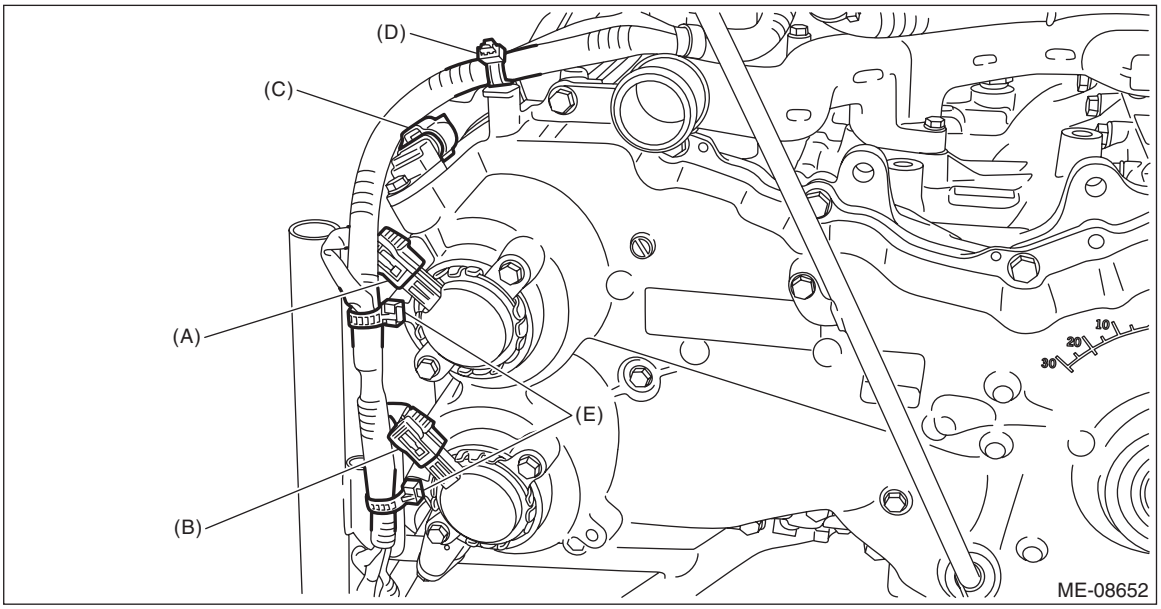
9) Attach the rubber cap to the oil pressure switch.



10) Secure the oil level switch harness with clips (A), and connect the connectors to the oil level switch.

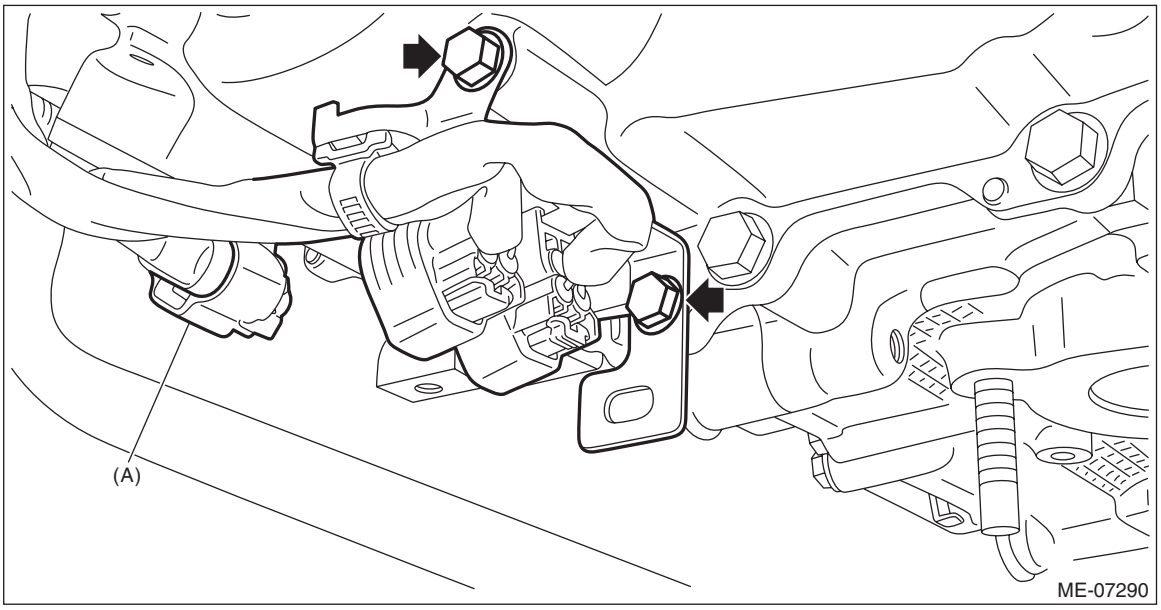


11) Connect the connector (A) to the intake oil control solenoid RH, connector (B) to the exhaust oil control solenoid RH, and connector (C) to the intake camshaft position sensor RH, and then secure the engine harness with the clips (D) (gasoline engine model) and the clips (E).



12) Connect the connector (A) to the exhaust camshaft position sensor RH, and install the engine harness stay to the chain cover.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



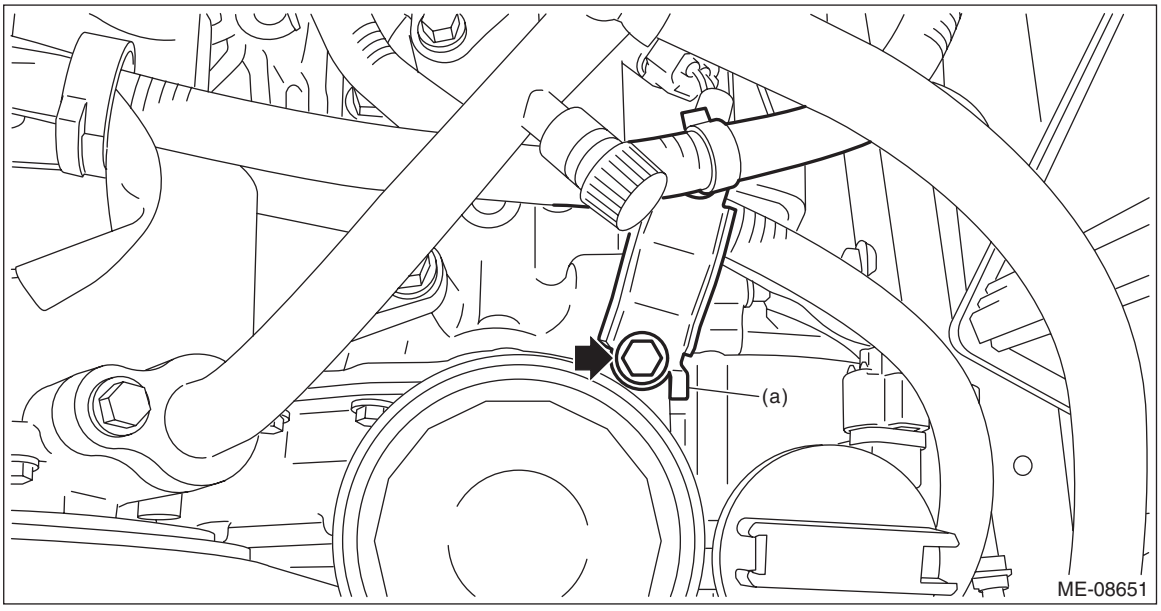
13) Install the crank pulley. <Ref. to ME(H4DO(w/o HEV))-142, INSTALLATION, Crank Pulley.>
14) Install the water pump pulley. <Ref. to CO(H4DO(w/o HEV))-22, WATER PUMP, INSTALLATION, Water Pump.>
15) Fill engine oil. <Ref. to LU(H4DO(w/o HEV))-13, REPLACEMENT, Engine Oil.>
16) Install the generator. (Gasoline engine model) <Ref. to SC(H4DO(w/o HEV))-34, INSTALLATION, Generator.>
17) Install the ISG. (HEV model) <Ref. to SC(H4DO(HEV))-35, INSTALLATION, Integrated Starter Generator (ISG).>

18) When working on the vehicle

NOTE:
When working on the vehicle, perform the following steps also.
(1) Install the radiator. <Ref. to CO(H4DO(w/o HEV))-82, INSTALLATION, Radiator.>
(2) Install the front exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-8, INSTALLATION, Front Exhaust Pipe.>
(3) Install the generator cord stay to the chain cover. (Gasoline engine model)

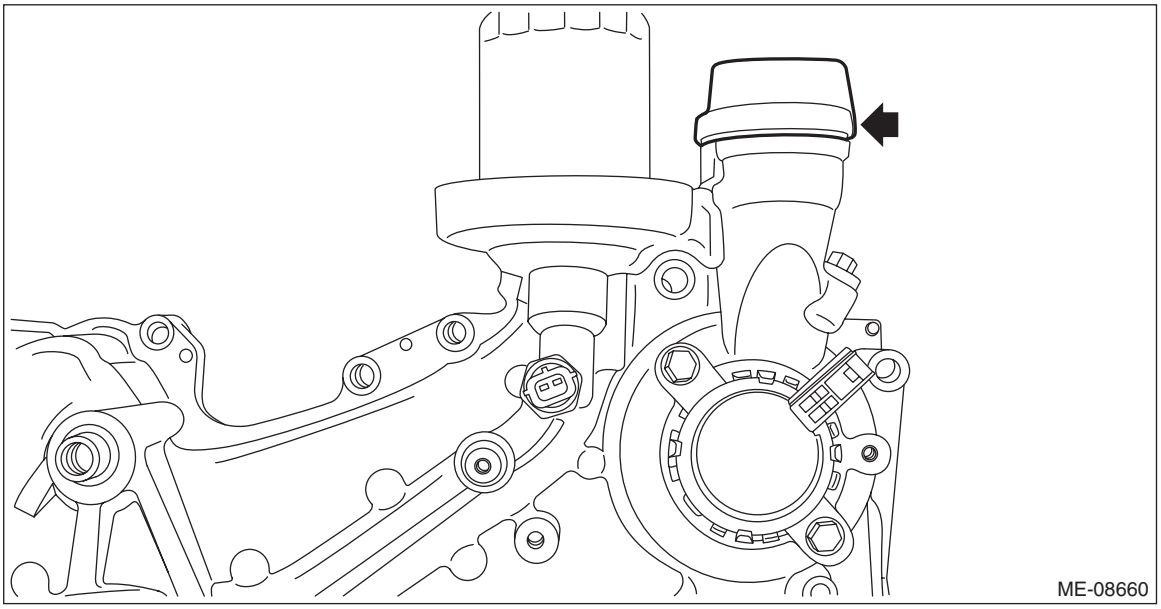
NOTE:
Install the generator cord stay so that the folded end (a) touches the chain cover boss.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



C: DISASSEMBLY

1) Remove the oil filler cap.

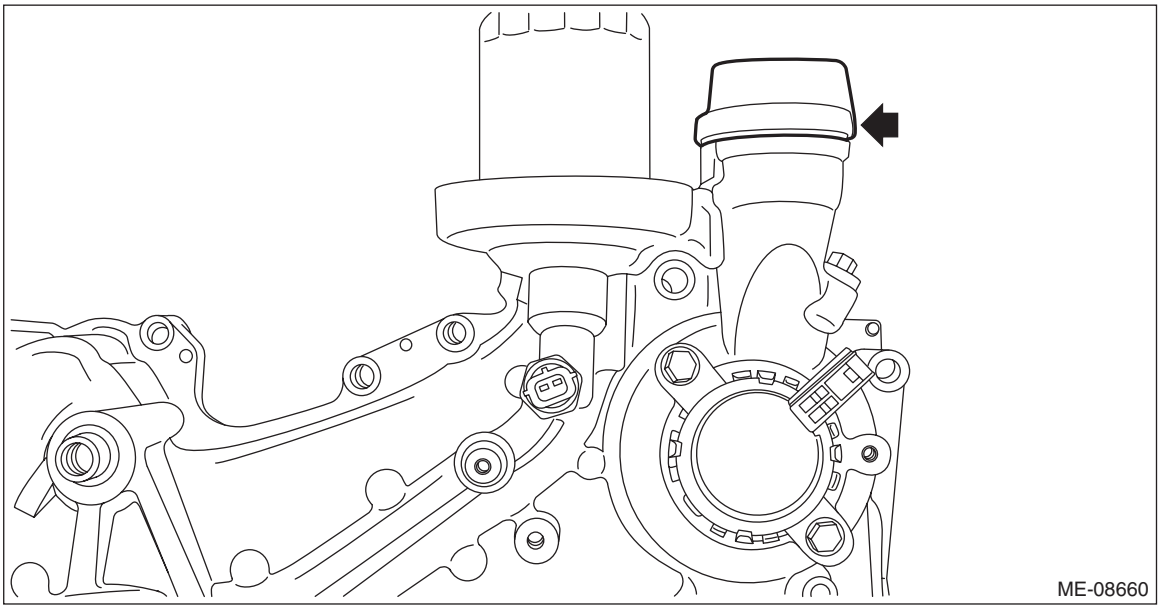


2) Remove the engine oil filter and the oil pump union. <Ref. to LU(H4DO(w/o HEV))-29, REMOVAL, Engine Oil Filter.>
3) Remove the oil pressure switch. <Ref. to LU(H4DO(w/o HEV))-25, REMOVAL, Oil Pressure Switch.>

4) Remove the engine oil temperature sensor. <Ref. to FU(H4DO(w/o HEV))-53, REMOVAL, Engine Oil Temperature Sensor.> <Ref. to FU(H4DO(HEV))-44, REMOVAL, Engine Oil Temperature Sensor.>
5) Remove the oil control solenoid. <Ref. to FU(H4DO(w/o HEV))-64, REMOVAL, Oil Control Solenoid.> <Ref. to FU(H4DO(HEV))-56, REMOVAL, Oil Control Solenoid.>
6) Remove the camshaft position sensor. <Ref. to FU(H4DO(w/o HEV))-59, REMOVAL, Camshaft Position Sensor.> <Ref. to FU(H4DO(HEV))-52, REMOVAL, Camshaft Position Sensor.>

D: ASSEMBLY

1) Install the camshaft position sensor. <Ref. to FU(H4DO(w/o HEV))-61, INSTALLATION, Camshaft Position Sensor.> <Ref. to FU(H4DO(HEV))-53, INSTALLATION, Camshaft Position Sensor.>
2) Install the oil control solenoid. <Ref. to FU(H4DO(w/o HEV))-66, INSTALLATION, Oil Control Solenoid.> <Ref. to FU(H4DO(HEV))-58, INSTALLATION, Oil Control Solenoid.>
3) Install the engine oil temperature sensor. <Ref. to FU(H4DO(w/o HEV))-53, INSTALLATION, Engine Oil Temperature Sensor.> <Ref. to FU(H4DO(HEV))-44, INSTALLATION, Engine Oil Temperature Sensor.>
4) Install the oil pressure switch. <Ref. to LU(H4DO(w/o HEV))-27, INSTALLATION, Oil Pressure Switch.>
5) Install the engine oil filter and the oil pump union. <Ref. to LU(H4DO(w/o HEV))-30, INSTALLATION, Engine Oil Filter.>
6) Install the oil filler cap.



E: INSPECTION

Check that the chain cover does not have deformation, cracks and any other damage.

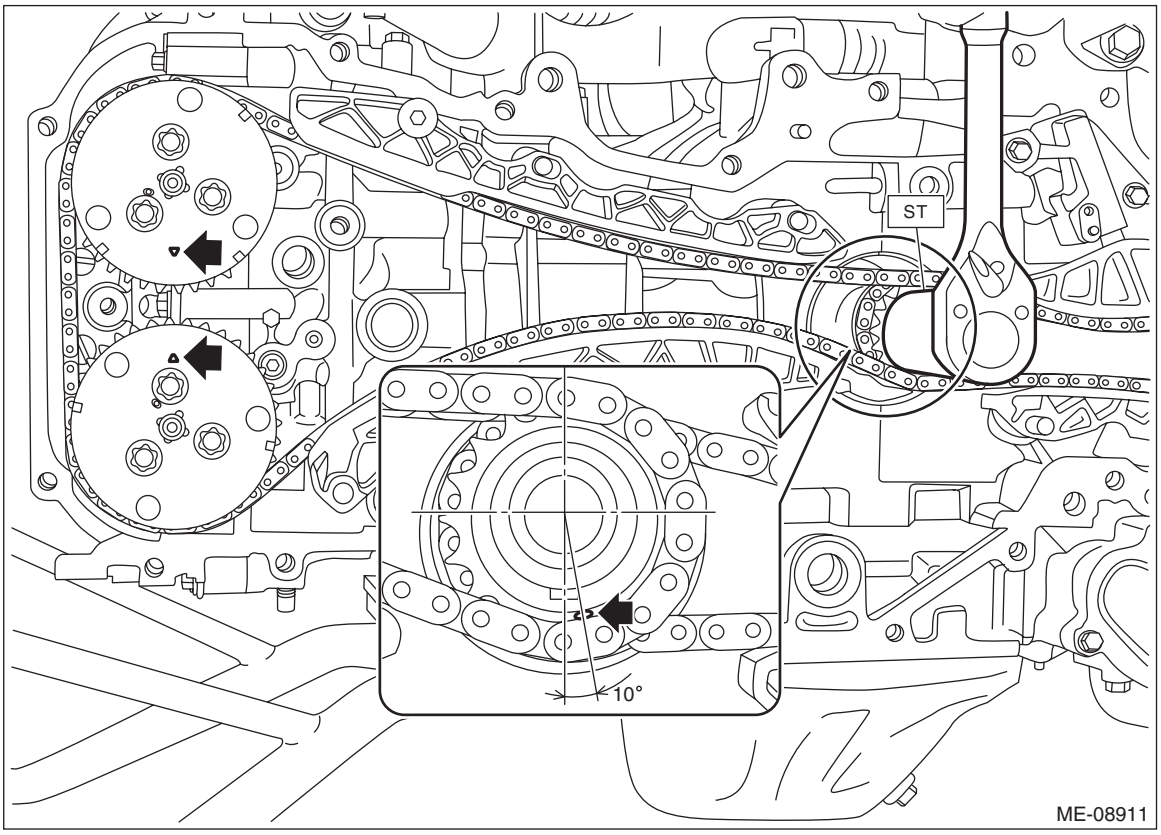
15.Timing Chain Assembly

A: REMOVAL

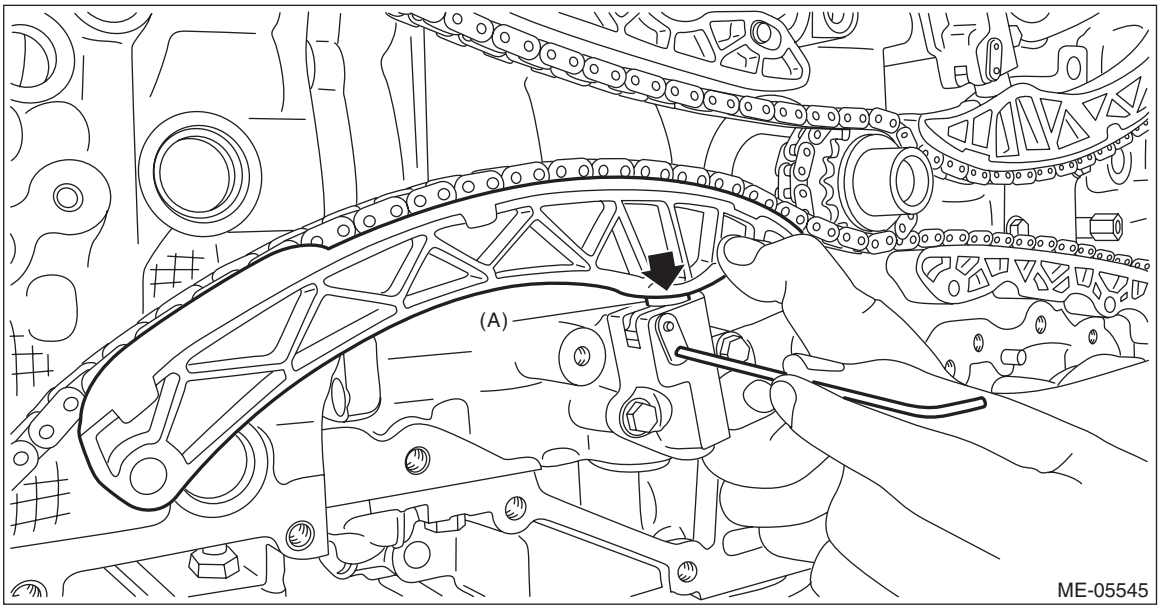
1. TIMING CHAIN RH

NOTE:
When replacing a single part, perform the work with the engine assembly installed to body.
1) Remove the chain cover. <Ref. to ME(H4DO(w/o HEV))-149, REMOVAL, Chain Cover.>
2) Using ST and by turning the crankshaft, align the alignment marks of crank sprocket, intake cam sprocket RH and exhaust cam sprocket RH to the positions as shown in the figure.

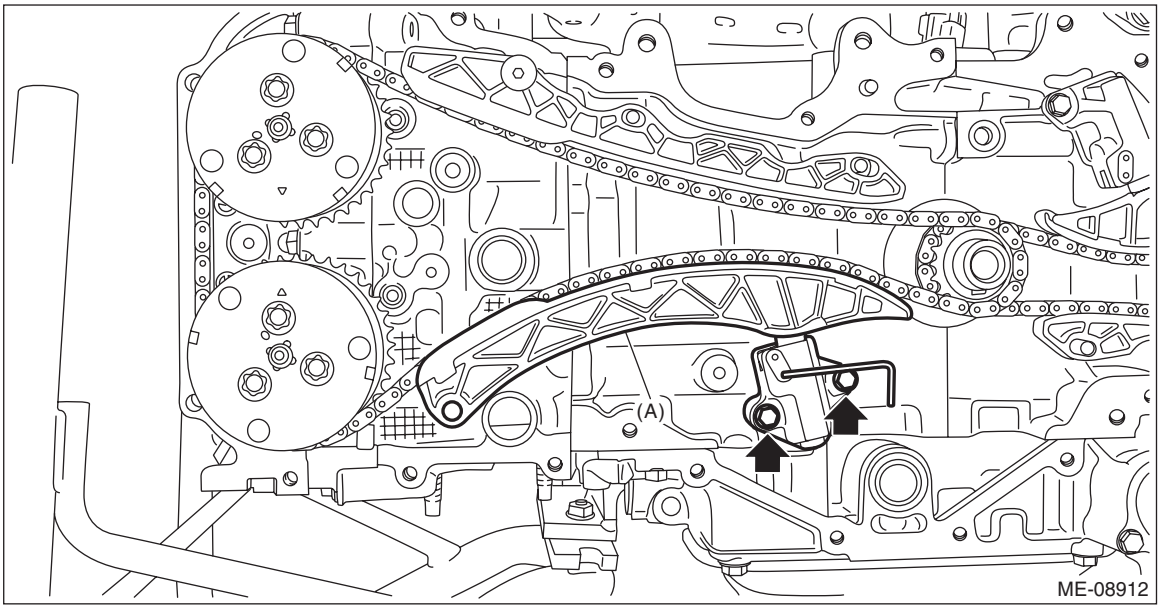
NOTE:
If the alignment marks are aligned to the positions as shown in the figure, the crankshaft key is located at six o'clock position.
ST 18252AA000 CRANKSHAFT SOCKET



3) Push down the chain lever tensioner RH, and with a 2.5 mm (0.98 in) dia. stopper pin or a 2.5 mm (0.98 in) dia. hex wrench inserted into the stopper pin hole in the chain tensioner RH, secure the plunger (A).



4) Remove the chain tensioner RH, and remove the chain tensioner lever RH (A).

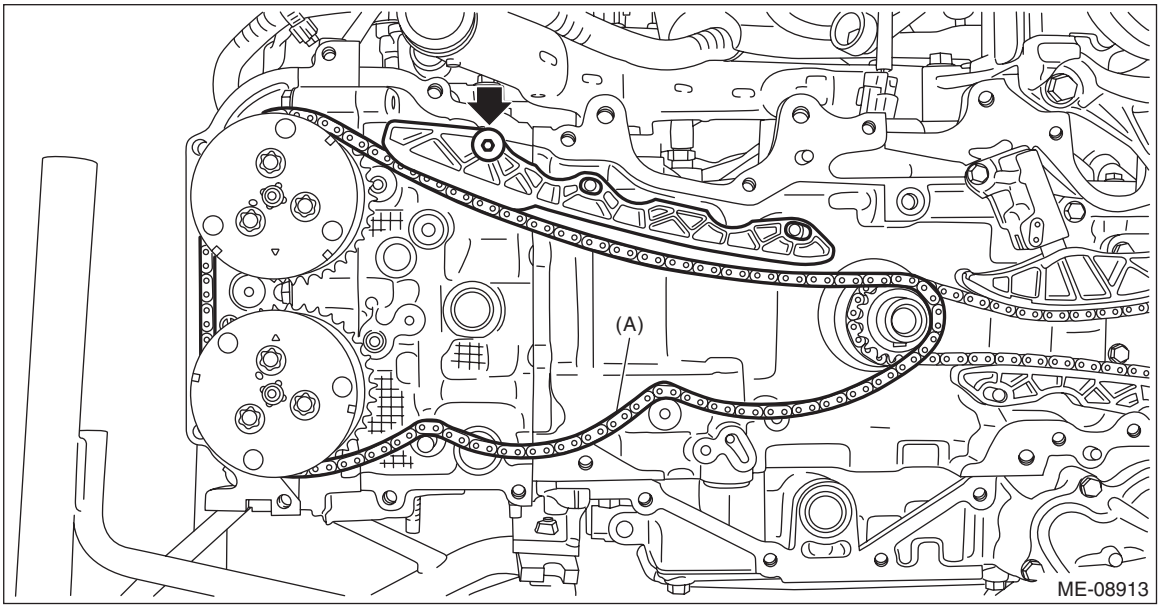


5) Remove the chain guide RH, and remove the timing chain RH (A).

CAUTION:

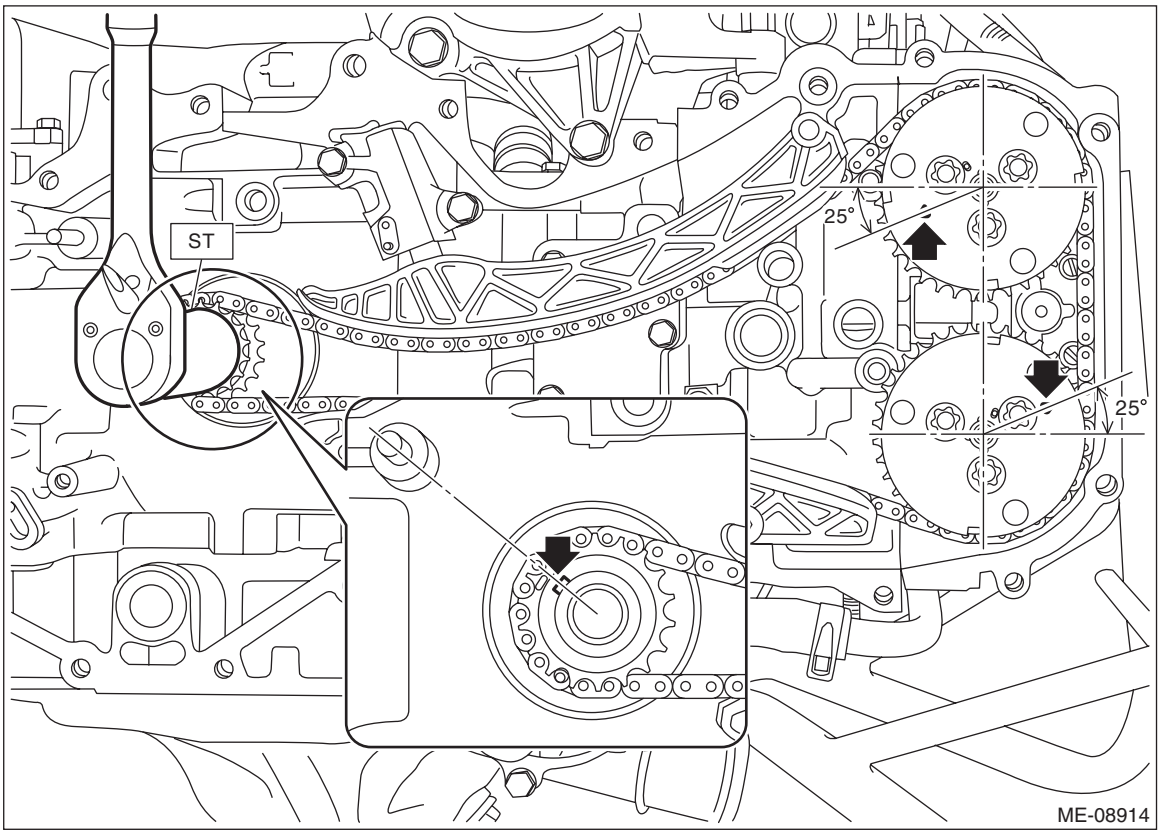
- **If the timing chain RH is not installed, the intake camshaft RH and exhaust camshaft RH are kept at zero-lift position. All cams on the camshaft are not pressing down the roller rocker arm (intake valve and exhaust valve). (Under this condition, all valves remain unlifted.)**
- **Intake camshaft RH and exhaust camshaft RH can be independently rotated with the timing chain RH removed. When the intake valve and exhaust valve lift at the same time, the valve heads contact each other and valve stem may bend. Do not turn it to the outside of range of zero-lift (in range where it can be turned lightly by hand).**

NOTE:
To avoid mixing with LH side, keep the removed part in order.

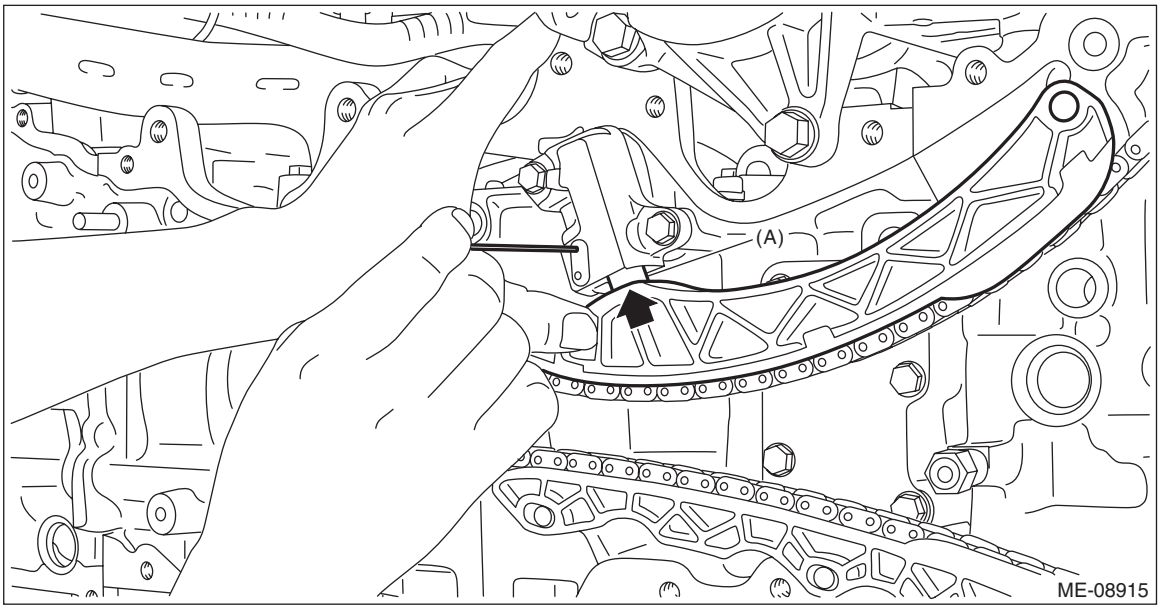


2. TIMING CHAIN LH

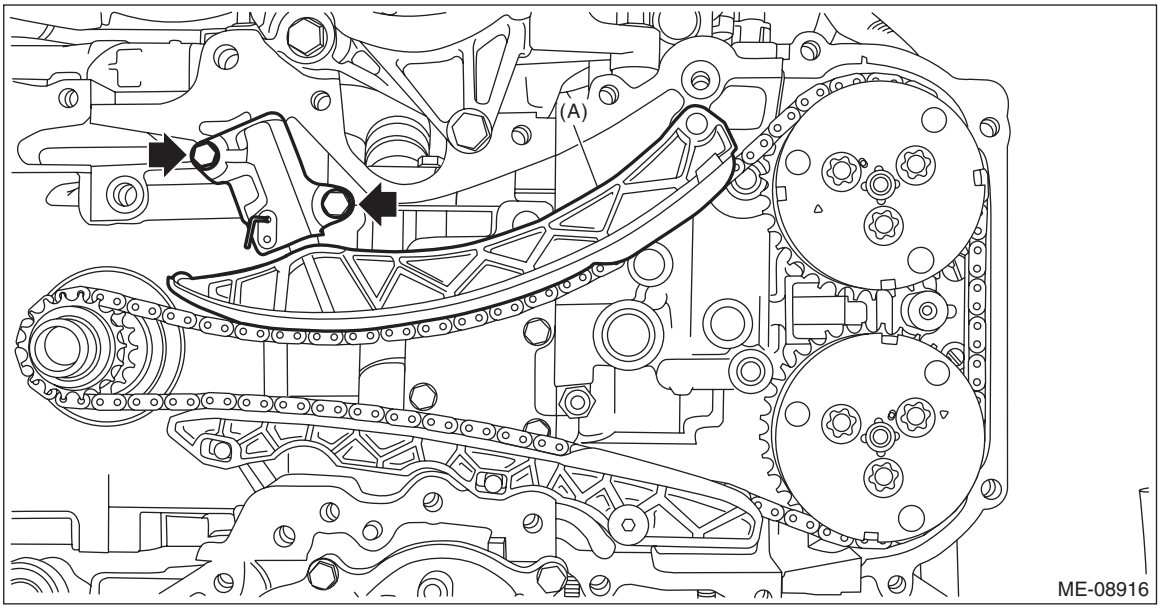
1) Remove the timing chain RH. <Ref. to ME(H4DO(w/o HEV))-169, TIMING CHAIN RH, REMOVAL, Timing Chain Assembly.>
2) Using ST and by turning the crankshaft, align the alignment marks of crankshaft key, intake cam sprocket LH and exhaust cam sprocket LH to the positions as shown in the figure.
ST 18252AA000 CRANKSHAFT SOCKET



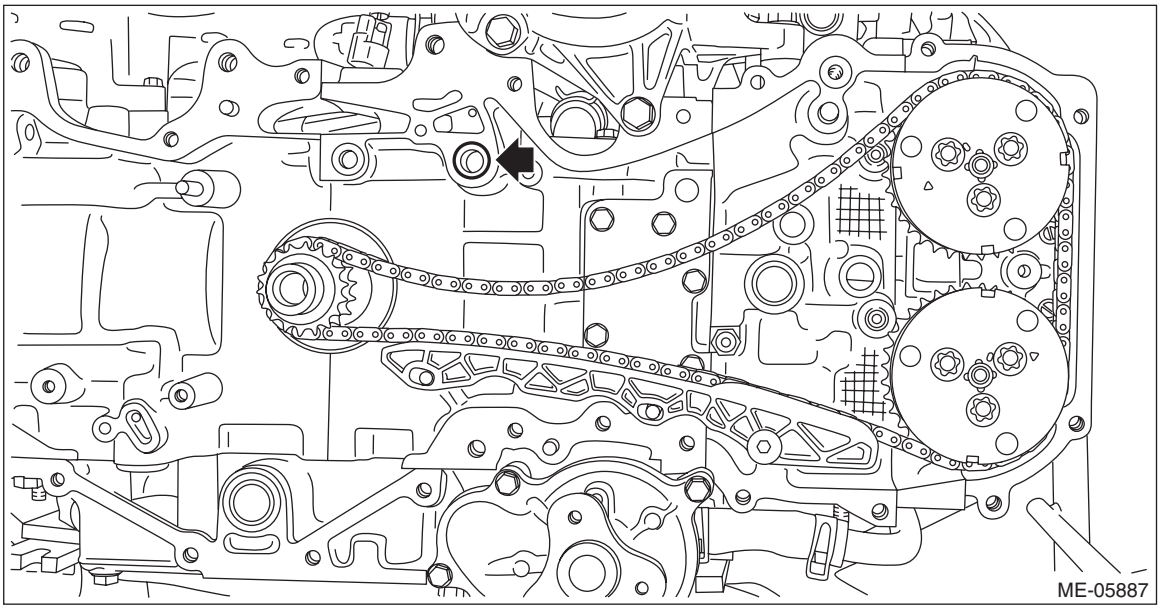
3) Push down the chain lever tensioner LH, and with a 1.3 mm (0.05 in) dia. stopper pin or a 1.3 mm (0.05 in) dia. hex wrench inserted into the stopper pin hole in the chain tensioner LH, secure the plunger (A).



4) Remove the chain tensioner LH, and remove the chain tensioner lever LH (A).



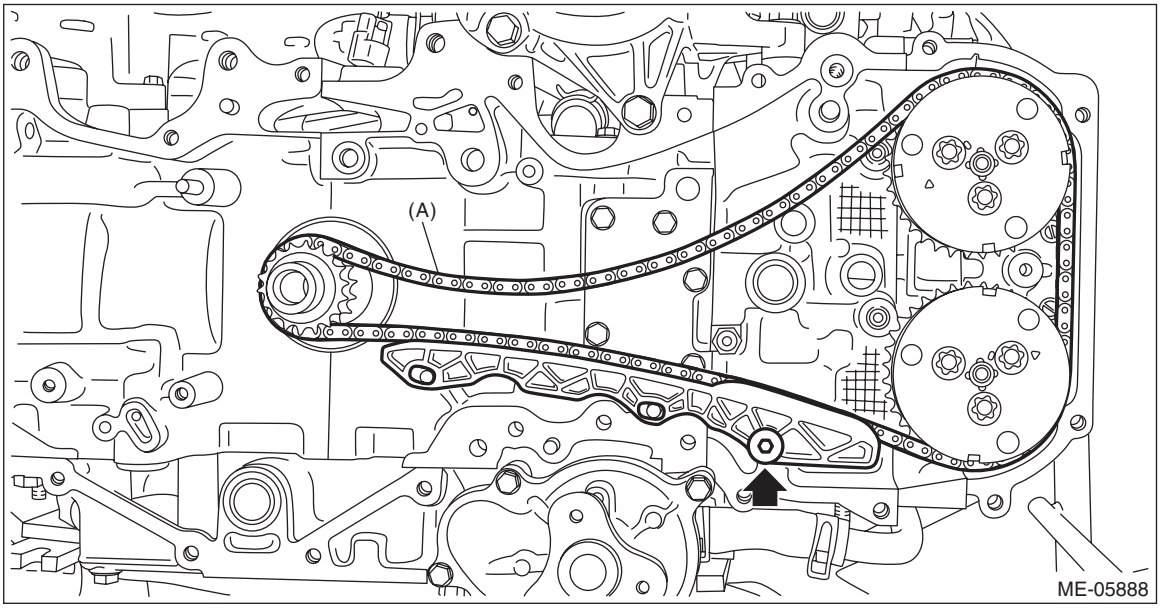
5) Remove the O-ring from the cylinder block LH.



6) Remove the chain guide LH, and remove the timing chain LH (A).

CAUTION:
• If the timing chain LH is not installed, the exhaust camshaft LH is kept at zero-lift position. All cams on the exhaust camshaft LH are not pressing down the roller rocker arm (exhaust valve). (Under this condition, exhaust valves remain unlifted.)
• Intake camshaft LH is kept at lift position. All cams on the intake camshaft LH are pressing down the roller rocker arm (intake valve). (Under this condition, intake valves remain lifted.)
• Intake camshaft LH and exhaust camshaft RH can be independently rotated with the timing chain LH removed. When the exhaust camshaft LH is turned, the valve heads contact each other and valve stem may bend as described in above. Do not turn the exhaust camshaft LH to the outside of range of zero-lift (in range where it can be turned lightly by hand).
• #1 piston and #4 piston are located near TDC. If the intake camshaft LH is turned, the valve and the piston may contact and valve stem may bend. Do not turn the intake camshaft LH at this time.

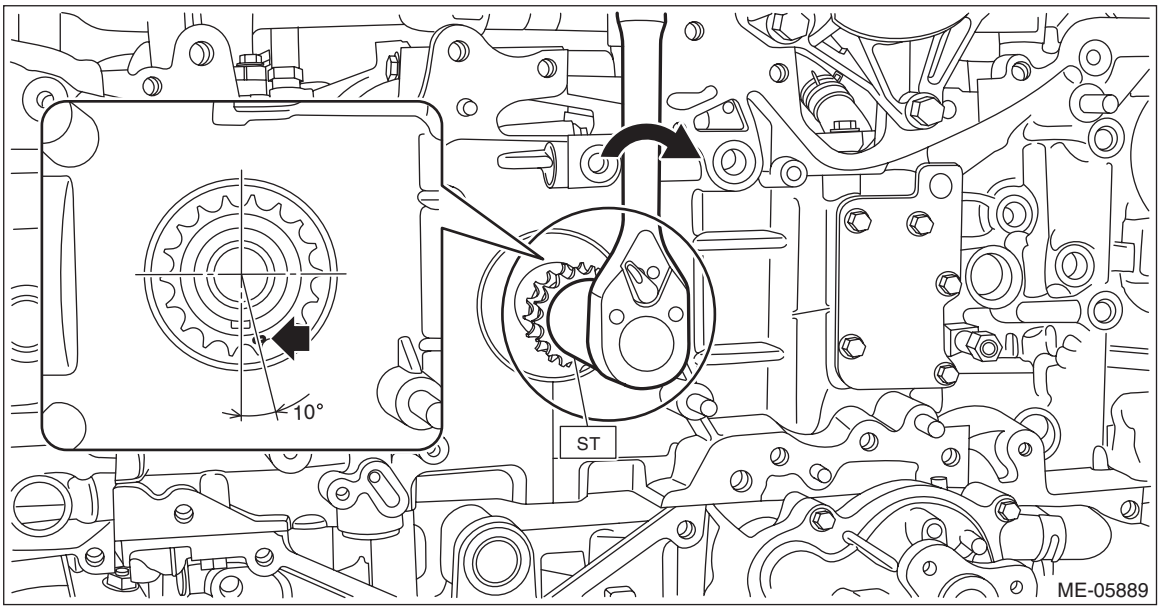
NOTE:
To avoid mixing with RH side, keep the removed part in order.



7) Using ST and by turning the crankshaft approximately 200° clockwise, align the alignment marks of crank sprocket to the positions as shown in the figure.

CAUTION:
• This procedure is required to prevent the valve and piston contacting with each other, by moving the all pistons to the middle of the cylinders.
• Never turn counterclockwise because the valve and piston may contact. Counterclockwise turn is allowed only when adjusting precisely the alignment marks, after turning the crank sprocket alignment mark clockwise near the position as shown in the figure.

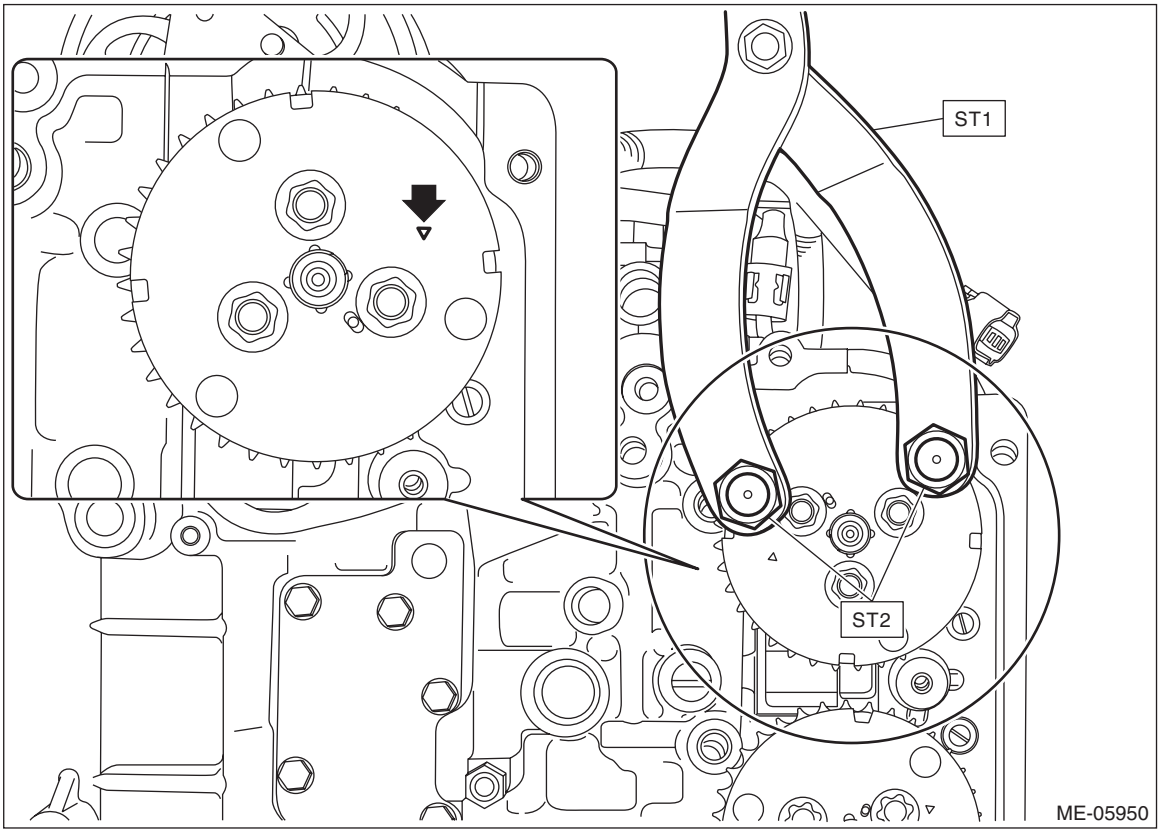
ST 18252AA000 CRANKSHAFT SOCKET



8) Using ST and by turning the intake cam sprocket LH approximately 180°, align the alignment marks of intake cam sprocket LH to the positions (zero-lift position) as shown in the figure.

CAUTION:
• After this work, when the intake valve and exhaust valve lift at the same time, the valve heads contact each other and valve stem may bend. Do not turn the intake camshaft LH and exhaust camshaft LH to the outside of range of zero-lift (in range where it can be turned lightly by hand).
• For gasoline engine models, perform the operation carefully since the ST comes off easily.

ST1 18355AA000 PULLEY WRENCH
ST2 18334AA020 PULLEY WRENCH PIN SET (gasoline engine model)
ST2 18334AA030 PULLEY WRENCH PIN SET (HEV model)

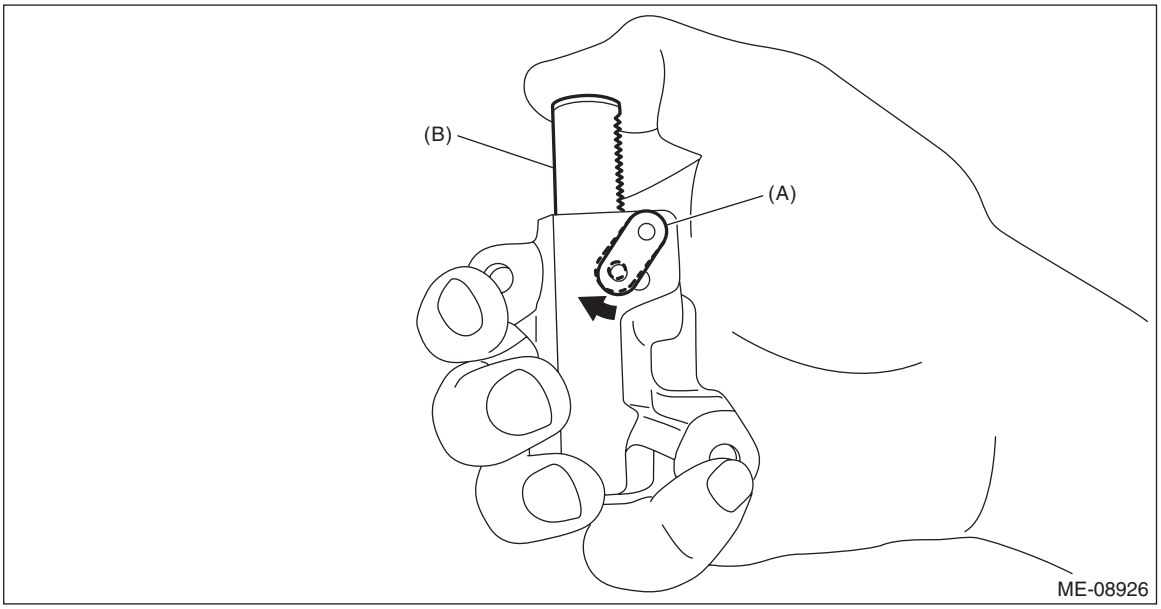


B: INSTALLATION

1. TIMING CHAIN LH

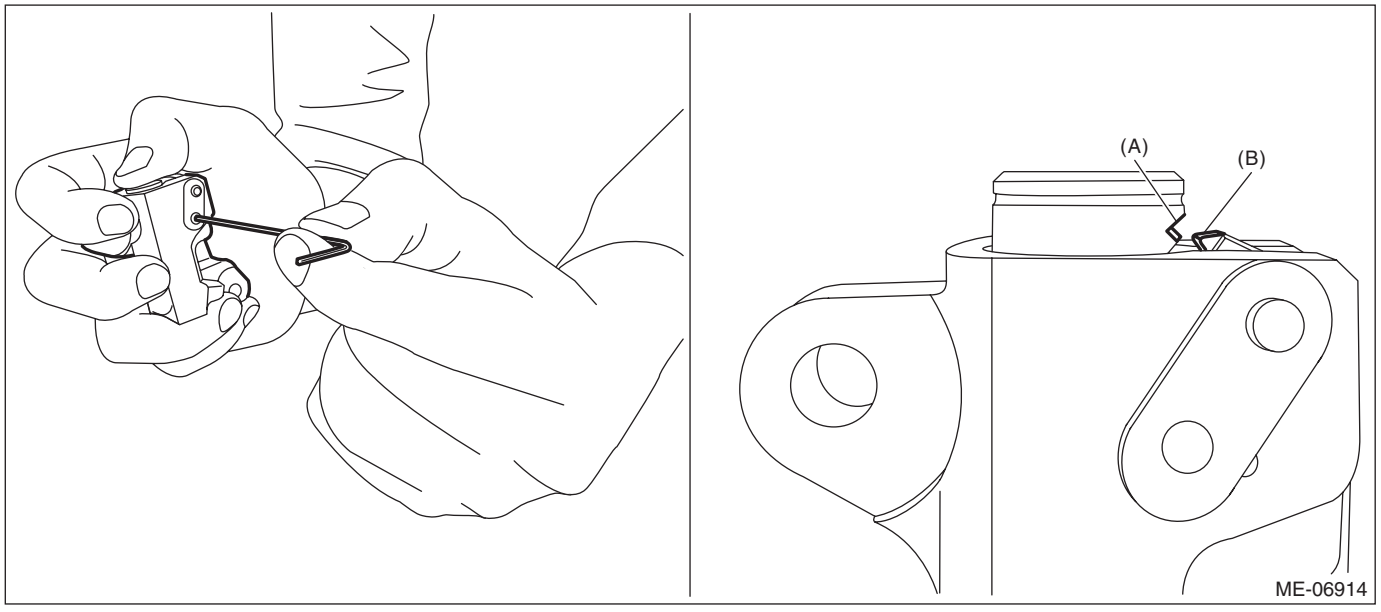
NOTE:
- Be careful that the foreign matter is not into or onto the assembled component during installation.
- Apply engine oil to all component parts of the timing chain.

1) Prepare to attach the chain tensioner LH.
   (1) Move the link plate (A) in the direction of arrow to press in the plunger (B).



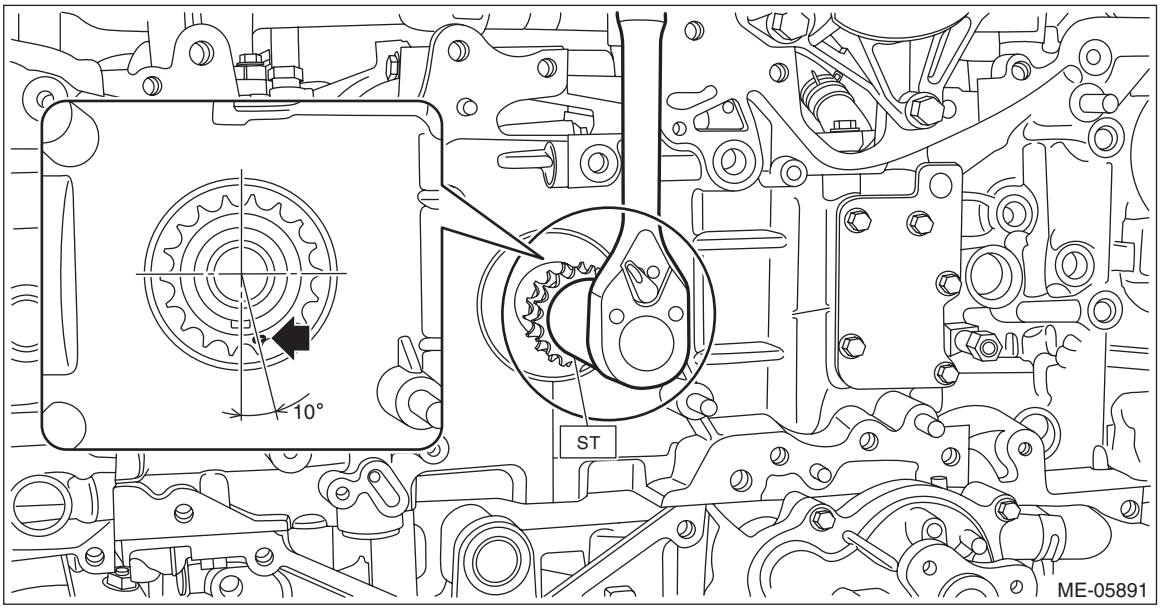
   (2) With a 1.3 mm (0.05 in) dia. stopper pin or a 1.3 mm (0.05 in) (nominal) dia. hex wrench inserted into the stopper pin hole, secure the plunger.

NOTE:
If the stopper pin hole on the link plate and the stopper pin hole on the chain tensioner are not aligned, check that the first notch of plunger rack (A) is engaged with the stopper tooth (B). If not engaged, retract the plunger a little so that the first notch of plunger rack (A) is engaged with the stopper tooth (B).



2) Check that the crank sprocket is located at the position shown in the figure. If not aligned, using ST turn the crankshaft to align the crank sprocket alignment mark to the position shown in the figure.

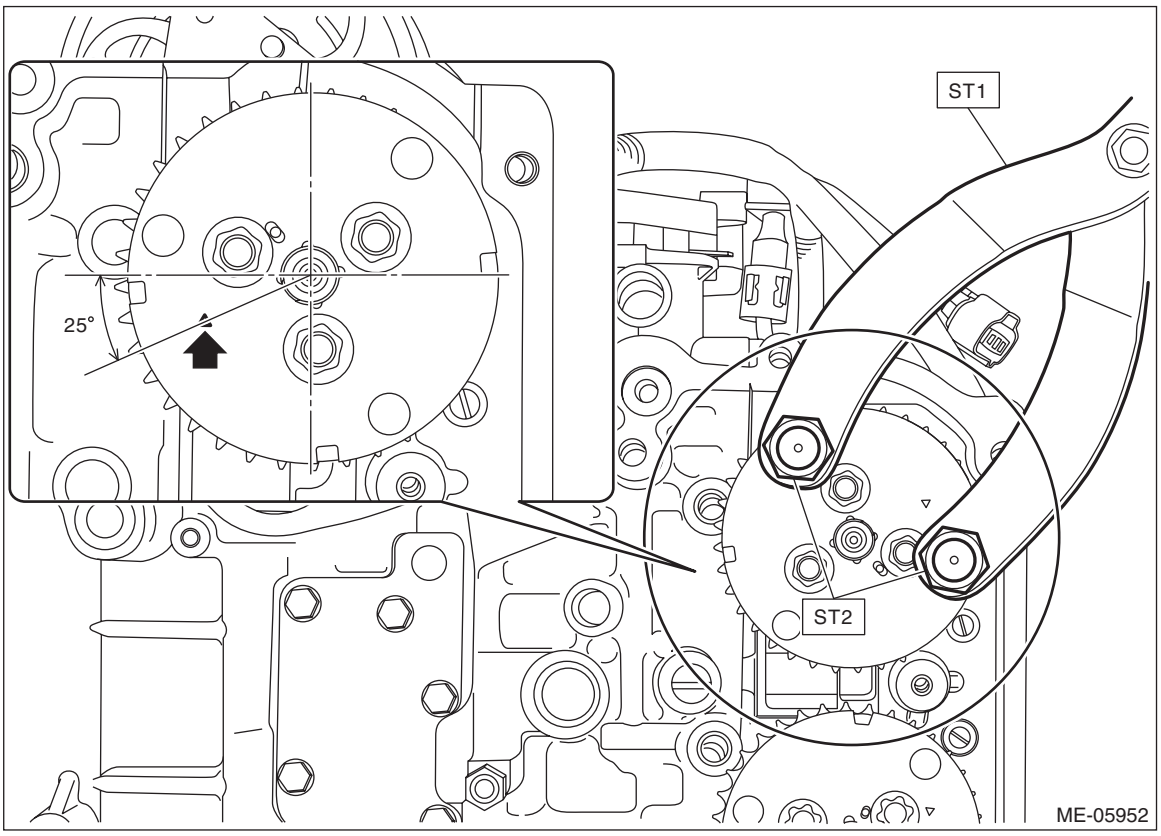
NOTE:
This procedure is required to prevent the valve and piston contacting with each other in the next step.
ST 18252AA000 CRANKSHAFT SOCKET



3) Using ST and by turning the intake cam sprocket LH, align the alignment marks to the positions as shown in the figure.

CAUTION:
• When the intake valve and exhaust valve lift at the same time, the valve heads contact each other and valve stem may bend. Do not turn the exhaust camshaft LH.
• For gasoline engine models, perform the operation carefully since the ST comes off easily.

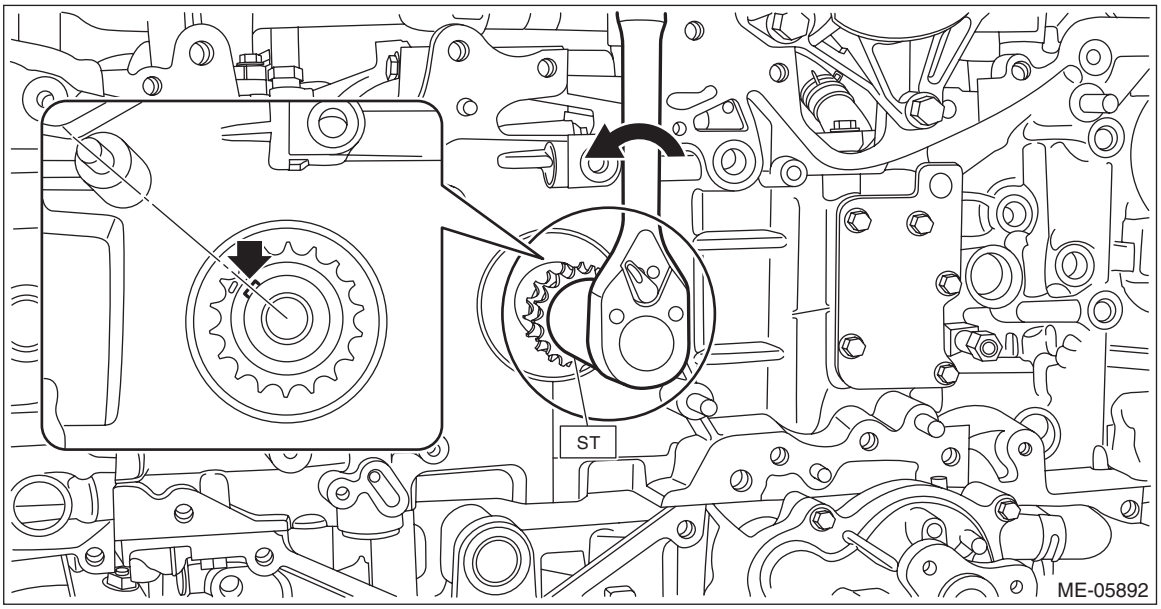
ST1 18355AA000 PULLEY WRENCH
ST2 18334AA020 PULLEY WRENCH PIN SET (gasoline engine model)
ST2 18334AA030 PULLEY WRENCH PIN SET (HEV model)



4) Using ST and by turning the crankshaft approximately 200° counterclockwise, align the alignment marks of crankshaft key to the positions as shown in the figure.

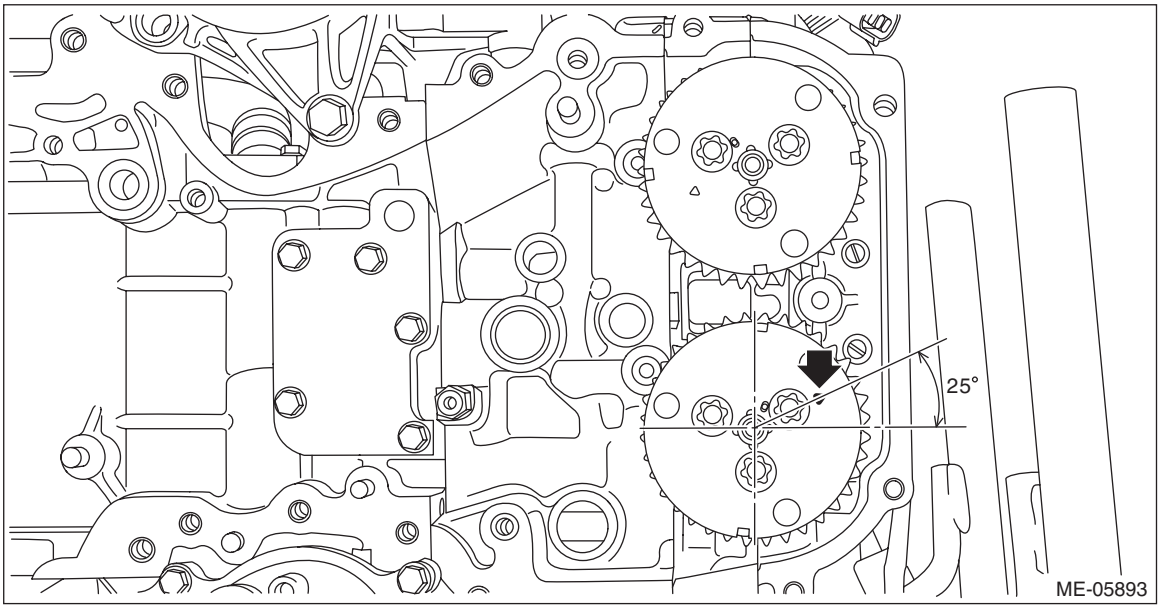
CAUTION:
Never turn clockwise because the valve and piston may contact. Clockwise turn is allowed only when adjusting the key position precisely, after turning the crankshaft counterclockwise to bring the key near the position as shown in the figure.

ST 18252AA000 CRANKSHAFT SOCKET



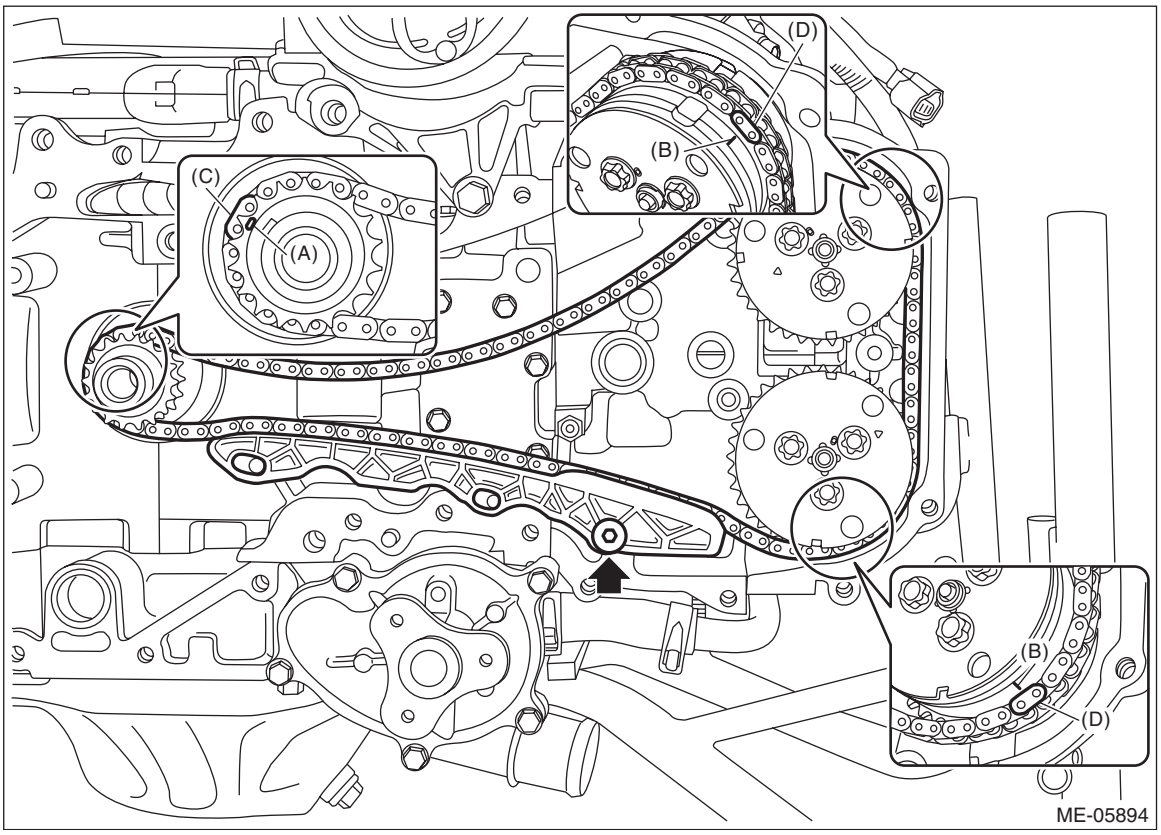
5) Align the alignment mark of exhaust cam sprocket LH to the position shown in the figure.

CAUTION:
To prevent valve damage, turn the exhaust cam sprocket LH only within the range of zero-lift (in range where it can be turned lightly by hand).



6) Install the timing chain LH and the timing chain guide LH.
   (1) Match the timing chain mark (blue) to the alignment mark of the crank sprocket.
   (2) Match the timing chain mark (pink) to the timing mark position of the intake cam sprocket LH.
   (3) Match the timing chain mark (pink) to the timing mark position of the exhaust cam sprocket LH.
   (4) Install timing chain guide LH.

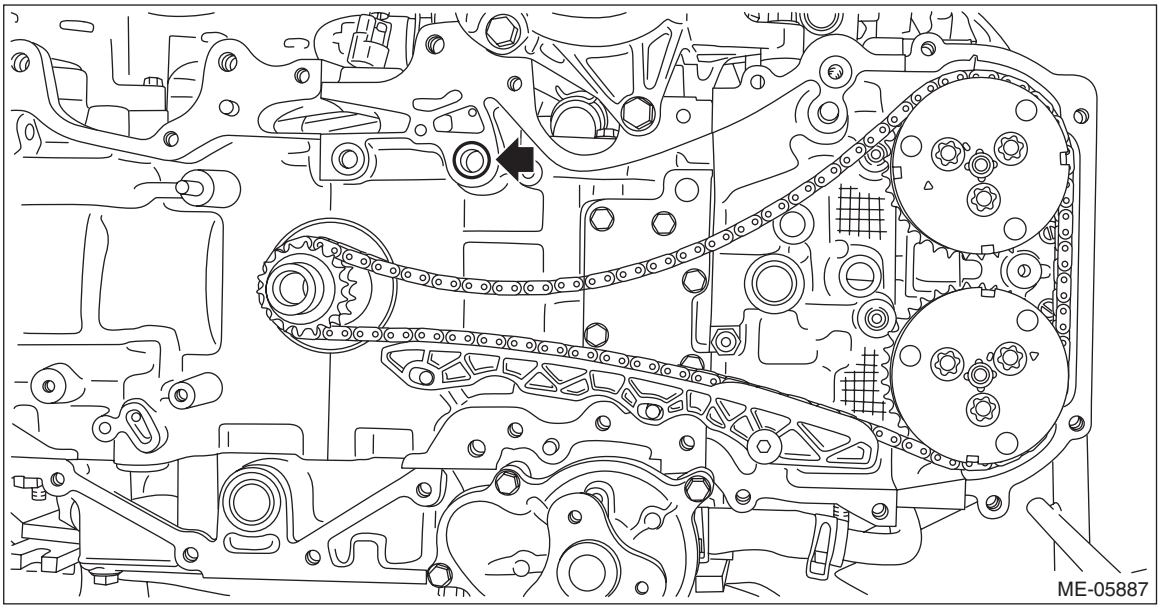
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



(A) Alignment mark
(B) Timing mark
(C) Blue
(D) Pink

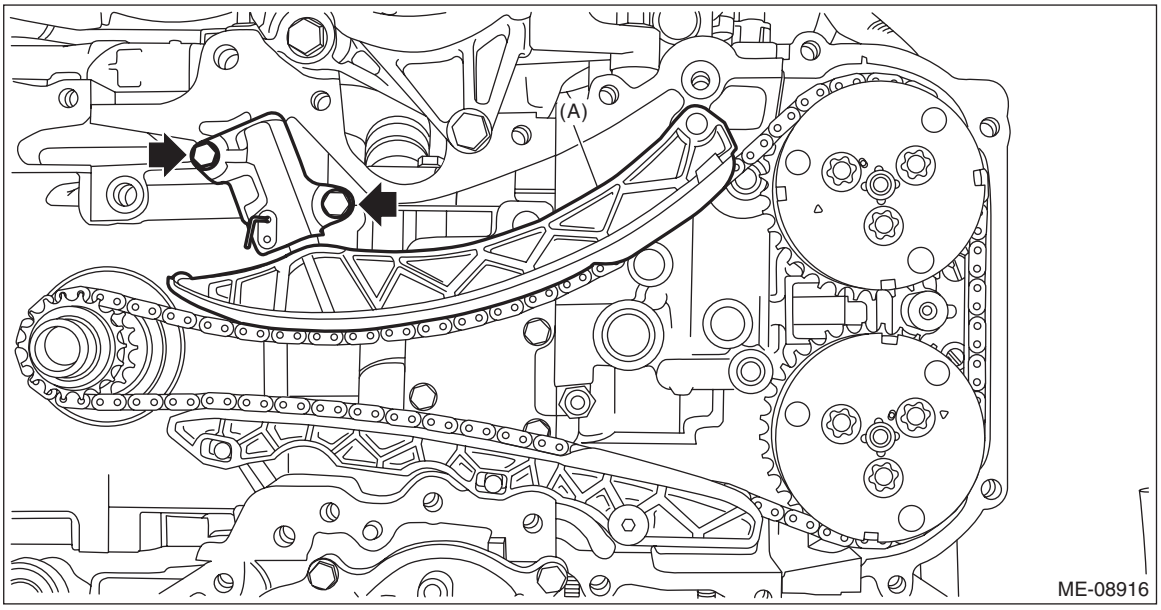
7) Install O-rings to the cylinder block LH.

NOTE:
Use new O-rings.



8) Install the chain tensioner lever LH (A) and chain tensioner LH.

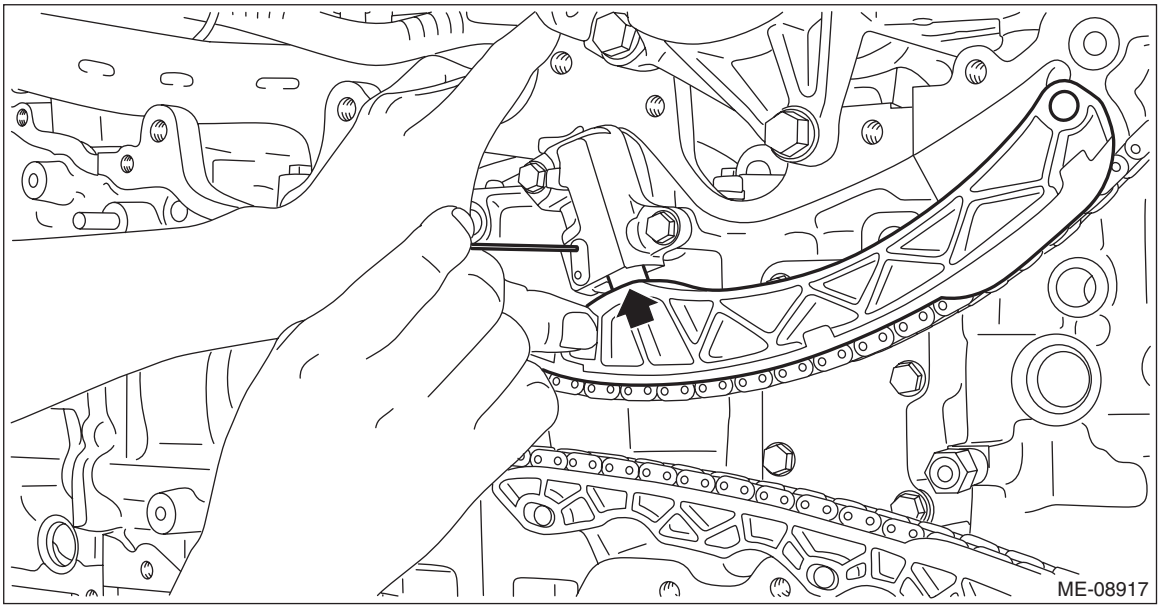
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

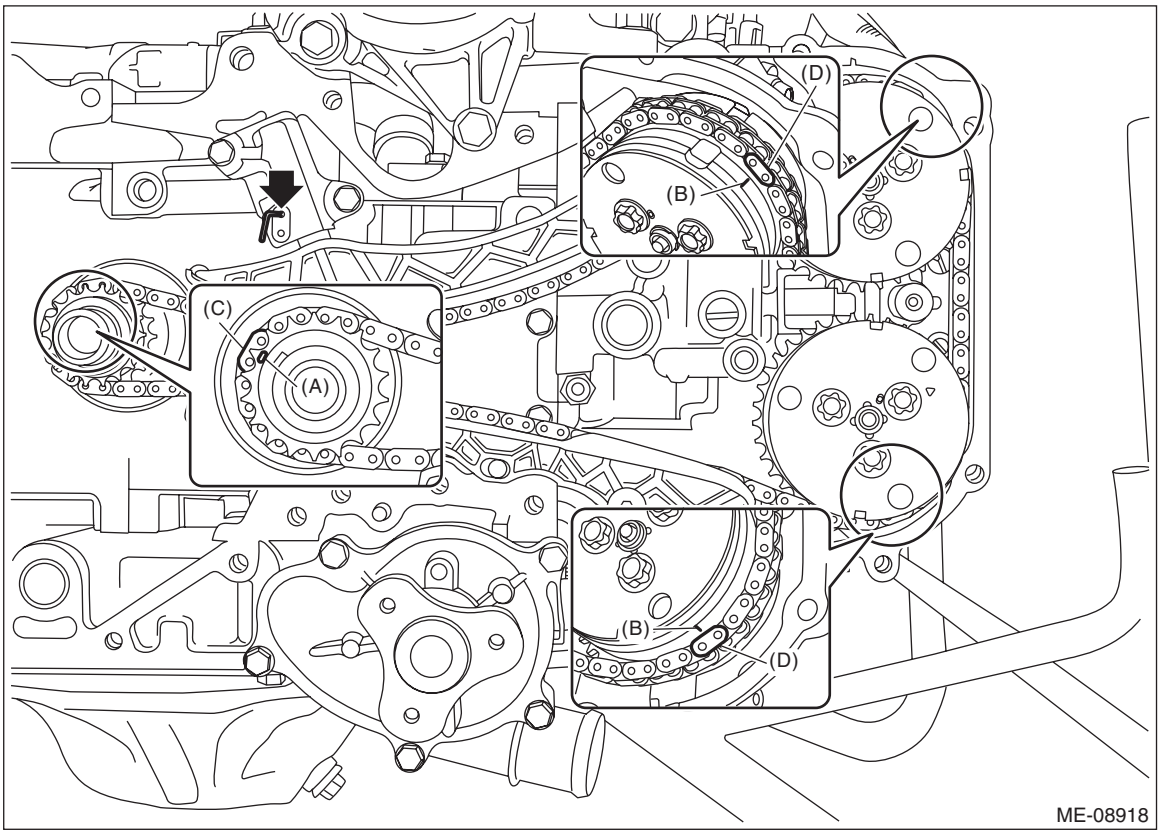


9) Pull out the stopper pin from the chain tensioner LH.

CAUTION:
Confirm the following before pulling out the stopper pin.
- **Matching of the timing chain mark (blue) to the alignment mark of the crank sprocket.**
- **Matching of the timing chain mark (pink) to the timing mark position of the intake cam sprocket LH.**
- **Matching of the timing chain mark (pink) to the timing mark position of the exhaust cam sprocket LH.**

NOTE:
If the stopper pin cannot be removed, lift the chain tension lever LH to remove as shown in the figure.

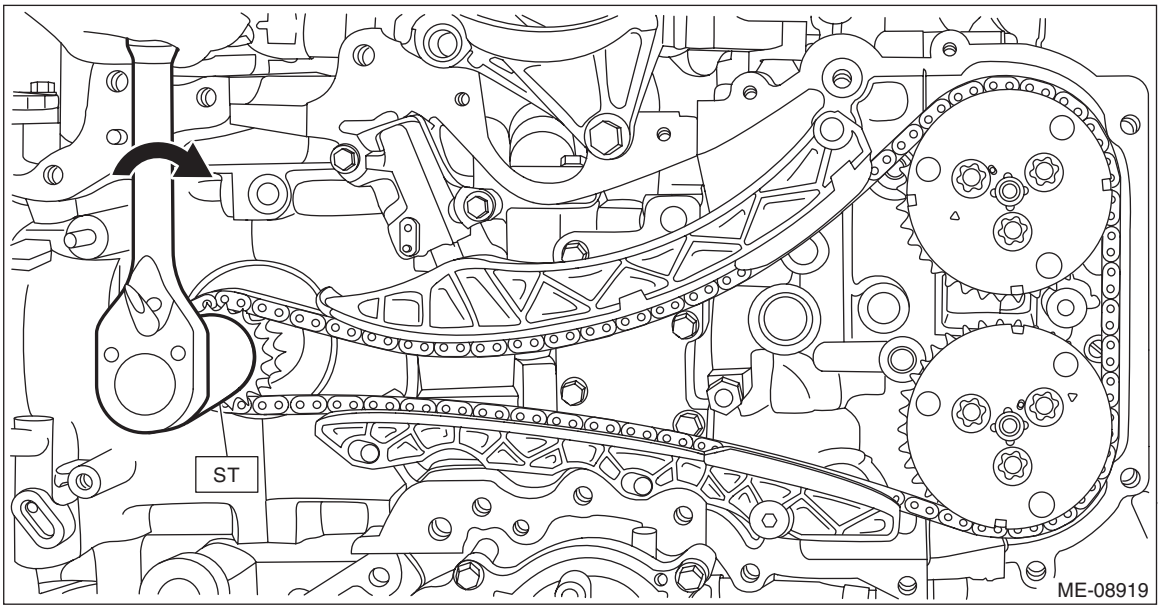




(A) Alignment mark
(B) Timing mark
(C) Blue
(D) Pink

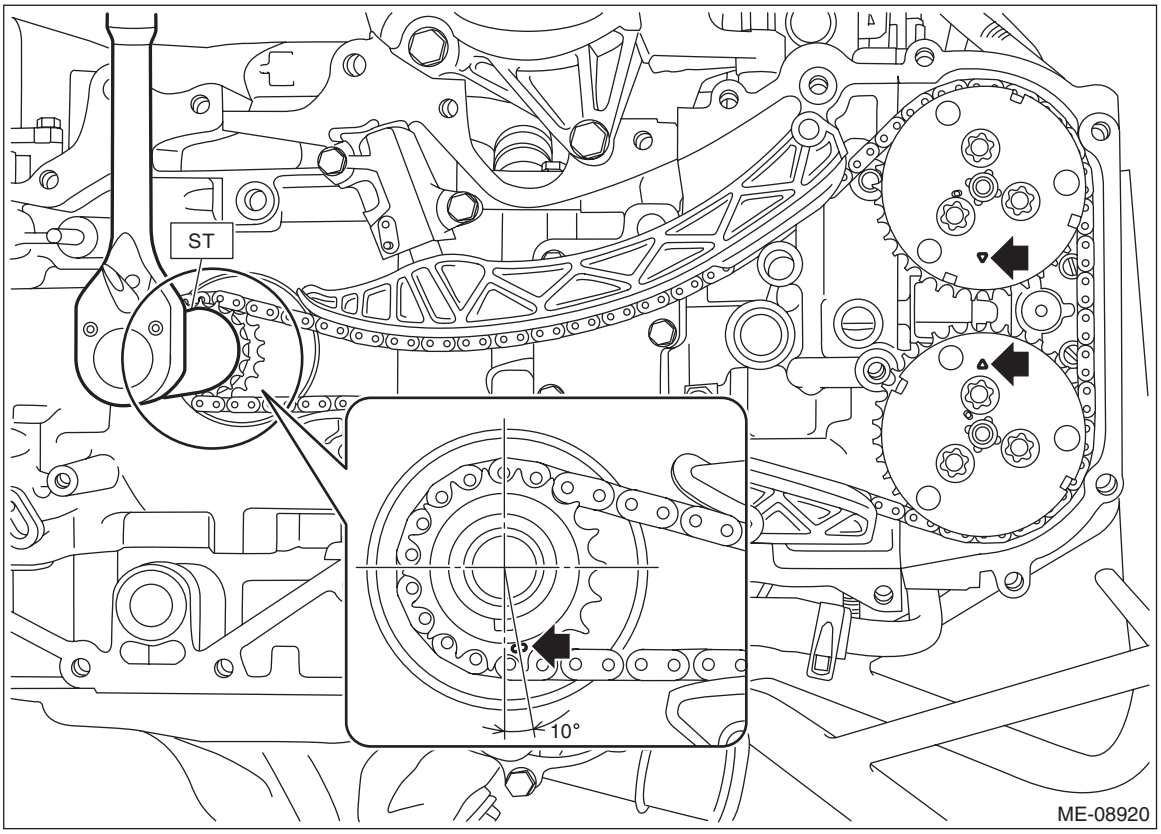
10) Using the ST, turn the crankshaft clockwise, and make sure that there are no abnormal conditions.

CAUTION:
Always make sure to perform this confirmation.
ST 18252AA000 CRANKSHAFT SOCKET



11) Using ST and by turning the crankshaft, align the alignment marks of crank sprocket, intake cam sprocket LH and exhaust cam sprocket LH to the positions as shown in the figure.

NOTE:
If the alignment marks are aligned to the positions as shown in the figure, the crankshaft key is located at six o'clock position.
ST 18252AA000 CRANKSHAFT SOCKET

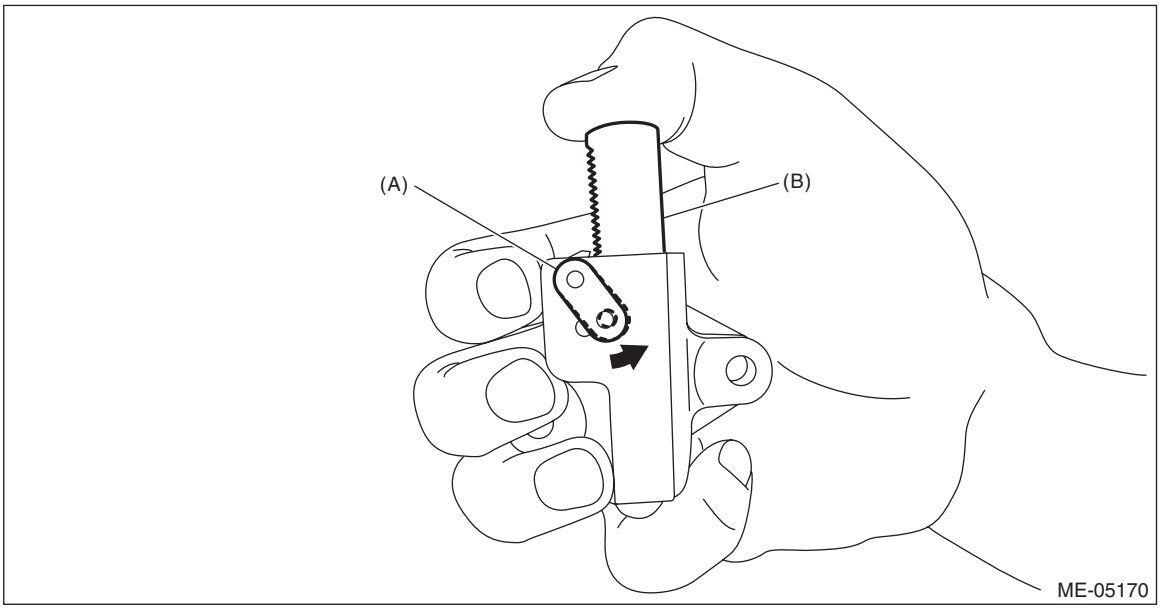


12) Install the timing chain RH. <Ref. to ME(H4DO(w/o HEV))-184, TIMING CHAIN RH, INSTALLATION, Timing Chain Assembly.>

2. TIMING CHAIN RH

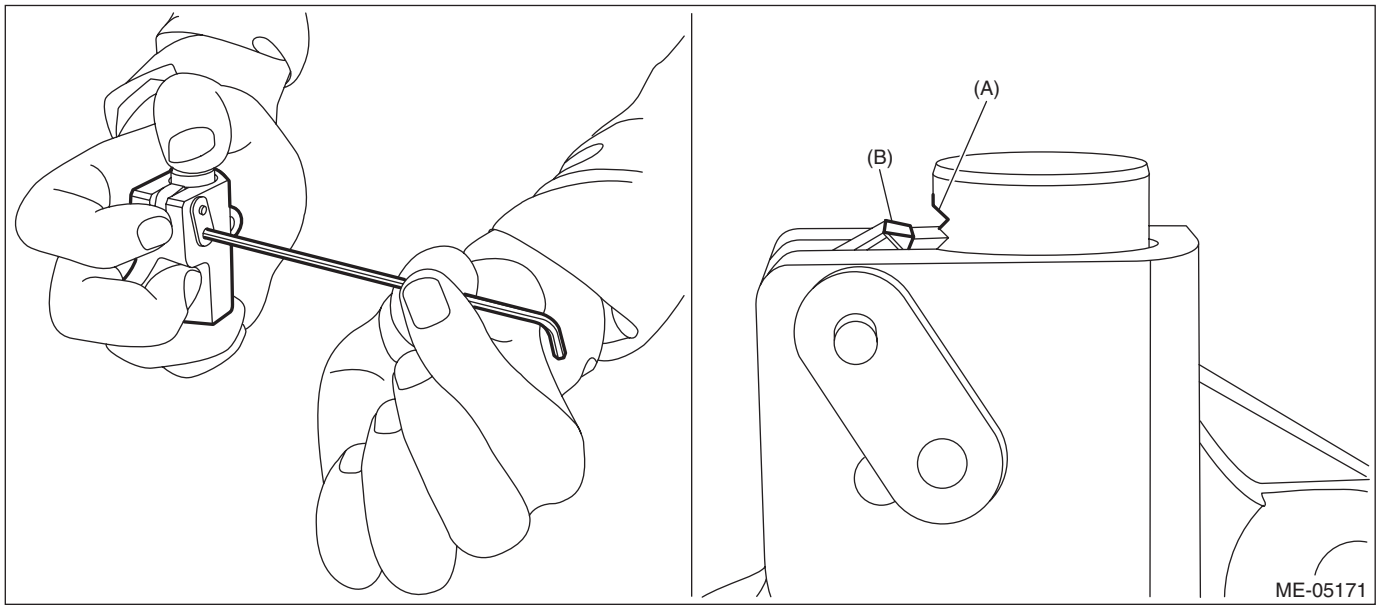
NOTE:
- Be careful that the foreign matter is not into or onto the assembled component during installation.
- Apply engine oil to all component parts of the timing chain.

1) Install timing chain LH. <Ref. to ME(H4DO(w/o HEV))-176, TIMING CHAIN LH, INSTALLATION, Timing Chain Assembly.>
2) Prepare to attach the chain tensioner RH.
   (1) Move the link plate (A) in the direction of arrow to press in the plunger (B).

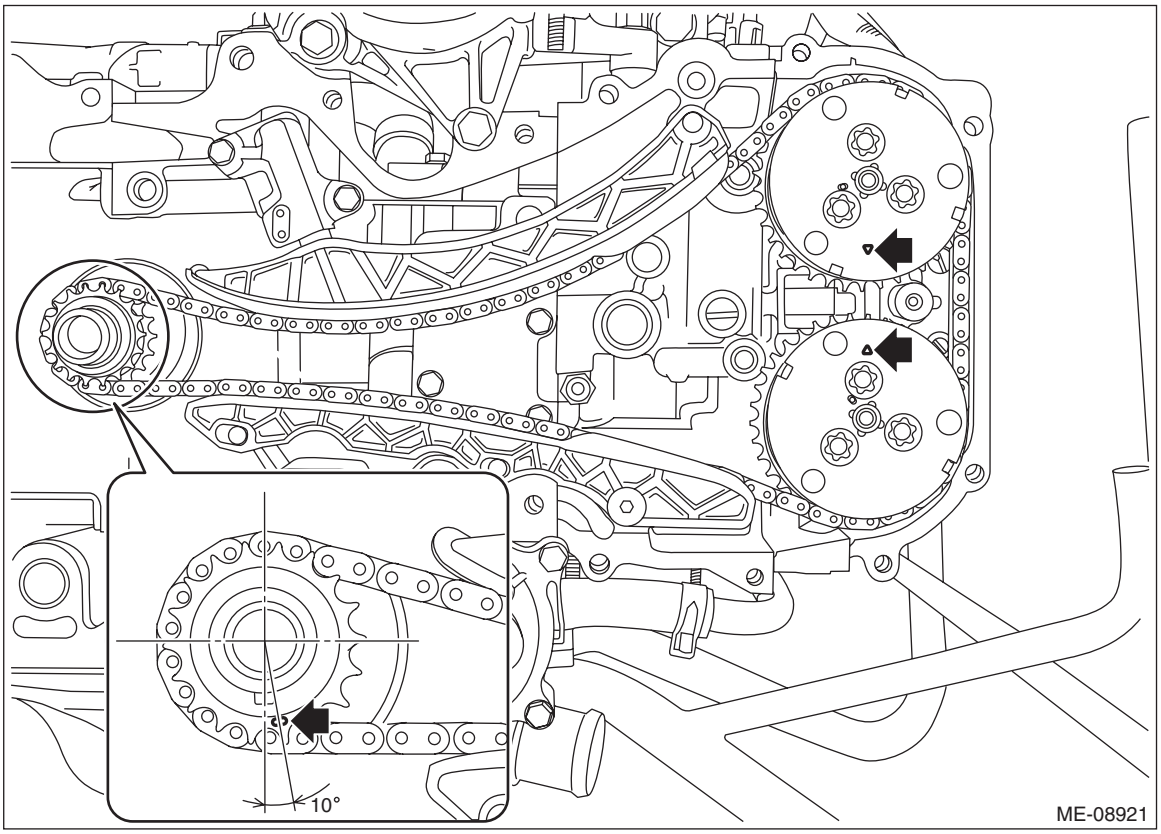


   (2) With a 2.5 mm (0.98 in) dia. stopper pin or a 2.5 mm (0.98 in) (nominal) dia. hex wrench inserted into the stopper pin hole, secure the plunger.

NOTE:
If the stopper pin hole on the link plate and the stopper pin hole on the chain tensioner are not aligned, check that the first notch of plunger rack (A) is engaged with the stopper tooth (B). If not engaged, retract the plunger a little so that the first notch of plunger rack (A) is engaged with the stopper tooth (B).

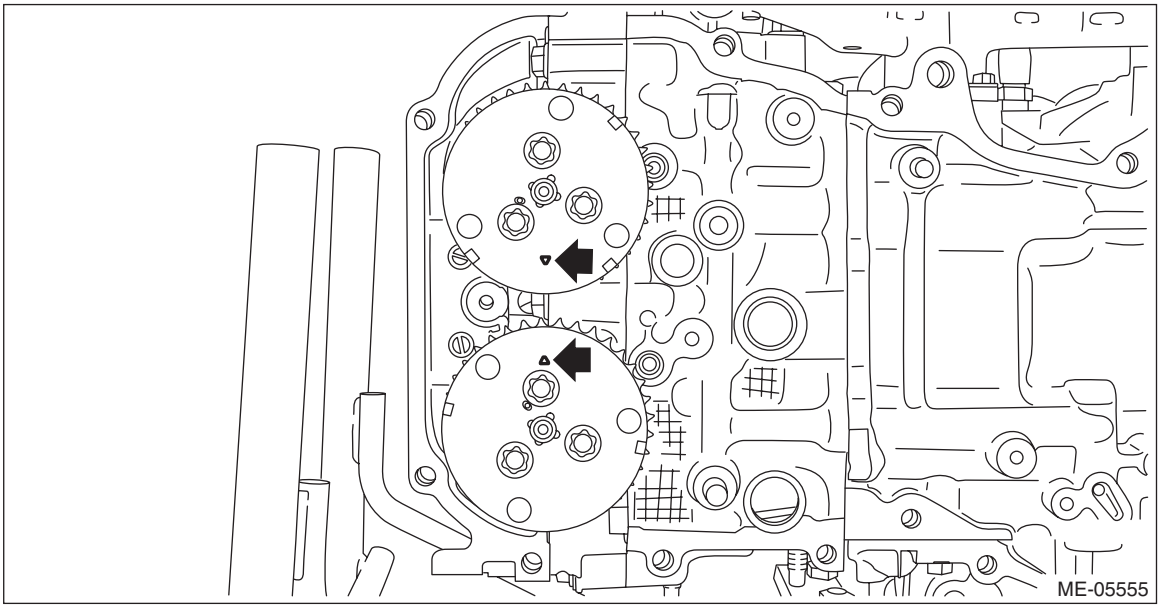


3) Make sure that the alignment marks of the crank sprocket, intake cam sprocket LH and exhaust cam sprocket LH are aligned to the positions as shown in the figure.



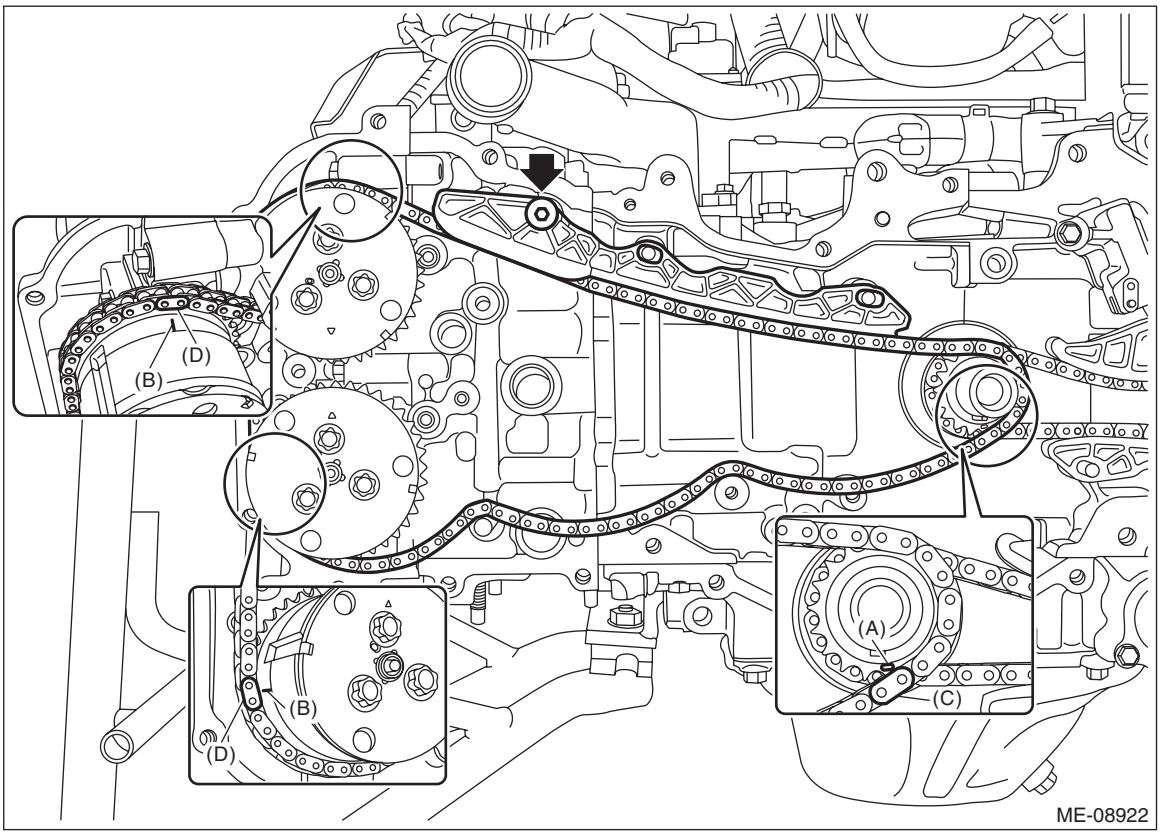
4) Align the alignment marks of intake cam sprocket RH and exhaust cam sprocket RH to the positions as shown in the figure.

CAUTION:
To prevent valve damage, turn the intake cam sprocket RH and exhaust cam sprocket RH only within the range of zero-lift (in range where it can be turned lightly by hand).



5) Install the timing chain RH and the timing chain guide RH.
   (1) Match the timing chain mark (blue) to the alignment mark of the crank sprocket.
   (2) Match the timing chain mark (pink) to the timing mark position of the intake cam sprocket RH.
   (3) Match the timing chain mark (pink) to the timing mark position of the exhaust cam sprocket RH.
   (4) Install the timing chain guide RH.

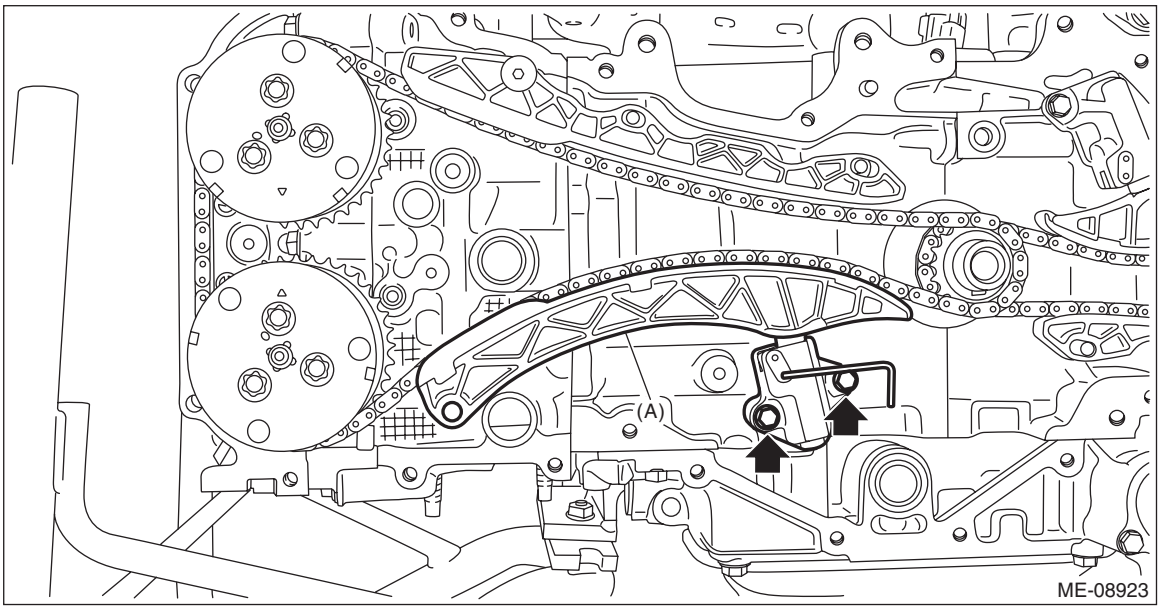
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



(A) Alignment mark
(B) Timing mark
(C) Blue
(D) Pink

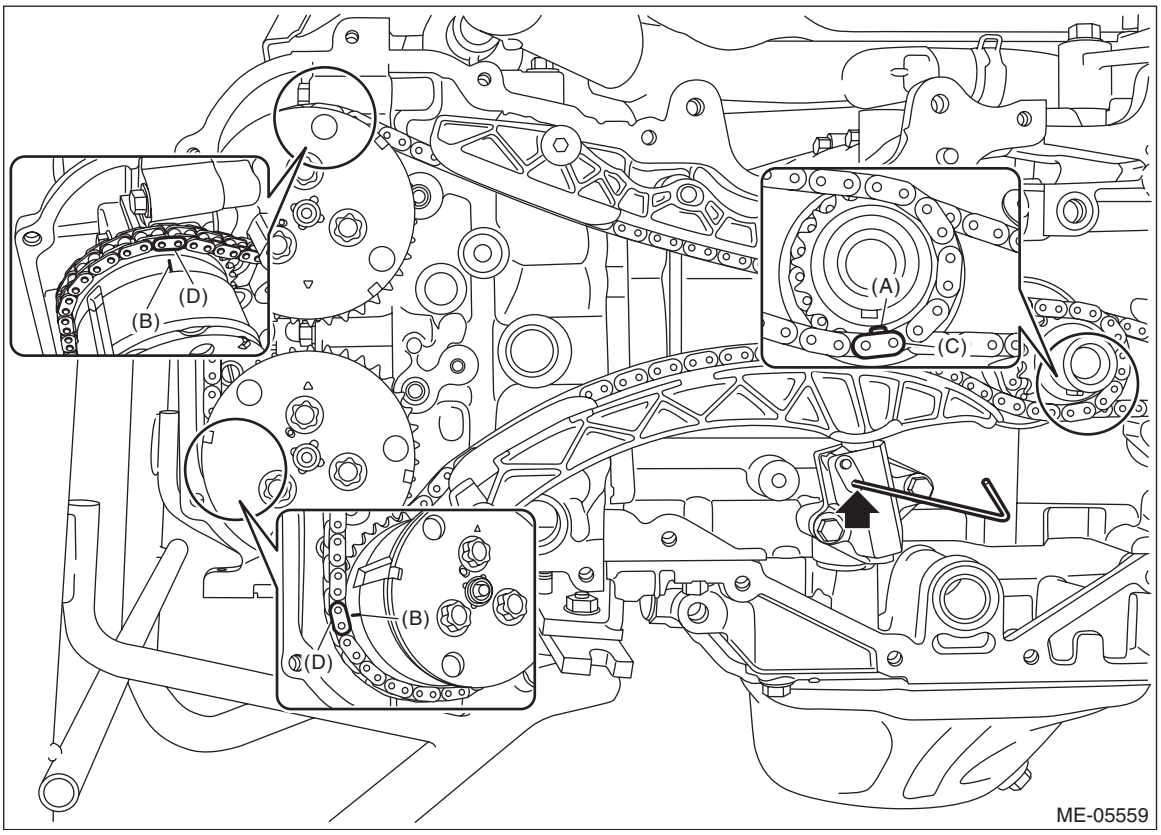
6) Install the chain tensioner lever RH (A) and chain tensioner RH.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



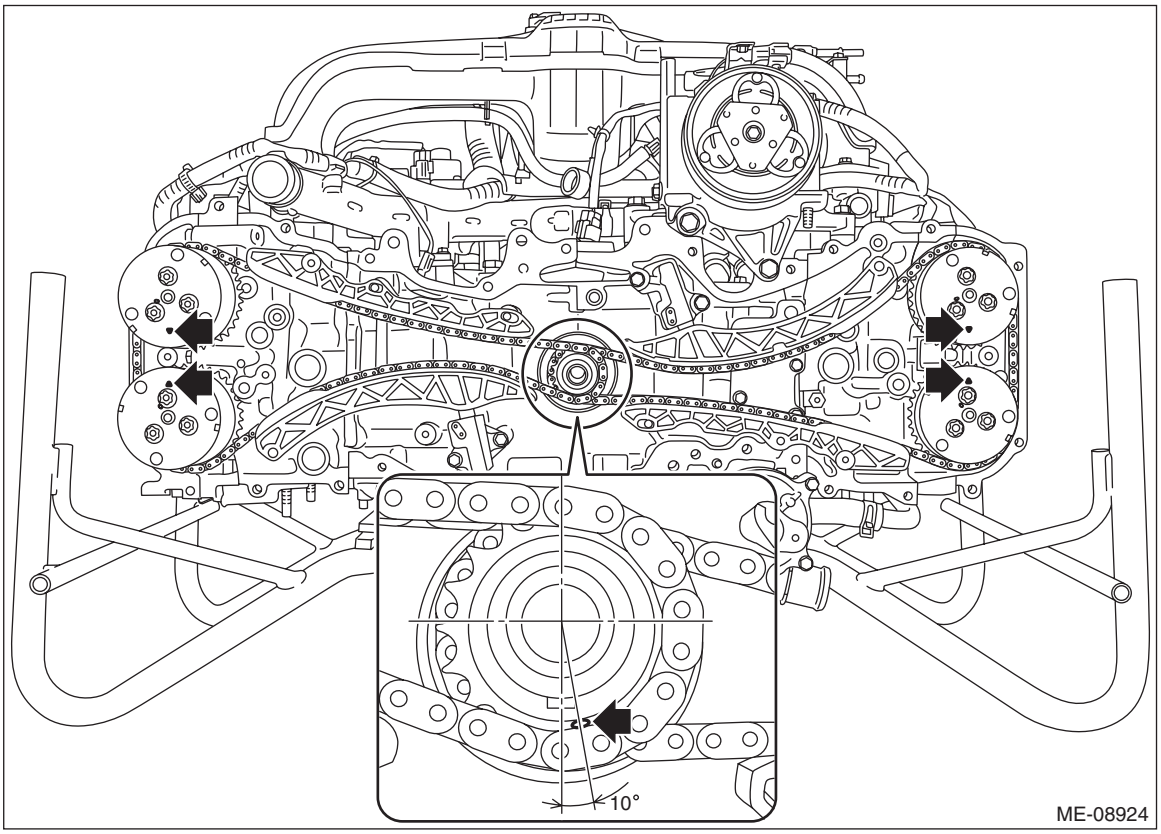
7) Pull out the stopper pin from the chain tensioner RH.

CAUTION:
Confirm the following before pulling out the stopper pin.
- **Matching of the timing chain mark (blue) to the alignment mark of the crank sprocket.**
- **Matching of the timing chain mark (pink) to the timing mark position of the intake cam sprocket RH.**
- **Matching of the timing chain mark (pink) to the timing mark position of the exhaust cam sprocket RH.**



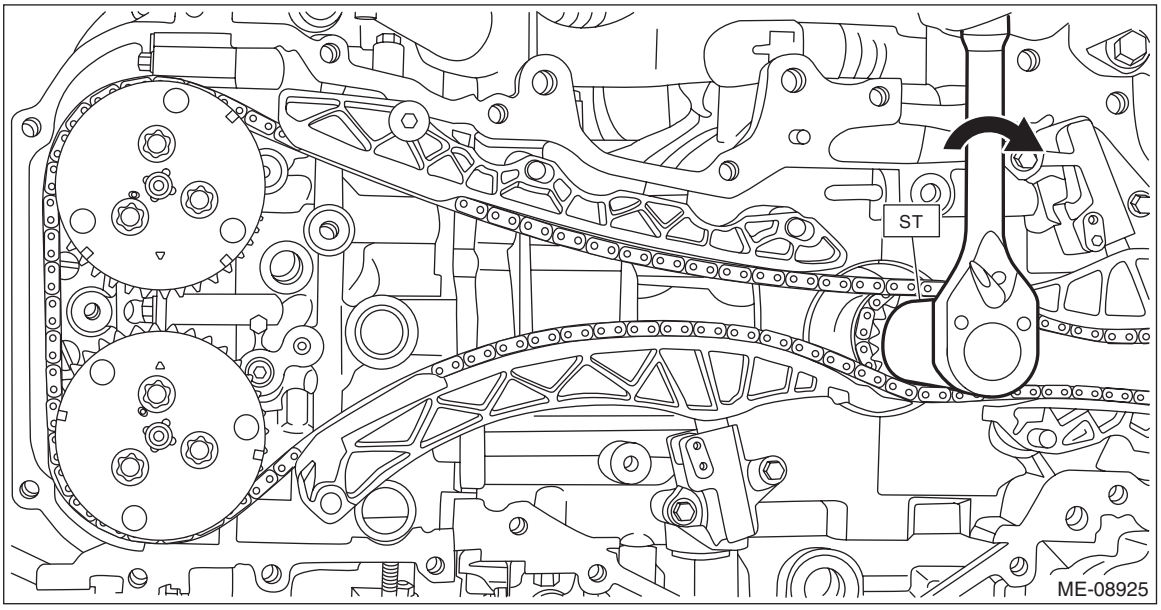
(A) Alignment mark
(B) Timing mark
(C) Blue
(D) Pink

8) Make sure that the alignment marks of the cam sprocket and crank sprocket are aligned to the positions as shown in the figure.



9) Using the ST, turn the crankshaft clockwise, and make sure that there are no abnormal conditions.

CAUTION:
Always make sure to perform this confirmation.
ST 18252AA000 CRANKSHAFT SOCKET



10) Install the chain cover. <Ref. to ME(H4DO(w/o HEV))-156, INSTALLATION, Chain Cover.>

C: INSPECTION

1) Check the timing chain, chain guide, chain tensioner lever and chain tensioner for deformation, cracks or other damages.
2) Check the chain guide and chain tensioner lever for abnormal wear.

16.Cam Sprocket

A: REMOVAL

1. CAM SPROCKET RH

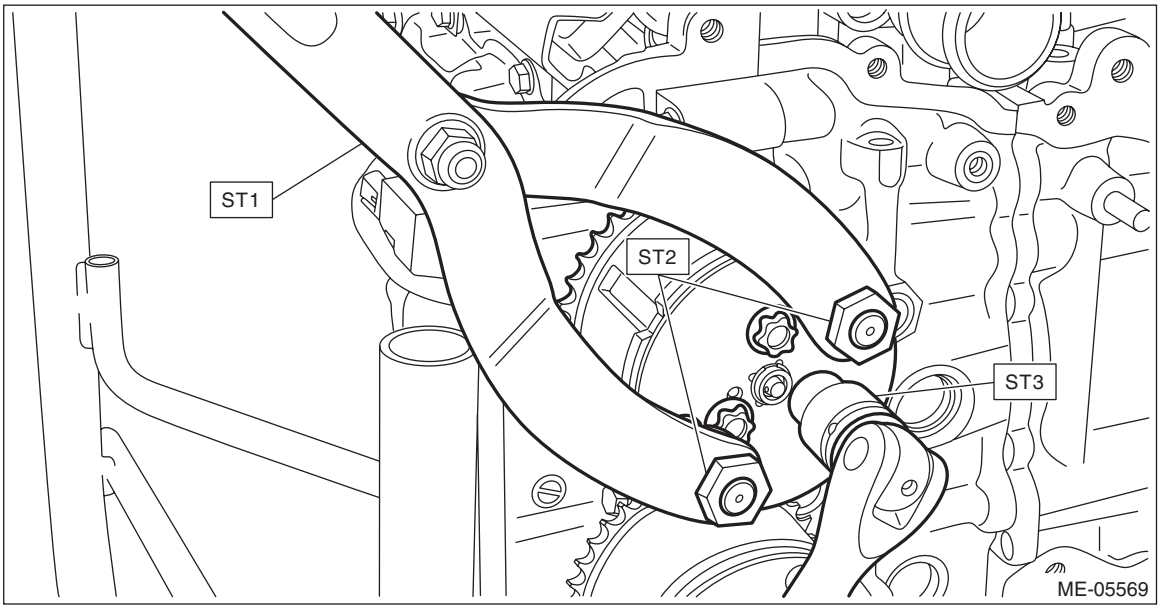
NOTE:
When replacing a single part, perform the work with the engine assembly installed to body.

- **Intake cam sprocket RH**

1) Remove the chain cover. <Ref. to ME(H4DO(w/o HEV))-149, REMOVAL, Chain Cover.>
2) Remove the timing chain RH. <Ref. to ME(H4DO(w/o HEV))-169, TIMING CHAIN RH, REMOVAL, Timing Chain Assembly.>
3) Hold the intake cam sprocket RH using the ST1 and ST2, and remove the bolts using the ST3.

CAUTION:
For gasoline engine models, perform the operation carefully since the ST comes off easily.

ST1	18355AA000	PULLEY WRENCH
ST2	18334AA020	PULLEY WRENCH PIN SET (gasoline engine model)
ST2	18334AA030	PULLEY WRENCH PIN SET (HEV model)
ST3	18270KA010	SOCKET



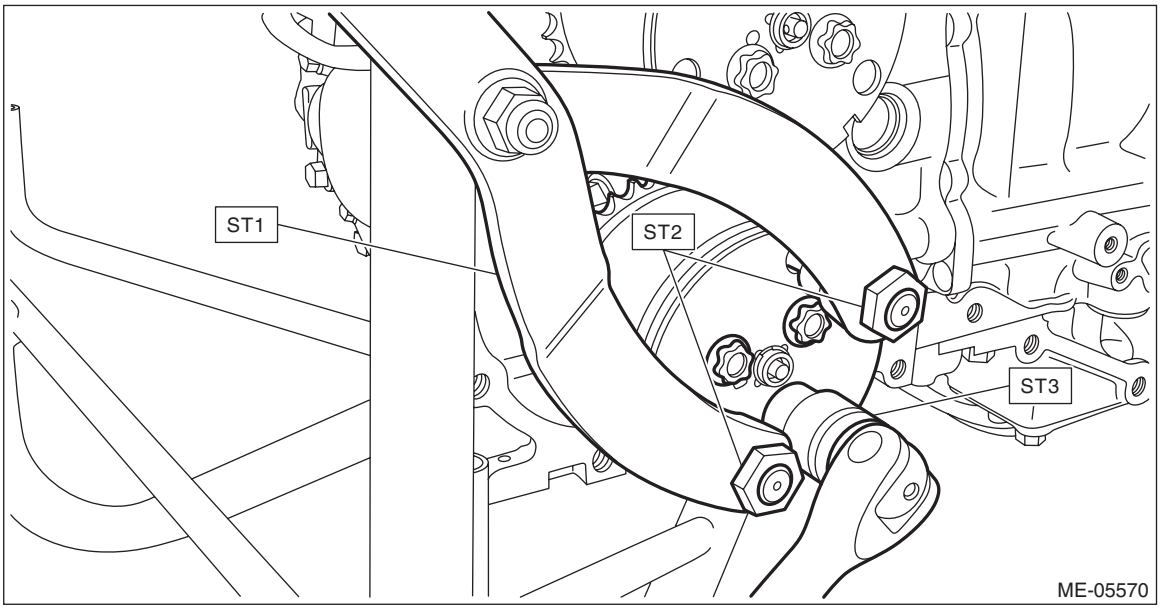
4) Remove the intake cam sprocket RH.

- **Exhaust cam sprocket RH**

1) Remove the chain cover. <Ref. to ME(H4DO(w/o HEV))-149, REMOVAL, Chain Cover.>
2) Remove the timing chain RH. <Ref. to ME(H4DO(w/o HEV))-169, TIMING CHAIN RH, REMOVAL, Timing Chain Assembly.>
3) Hold the exhaust cam sprocket RH using the ST1 and ST2, and remove the bolts using the ST3.

CAUTION:
For gasoline engine models, perform the operation carefully since the ST comes off easily.

ST1	18355AA000	PULLEY WRENCH
ST2	18334AA020	PULLEY WRENCH PIN SET (gasoline engine model)
ST2	18334AA030	PULLEY WRENCH PIN SET (HEV model)
ST3	18270KA010	SOCKET



4) Remove the exhaust cam sprocket RH.

2. CAM SPROCKET LH

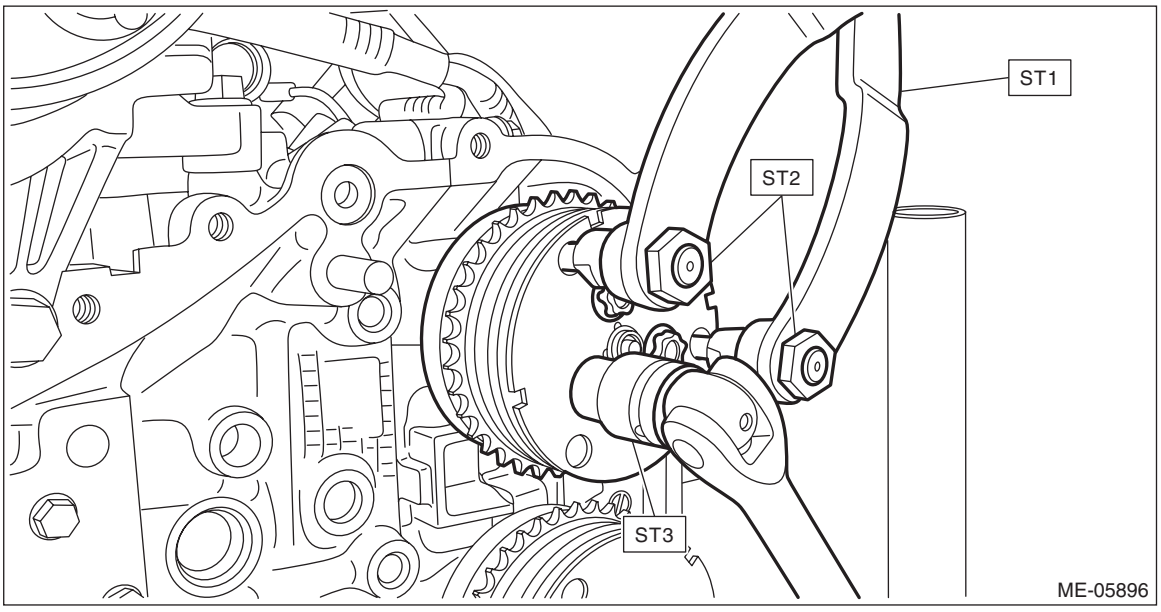
NOTE:
When replacing a single part, perform the work with the engine assembly installed to body.

- **Intake cam sprocket LH**

1) Remove the chain cover. <Ref. to ME(H4DO(w/o HEV))-149, REMOVAL, Chain Cover.>
2) Remove the timing chain LH. <Ref. to ME(H4DO(w/o HEV))-171, TIMING CHAIN LH, REMOVAL, Timing Chain Assembly.>
3) Hold the intake cam sprocket LH using the ST1 and ST2, and remove the bolts using the ST3.

CAUTION:
For gasoline engine models, perform the operation carefully since the ST comes off easily.

ST1	18355AA000	PULLEY WRENCH
ST2	18334AA020	PULLEY WRENCH PIN SET (gasoline engine model)
ST2	18334AA030	PULLEY WRENCH PIN SET (HEV model)
ST3	18270KA010	SOCKET



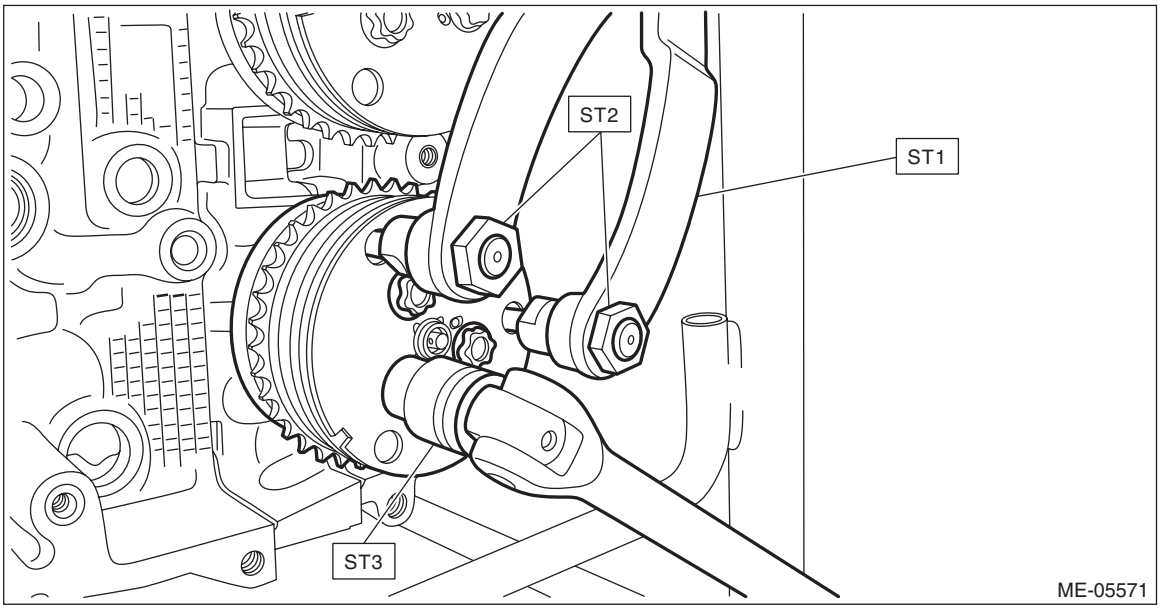
4) Remove the intake cam sprocket LH.

- **Exhaust cam sprocket LH**

1) Remove the chain cover. <Ref. to ME(H4DO(w/o HEV))-149, REMOVAL, Chain Cover.>
2) Remove the timing chain LH. <Ref. to ME(H4DO(w/o HEV))-171, TIMING CHAIN LH, REMOVAL, Timing Chain Assembly.>
3) Hold the exhaust cam sprocket LH using the ST1 and ST2, and remove the bolts using the ST3.

CAUTION:
For gasoline engine models, perform the operation carefully since the ST comes off easily.

ST1	18355AA000	PULLEY WRENCH
ST2	18334AA020	PULLEY WRENCH PIN SET (gasoline engine model)
ST2	18334AA030	PULLEY WRENCH PIN SET (HEV model)
ST3	18270KA010	SOCKET



4) Remove the exhaust cam sprocket LH.

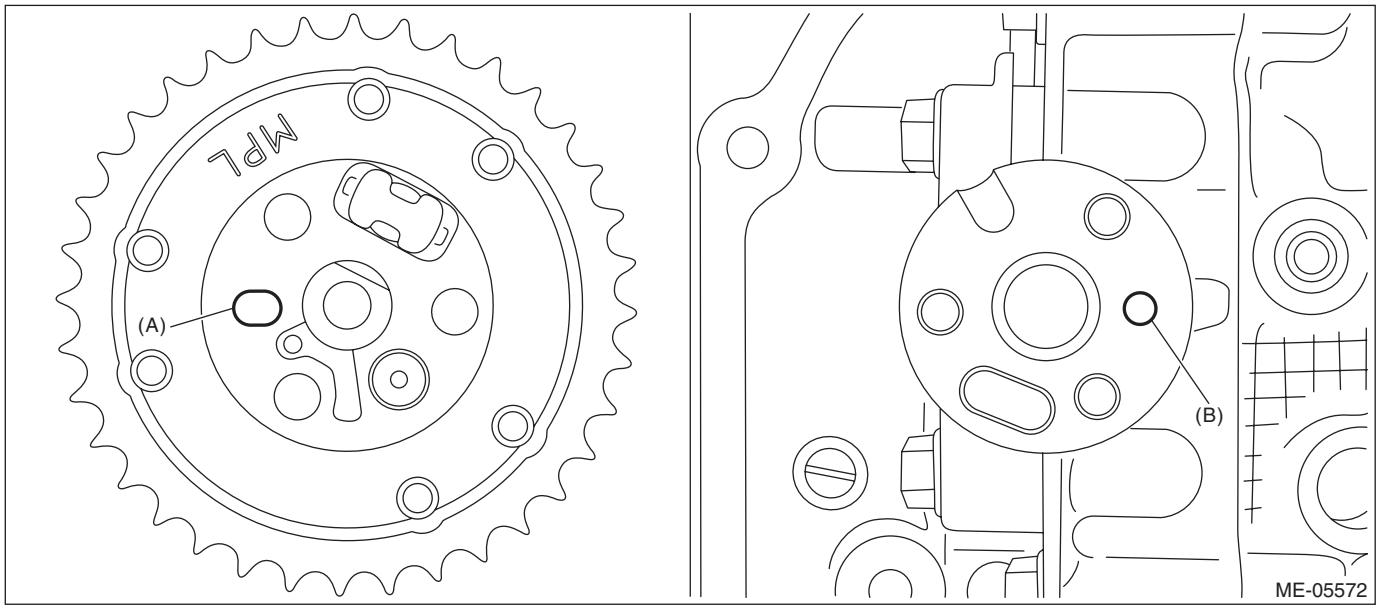
B: INSTALLATION

1. CAM SPROCKET RH

- **Intake cam sprocket RH**

1) Install the intake cam sprocket RH by aligning the knock hole (A) of intake cam sprocket RH and the knock pin (B) of intake camshaft RH.

NOTE:
Before installation, check that there is no foreign matter on the intake cam sprocket RH and intake camshaft RH.

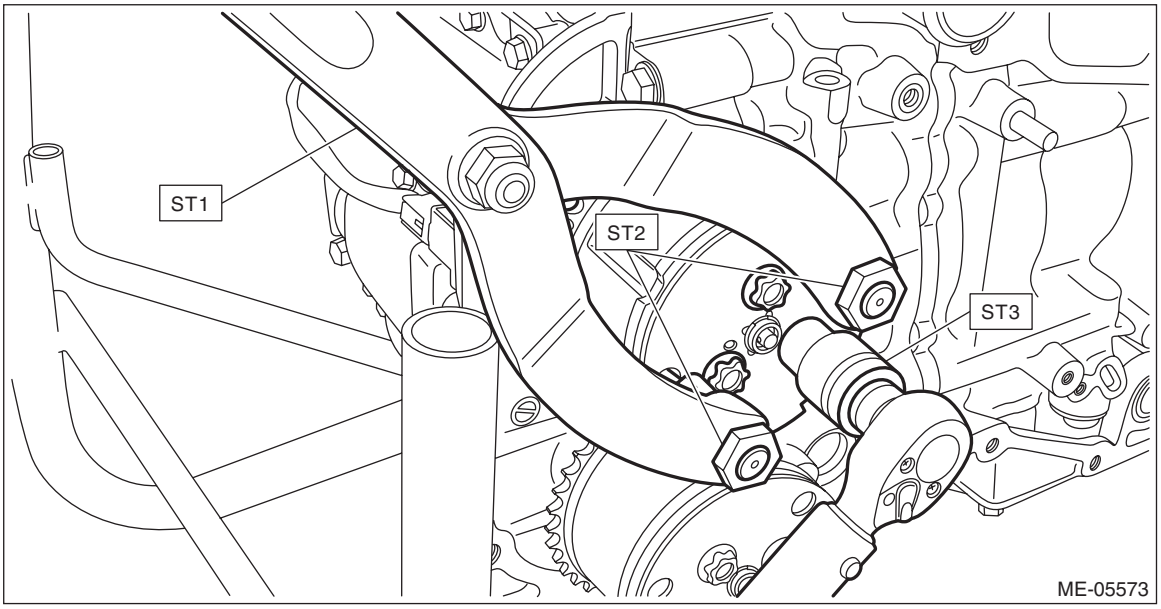


2) Hold the intake cam sprocket RH using the ST1 and ST2, and install the bolts using the ST3.

CAUTION:
For gasoline engine models, perform the operation carefully since the ST comes off easily.

ST1	18355AA000	PULLEY WRENCH
ST2	18334AA020	PULLEY WRENCH PIN SET (gasoline engine model)
ST2	18334AA030	PULLEY WRENCH PIN SET (HEV model)
ST3	18270KA010	SOCKET

Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)

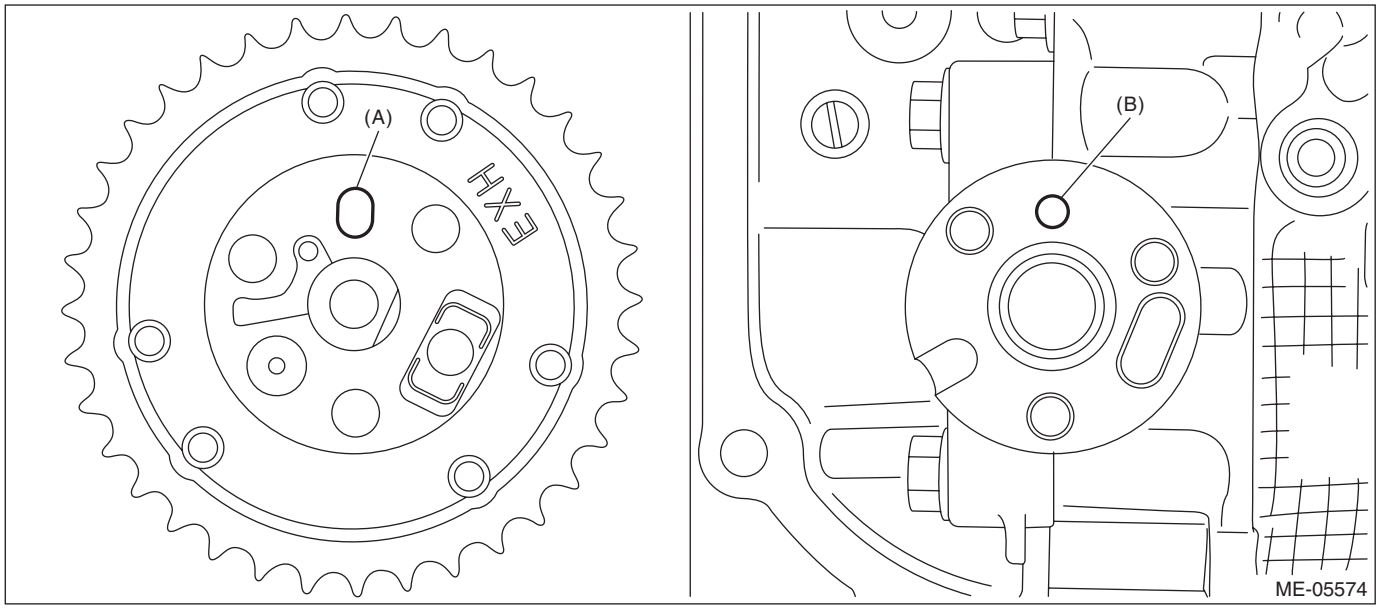


3) Install the timing chain RH. <Ref. to ME(H4DO(w/o HEV))-184, TIMING CHAIN RH, INSTALLATION, Timing Chain Assembly.>
4) Install the chain cover. <Ref. to ME(H4DO(w/o HEV))-156, INSTALLATION, Chain Cover.>

- **Exhaust cam sprocket RH**

1) Install the exhaust cam sprocket RH by aligning the knock hole (A) of exhaust cam sprocket RH and the knock pin (B) of exhaust camshaft RH.

NOTE:
Before installation, check that there is no foreign matter on the exhaust cam sprocket RH and exhaust camshaft RH.

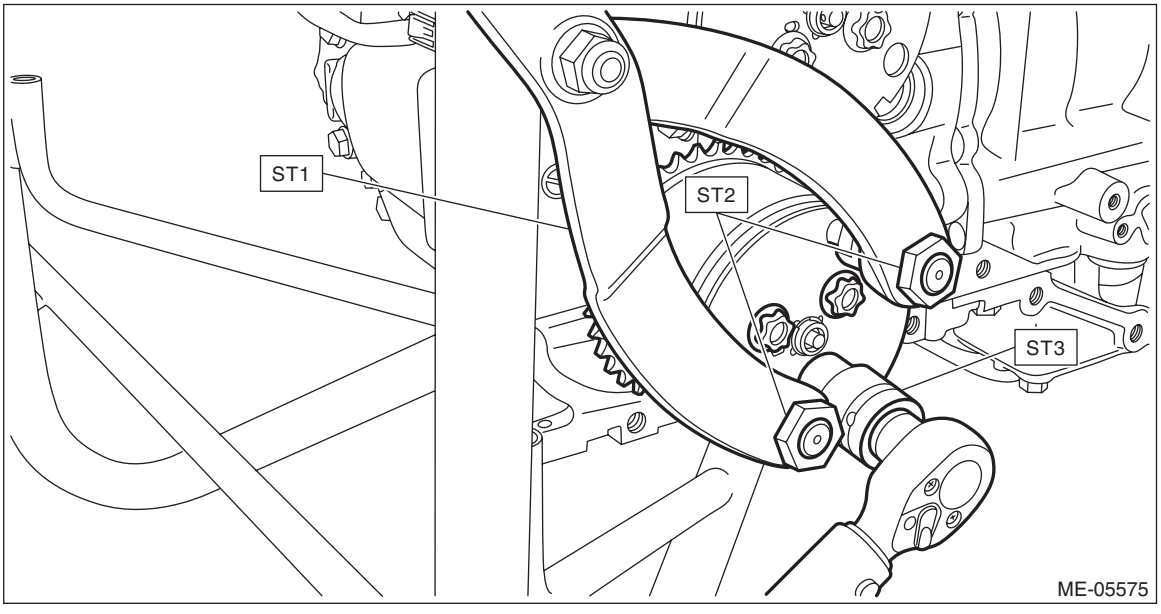


2) Hold the exhaust cam sprocket RH using ST1 and ST2, and install the bolts using ST3.

CAUTION:
For gasoline engine models, perform the operation carefully since the ST comes off easily.

ST1	18355AA000	PULLEY WRENCH
ST2	18334AA020	PULLEY WRENCH PIN SET (gasoline engine model)
ST2	18334AA030	PULLEY WRENCH PIN SET (HEV model)
ST3	18270KA010	SOCKET

Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)



3) Install the timing chain RH. <Ref. to ME(H4DO(w/o HEV))-184, TIMING CHAIN RH, INSTALLATION, Timing Chain Assembly.>

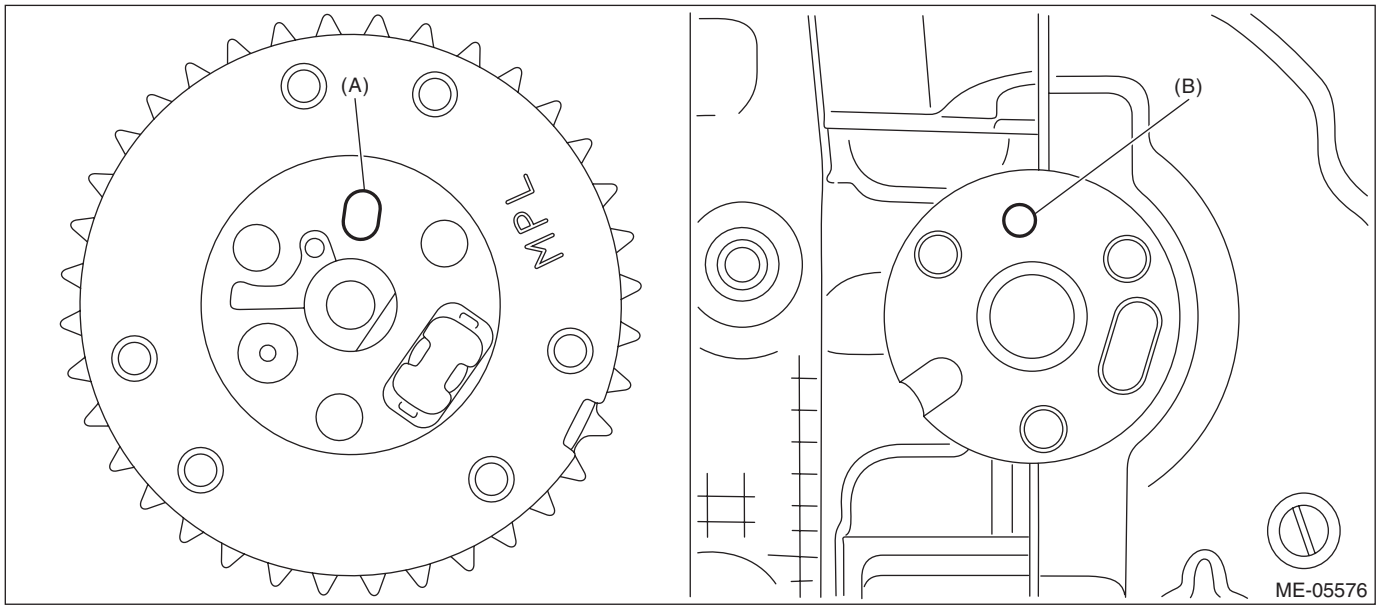
4) Install the chain cover. <Ref. to ME(H4DO(w/o HEV))-156, INSTALLATION, Chain Cover.>

2. CAM SPROCKET LH

• Intake cam sprocket LH

1) Install the intake cam sprocket LH by aligning the knock hole (A) of intake cam sprocket LH and the knock pin (B) of intake camshaft LH.

NOTE:
Before installation, check that there is no foreign matter on the intake cam sprocket LH and intake camshaft LH.

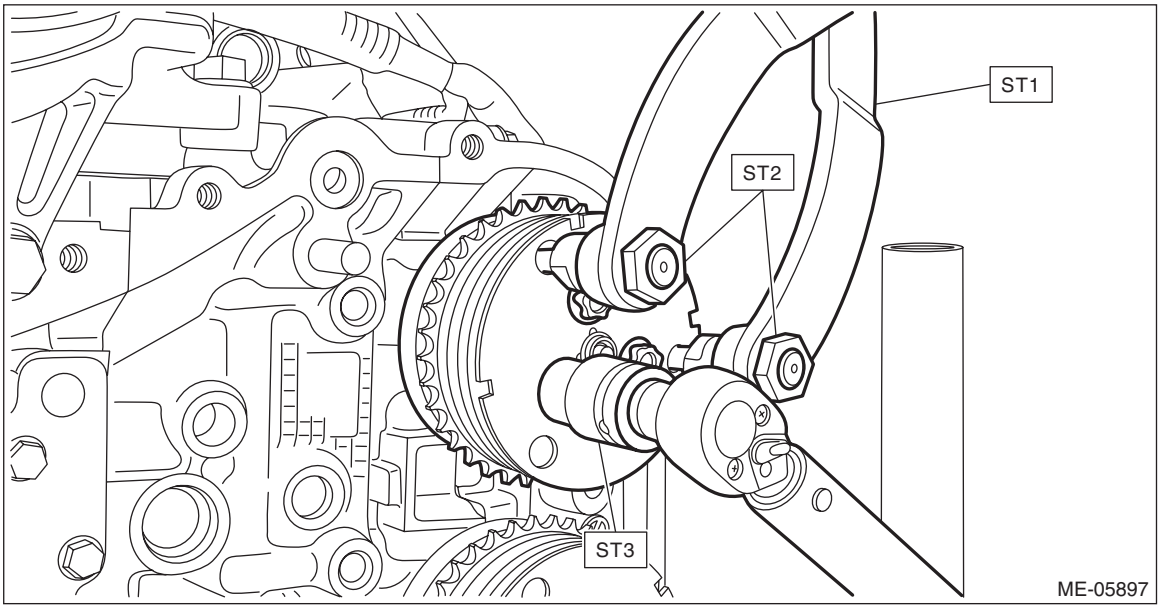


2) Hold the intake cam sprocket LH using the ST1 and ST2, and install the bolts using the ST3.

CAUTION:
For gasoline engine models, perform the operation carefully since the ST comes off easily.

ST1	18355AA000	PULLEY WRENCH
ST2	18334AA020	PULLEY WRENCH PIN SET (gasoline engine model)
ST2	18334AA030	PULLEY WRENCH PIN SET (HEV model)
ST3	18270KA010	SOCKET

Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)

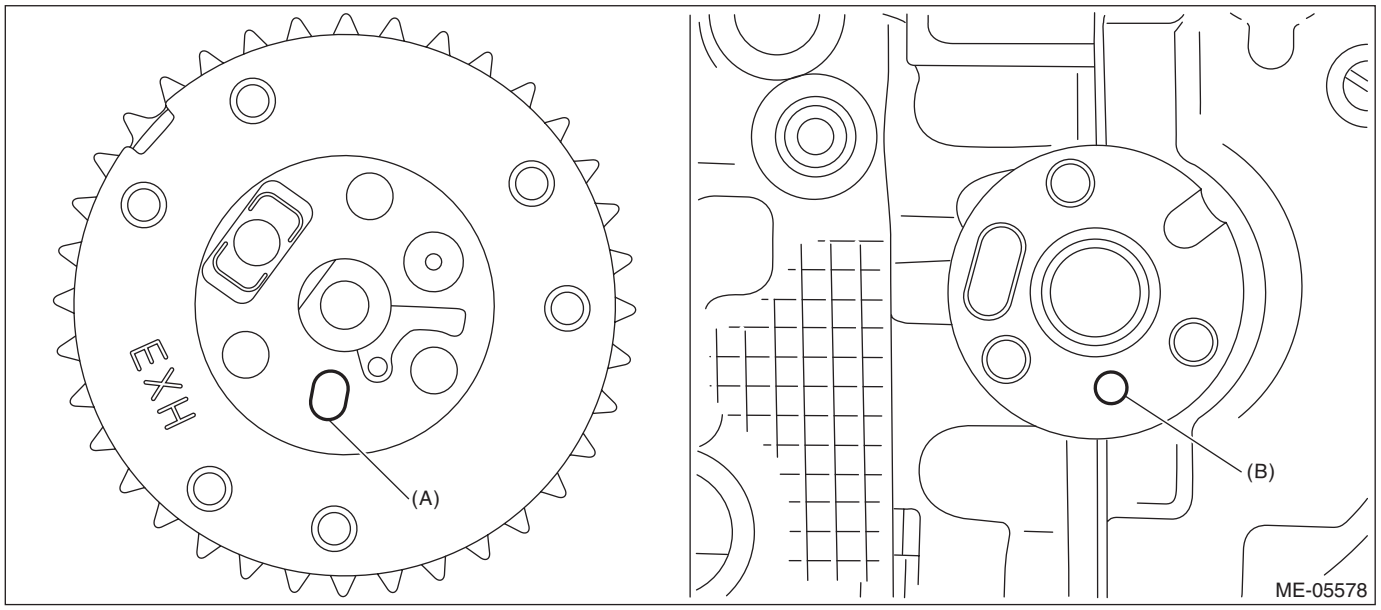


3) Install timing chain LH. <Ref. to ME(H4DO(w/o HEV))-176, TIMING CHAIN LH, INSTALLATION, Timing Chain Assembly.>
4) Install the chain cover. <Ref. to ME(H4DO(w/o HEV))-156, INSTALLATION, Chain Cover.>

- **Exhaust cam sprocket LH**

1) Install the exhaust cam sprocket LH by aligning the knock hole (A) of exhaust cam sprocket LH and the knock pin (B) of exhaust camshaft LH.

NOTE:
Before installation, check that there is no foreign matter on the exhaust cam sprocket LH and exhaust camshaft LH.

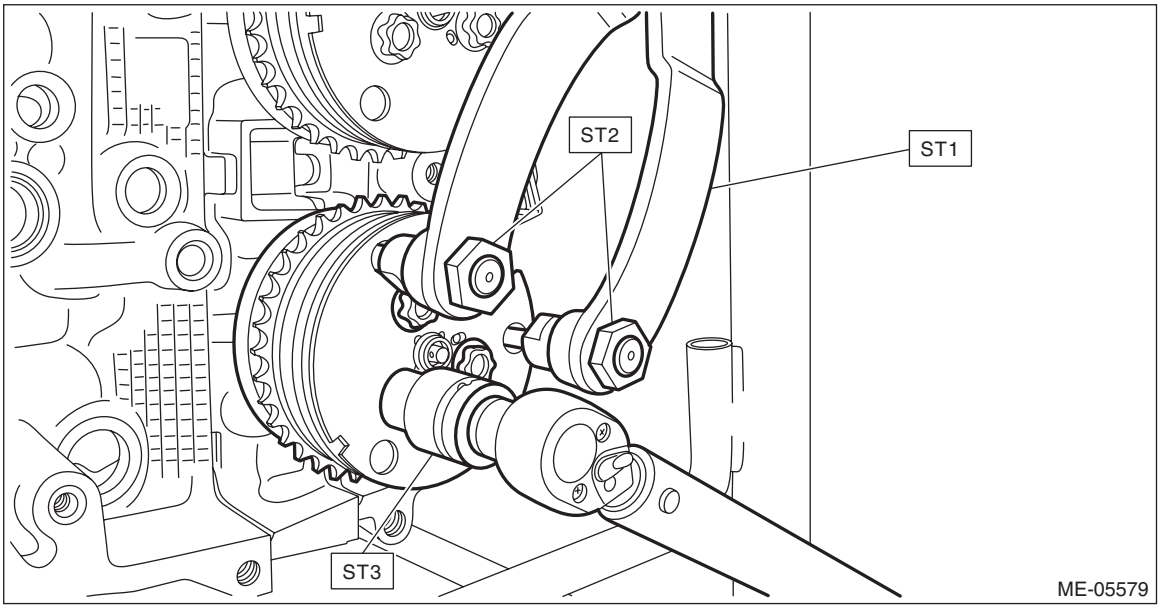


2) Hold the exhaust cam sprocket LH using the ST1 and ST2, and install the bolts using the ST3.

CAUTION:
For gasoline engine models, perform the operation carefully since the ST comes off easily.

ST1	18355AA000	PULLEY WRENCH
ST2	18334AA020	PULLEY WRENCH PIN SET (gasoline engine model)
ST2	18334AA030	PULLEY WRENCH PIN SET (HEV model)
ST3	18270KA010	SOCKET

Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)



3) Install timing chain LH. <Ref. to ME(H4DO(w/o HEV))-176, TIMING CHAIN LH, INSTALLATION, Timing Chain Assembly.>
4) Install the chain cover. <Ref. to ME(H4DO(w/o HEV))-156, INSTALLATION, Chain Cover.>

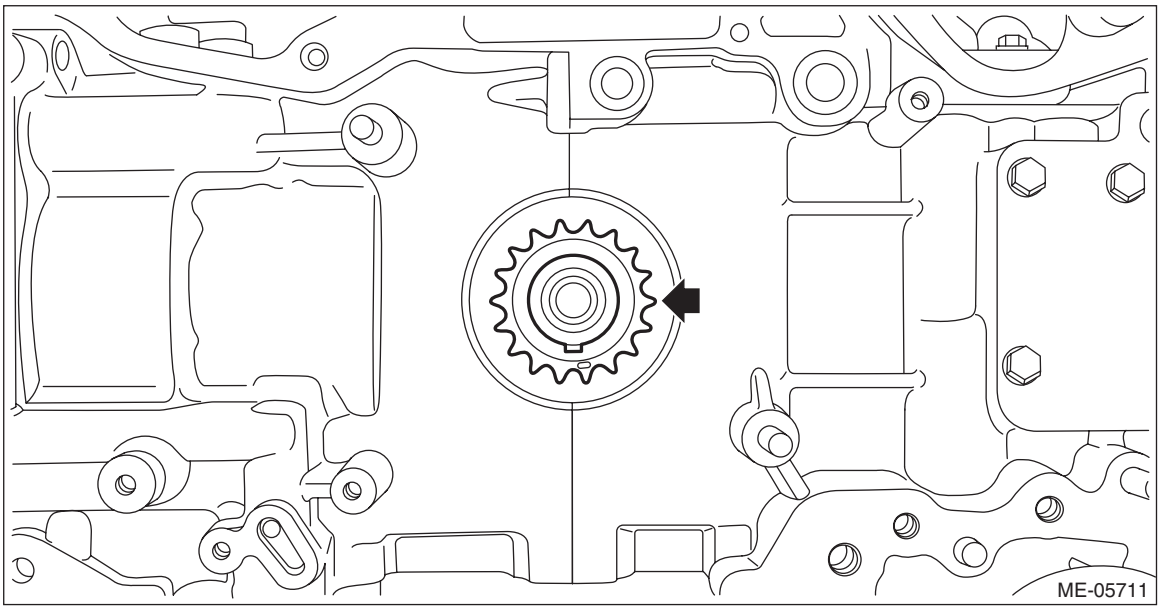
C: INSPECTION

Check the cam sprocket teeth for abnormal wear and scratches.

17.Crank Sprocket

A: REMOVAL

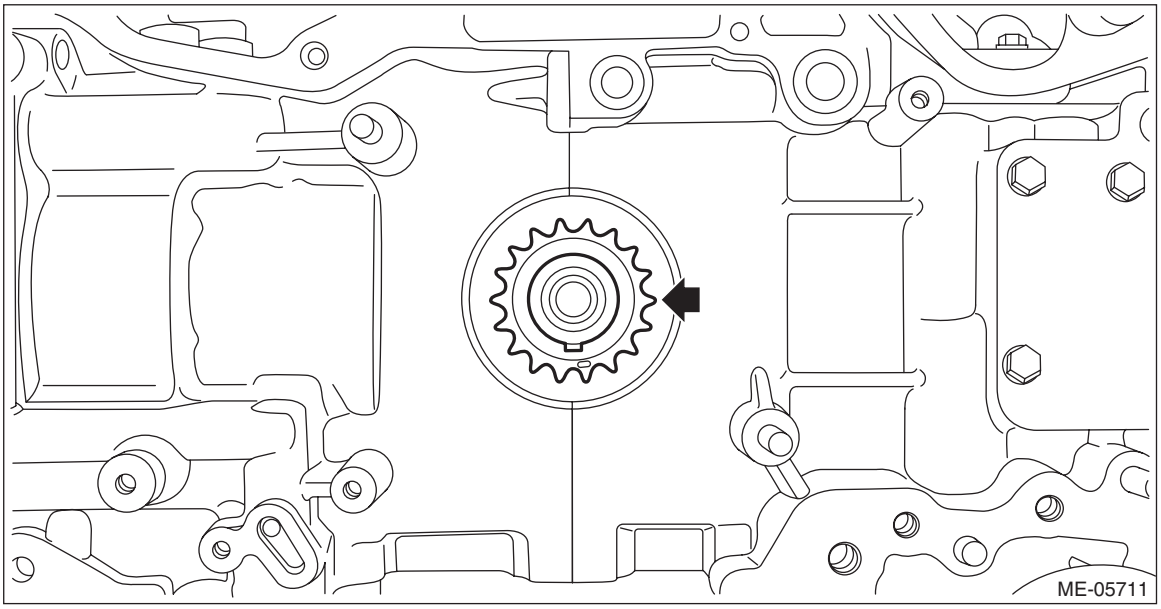
NOTE:
When replacing a single part, perform the work with the engine assembly installed to body.
1) Remove the chain cover. <Ref. to ME(H4DO(w/o HEV))-149, REMOVAL, Chain Cover.>
2) Remove the timing chain. <Ref. to ME(H4DO(w/o HEV))-169, REMOVAL, Timing Chain Assembly.>
3) Remove the crank sprocket.



B: INSTALLATION

1) Install the crank sprocket.

NOTE:
The direction of installation is not specified for the crank sprocket.



2) Install the timing chain. <Ref. to ME(H4DO(w/o HEV))-176, INSTALLATION, Timing Chain Assembly.>
3) Install the chain cover. <Ref. to ME(H4DO(w/o HEV))-156, INSTALLATION, Chain Cover.>

C: INSPECTION

1) Check the crank sprocket teeth for abnormal wear and scratches.
2) Make sure there is no free play between crank sprocket and key.

18.Rocker Cover

A: REMOVAL

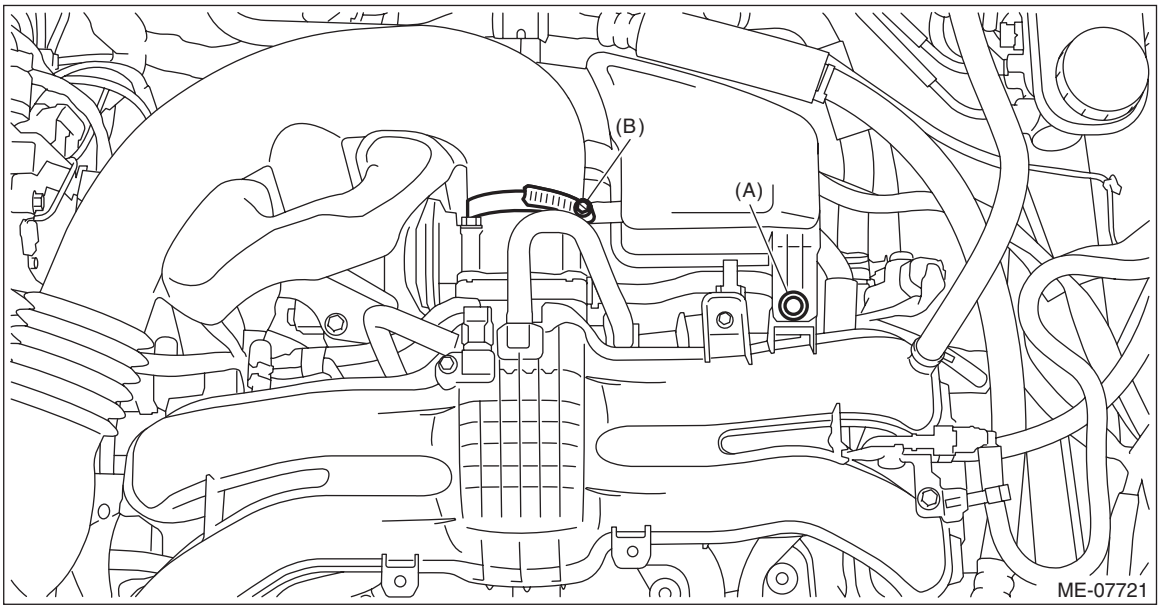
1. ROCKER COVER RH

NOTE:
When replacing a single part, perform the work with the engine assembly installed to body.
1) When working on the vehicle

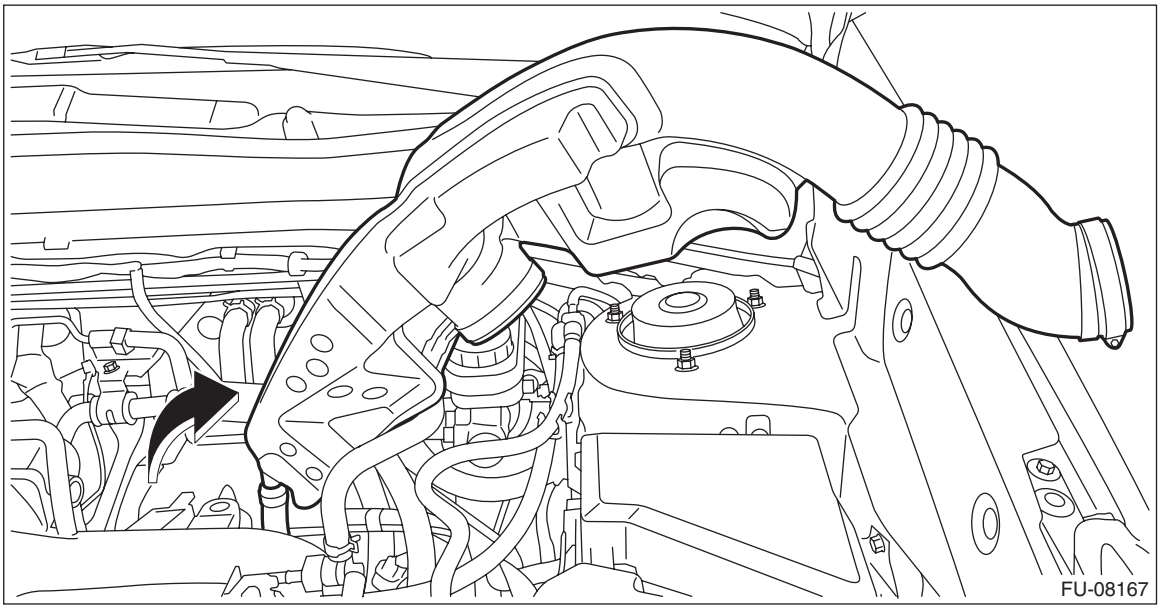
NOTE:
When working on the vehicle, perform the following steps also.

(1) Remove the air cleaner case. (Gasoline engine model) <Ref. to IN(H4DO(w/o HEV))-7, REMOVAL, Air Cleaner Case.>

(2) Remove the clip (A) from the air intake boot, and loosen the clamp (B) securing the air intake boot to the throttle body. (Gasoline engine model)

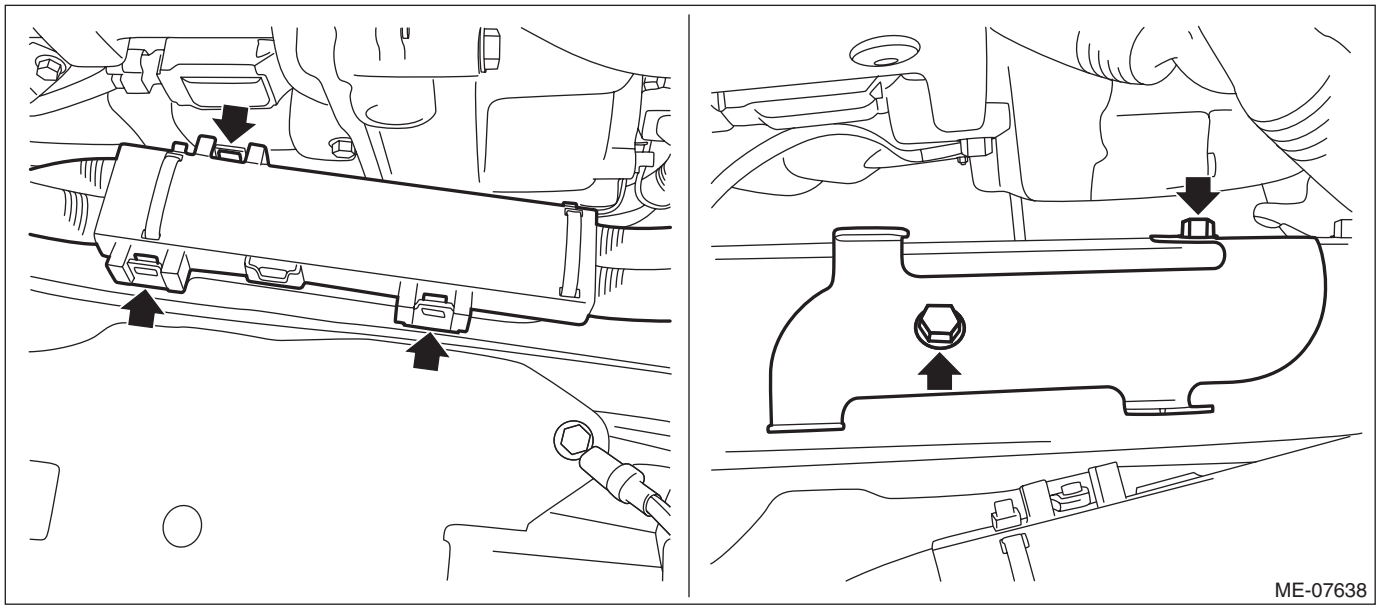


(3) Remove the air intake boot from the throttle body, and move it to the left side wheel apron. (Gasoline engine model)



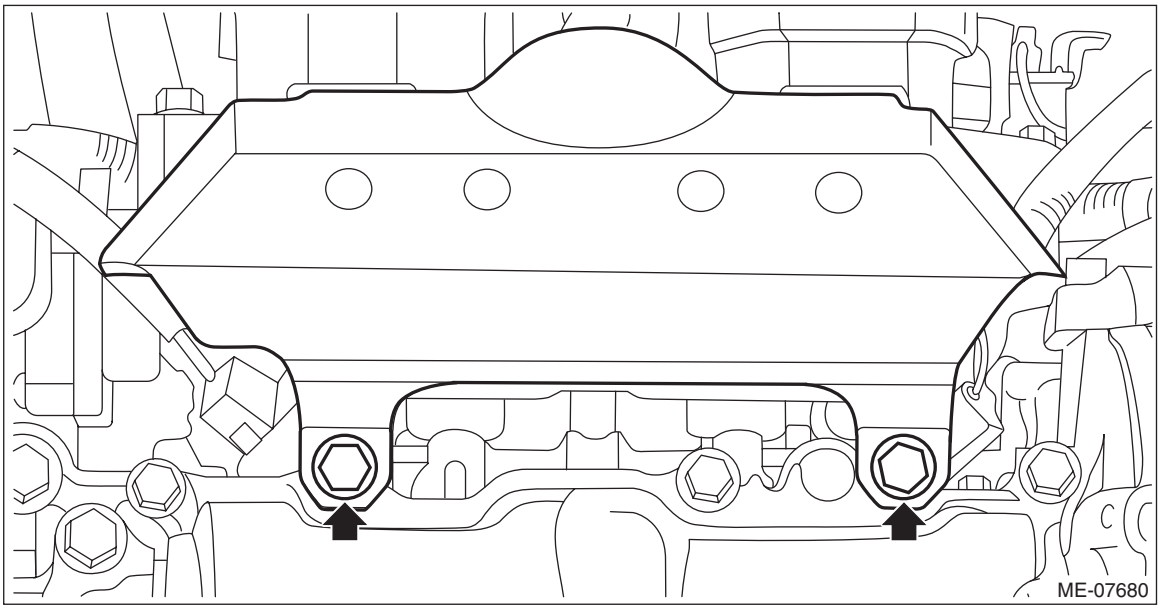
(4) Remove the intake duct. (HEV model) <Ref. to IN(H4DO(HEV))-16, REMOVAL, Intake Duct.>

(5) Remove the 12 volt engine restart battery. (HEV model) <Ref. to SC(H4DO(HEV))-40, 12 VOLT ENGINE RESTART BATTERY, REMOVAL, Battery.>
(6) Remove the battery cable assembly from the battery cable bracket No. 2, and remove the battery cable bracket No. 2 from the vehicle. (HEV model)

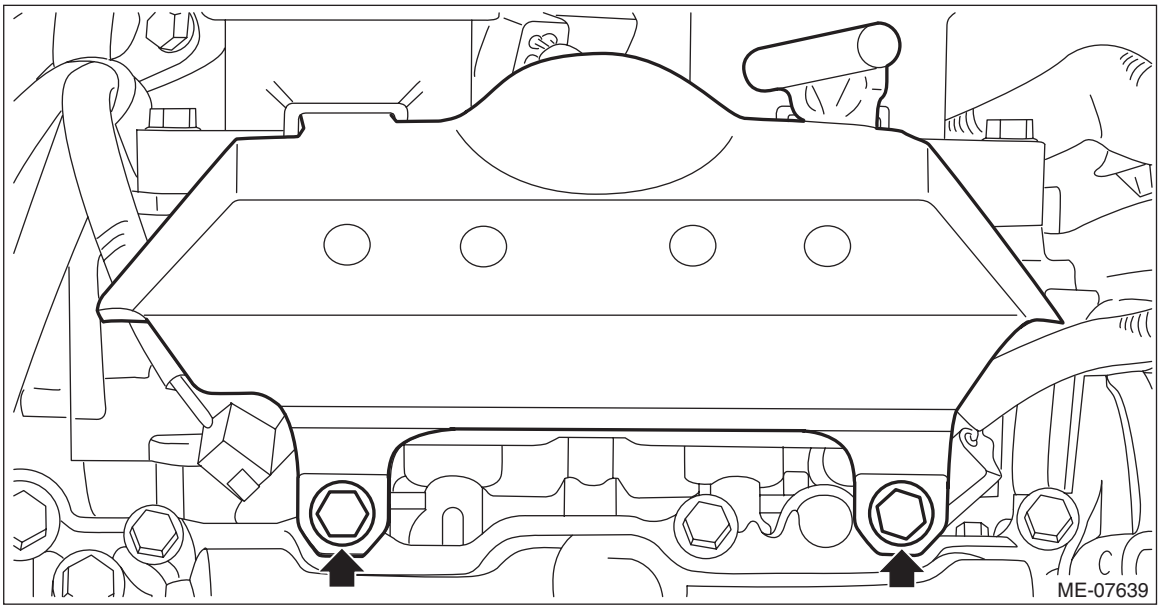


(7) Remove the front exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-6, REMOVAL, Front Exhaust Pipe.>
2) Remove the #1 ignition coil and the #3 ignition coil. <Ref. to IG(H4DO(w/o HEV))-12, REMOVAL, Ignition Coil.>
3) Remove the intake manifold protector RH.

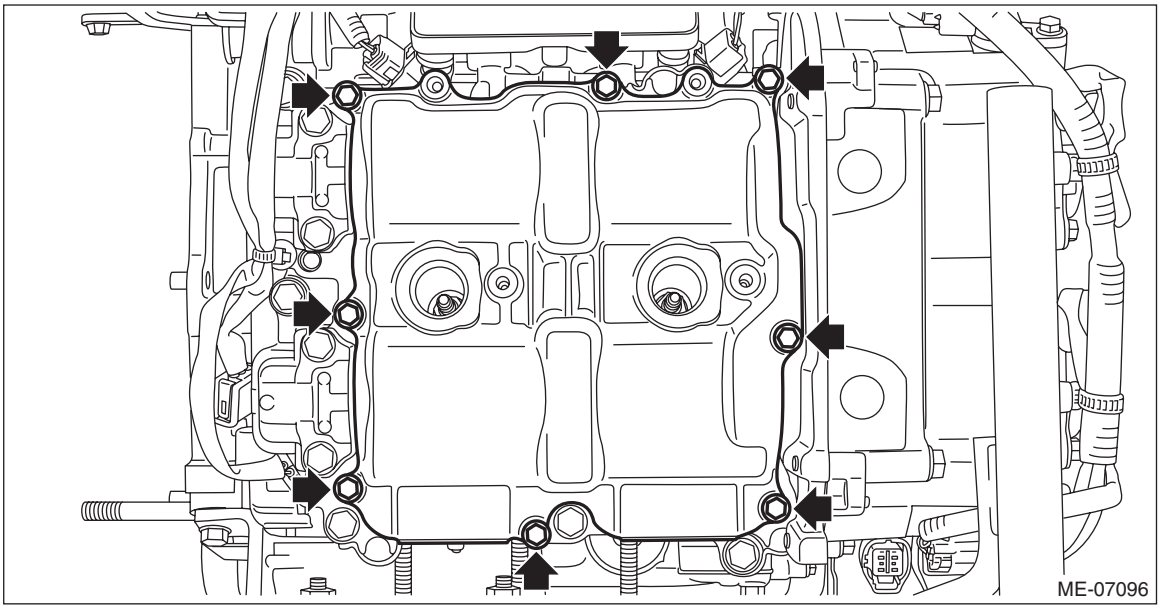
- Gasoline engine model



- HEV model



4) Remove the rocker cover RH.

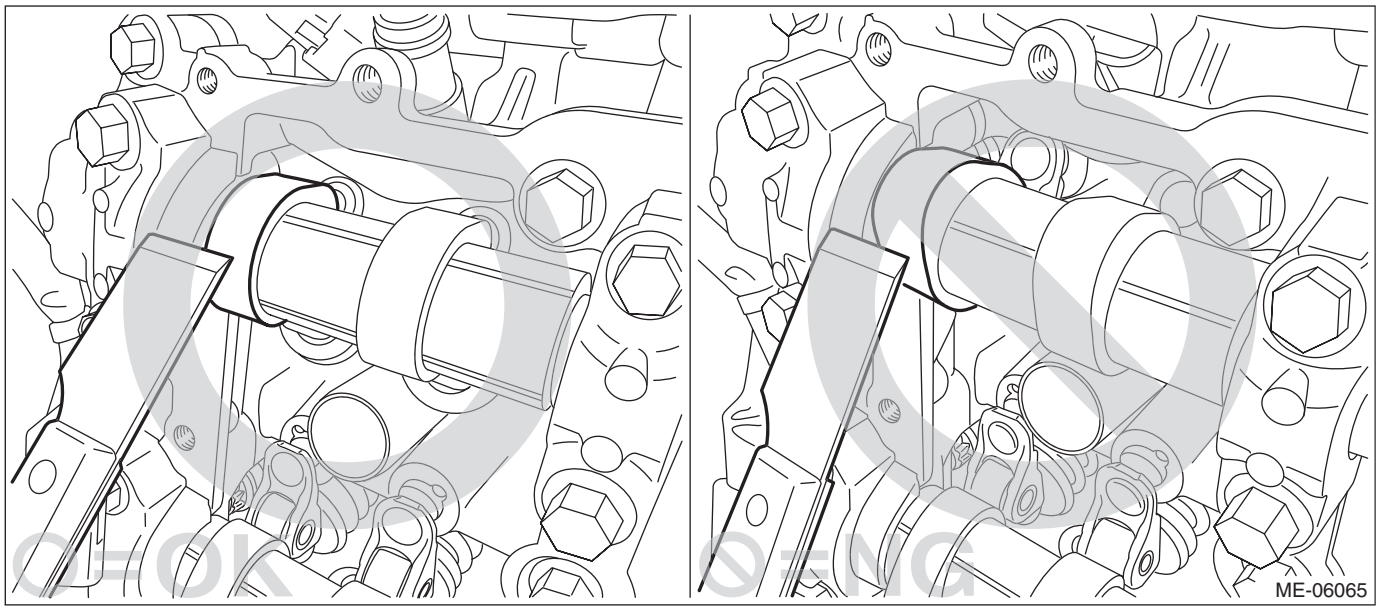


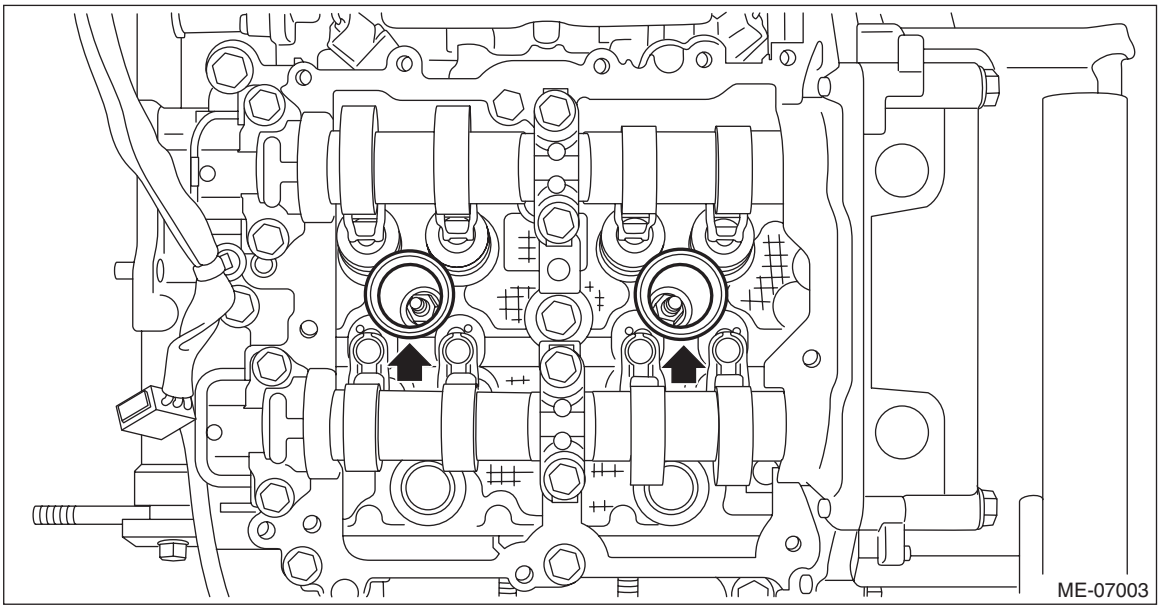
5) Remove the rocker cover gasket RH, #1 spark plug pipe gasket and #3 spark plug pipe gasket, and remove the liquid gasket.

CAUTION:

• When removing the liquid gasket from engine unit using scraper, use special care not to damage the cam lobe of camshaft RH.

• If the cam lobe of camshaft RH interferes, turn the crankshaft to the position where the scraper does not touch.



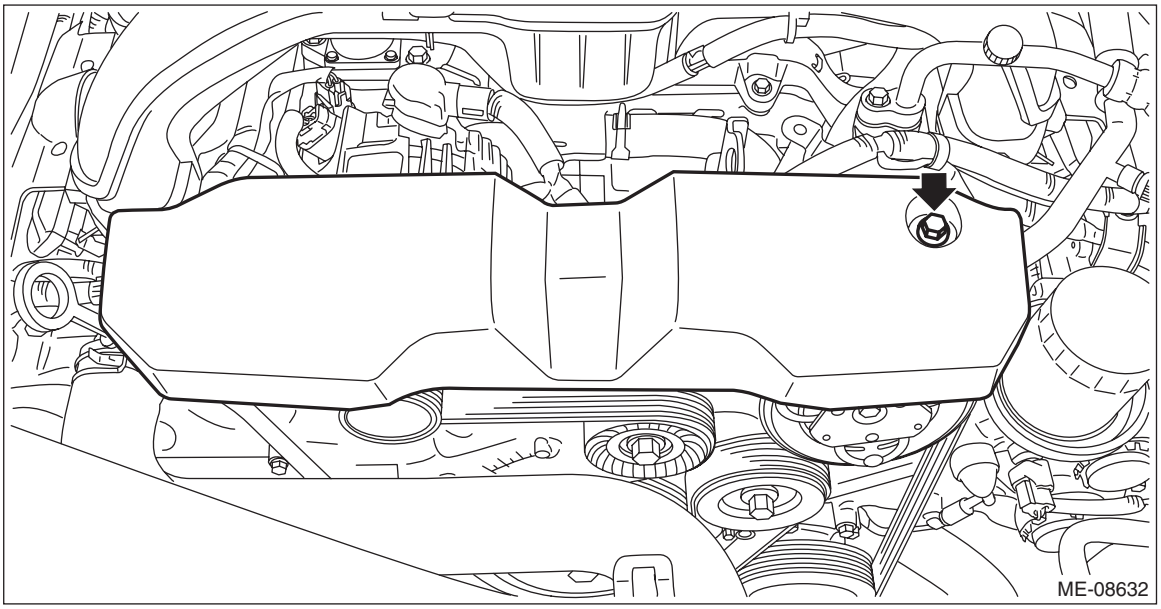


2. ROCKER COVER LH

NOTE:
When replacing a single part, perform the work with the engine assembly installed to body.
1) When working on the vehicle

NOTE:
When working on the vehicle, perform the following steps also.

(1) Remove the V-belt covers. (Gasoline engine model)



(2) Remove the V-belts. (Gasoline engine model) <Ref. to ME(H4DO(w/o HEV))-122, GASOLINE ENGINE MODEL, REMOVAL, V-belt.>

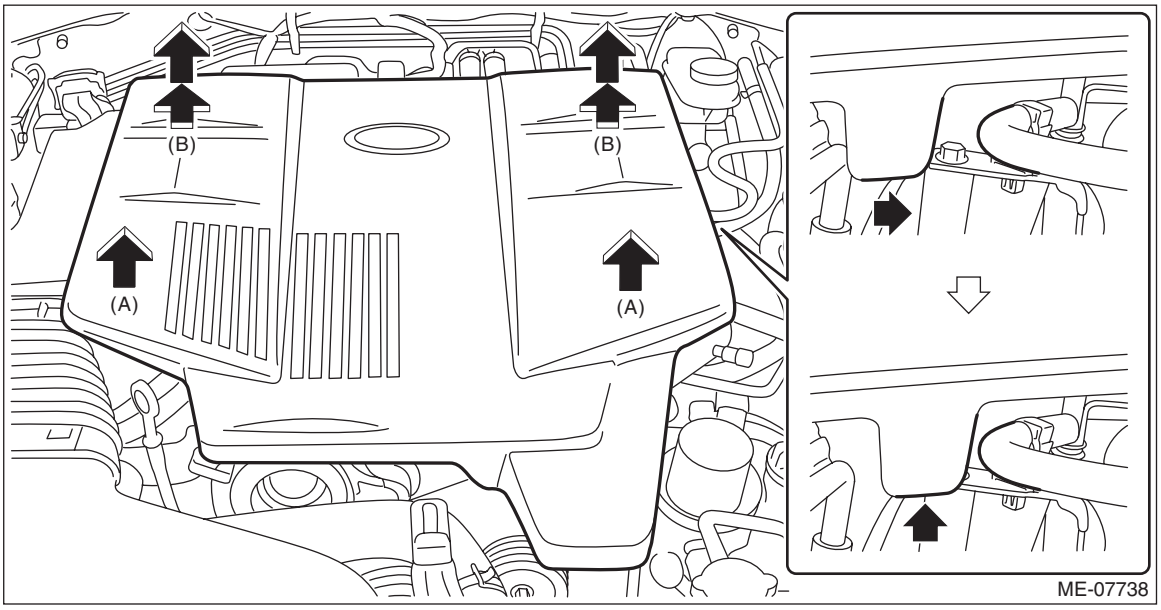
(3) Remove the battery. (Gasoline engine model) <Ref. to SC(H4DO(w/o HEV))-52, REMOVAL, Battery.>

(4) Turn the ignition switch to OFF. (HEV model)

(5) Remove the collector cover. (HEV model)

1. Carefully pull up the front of collector cover at two positions (A).
2. Carefully pull up the rear of collector cover at two positions (B) while moving it backward.

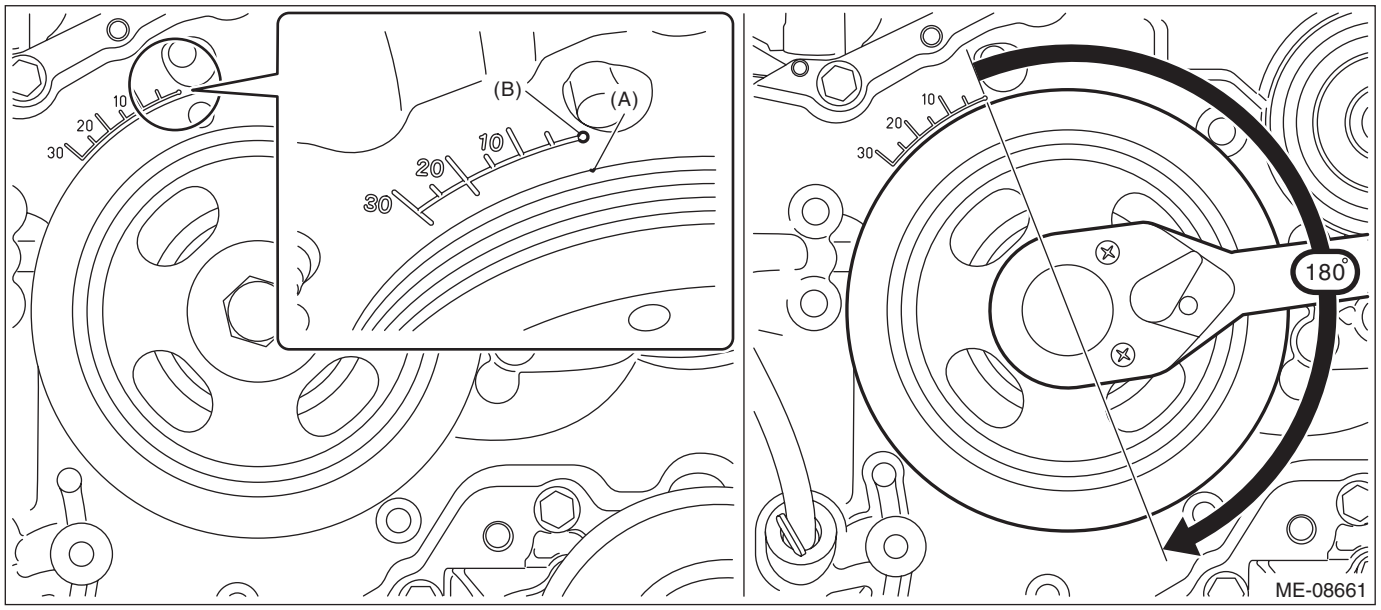
NOTE:
Be careful not to contact the fuel delivery tube when moving the collector cover rearward.



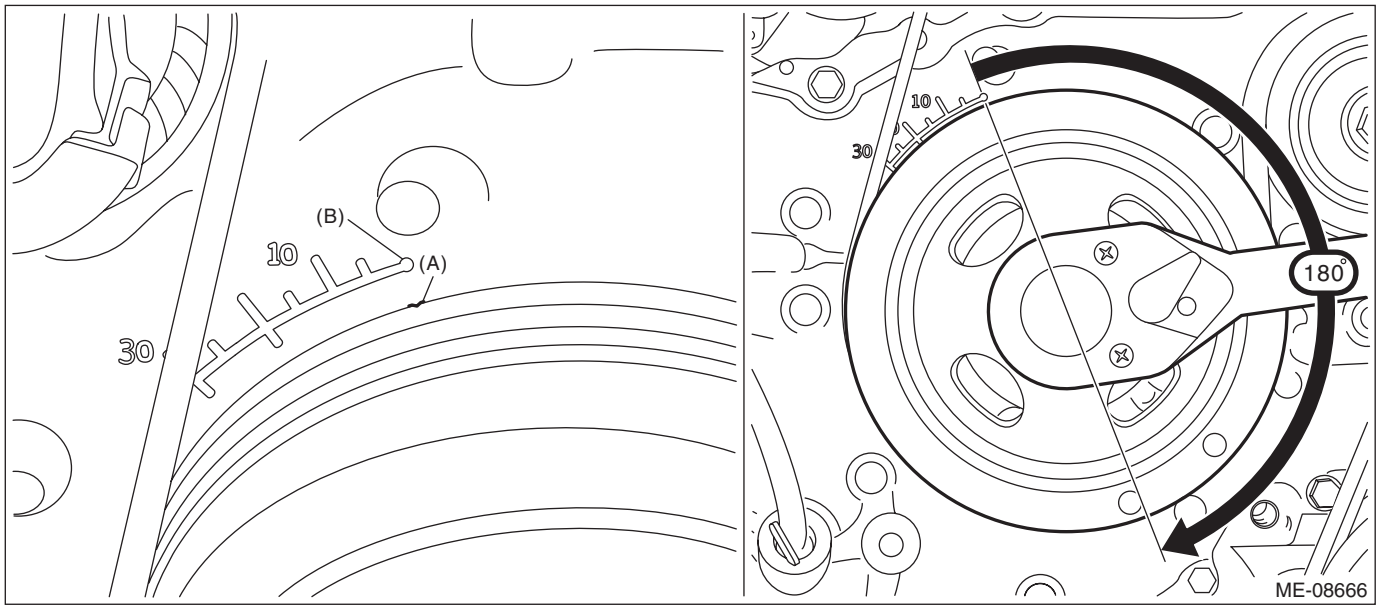
(6) Remove the 12 volt auxiliary battery. (HEV model) <Ref. to SC(H4DO(HEV))-39, 12 VOLT AUXILIARY BATTERY, REMOVAL, Battery.>
(7) Remove the air intake duct. <Ref. to IN(H4DO(w/o HEV))-13, REMOVAL, Air Intake Duct.> <Ref. to IN(H4DO(HEV))-15, REMOVAL, Air Intake Duct.>
(8) Align the timing mark (A) of crank pulley to the timing gauge (B) 0° of chain cover as shown in the figure, and turn the crankshaft by 180° clockwise from that position.

NOTE:
This procedure is required to prevent the rocker cover LH and the cam lobe of camshaft LH contacting with each other when removing the rocker cover LH.

- Gasoline engine model

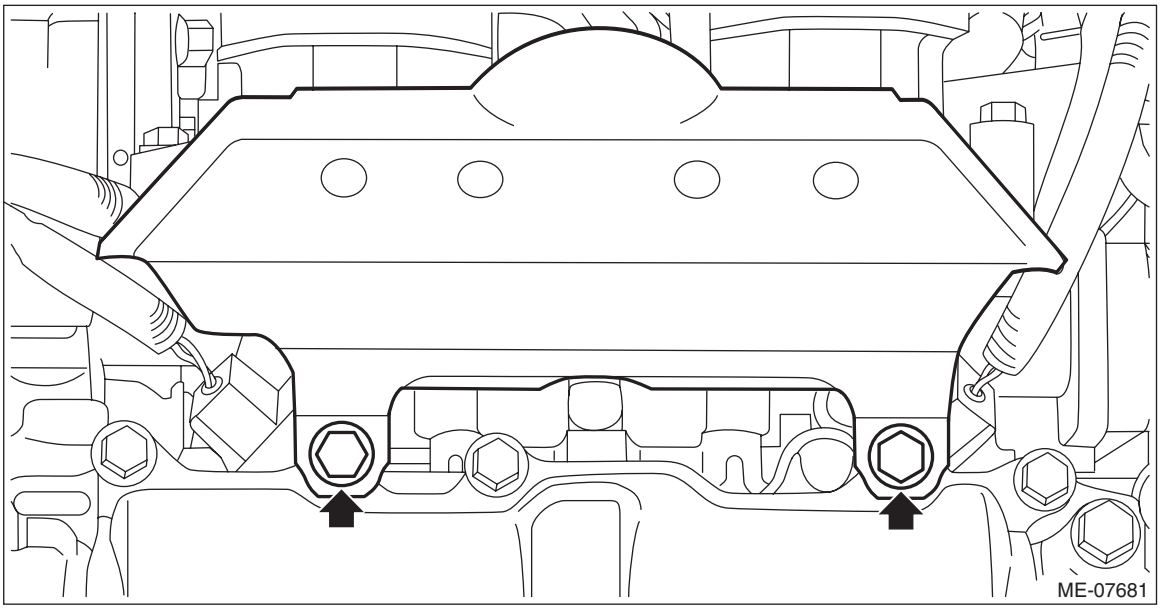


- HEV model

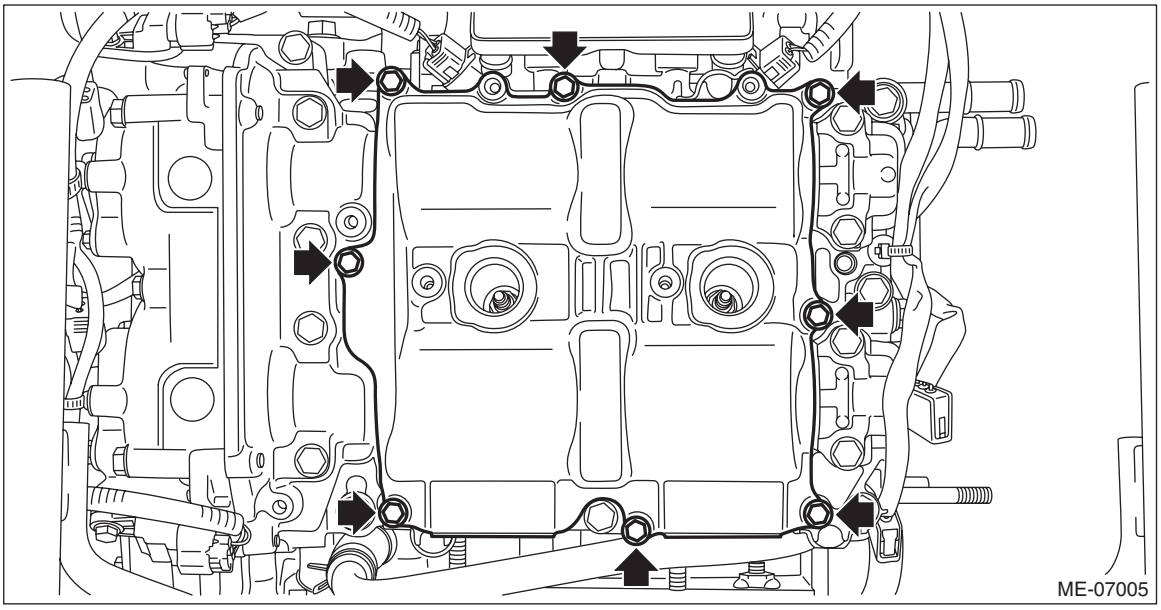


2) Remove the #2 ignition coil and the #4 ignition coil. <Ref. to IG(H4DO(w/o HEV))-12, REMOVAL, Ignition Coil.>

3) Remove the intake manifold protector LH.

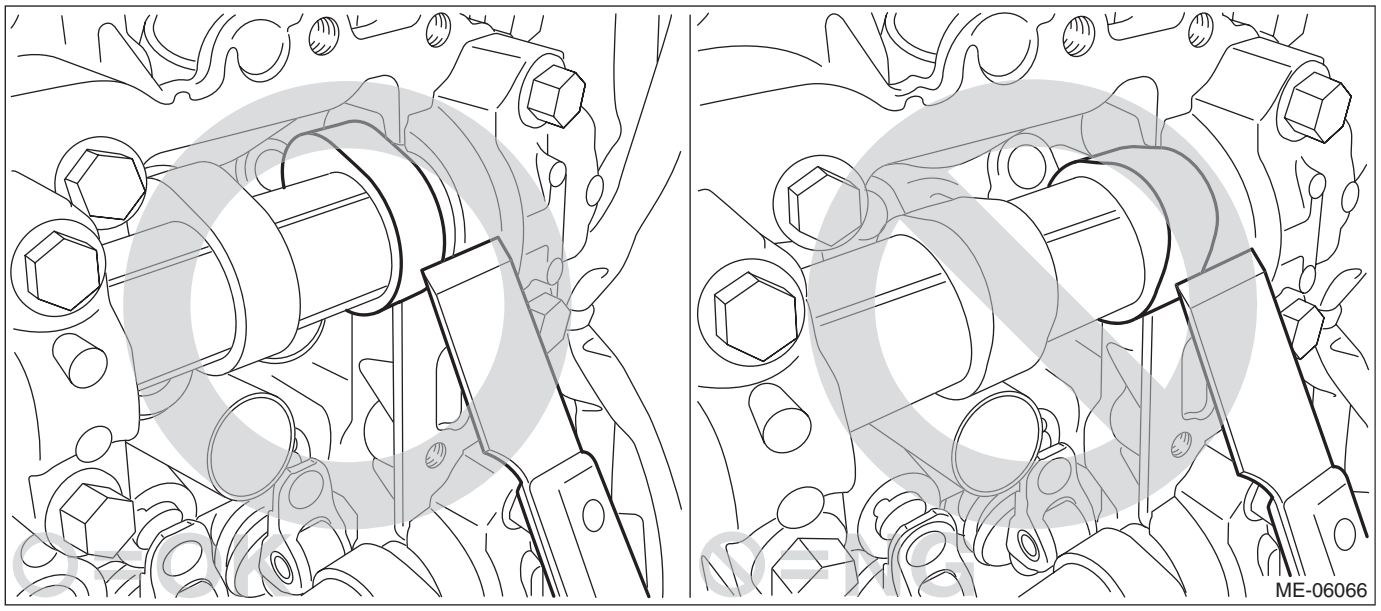


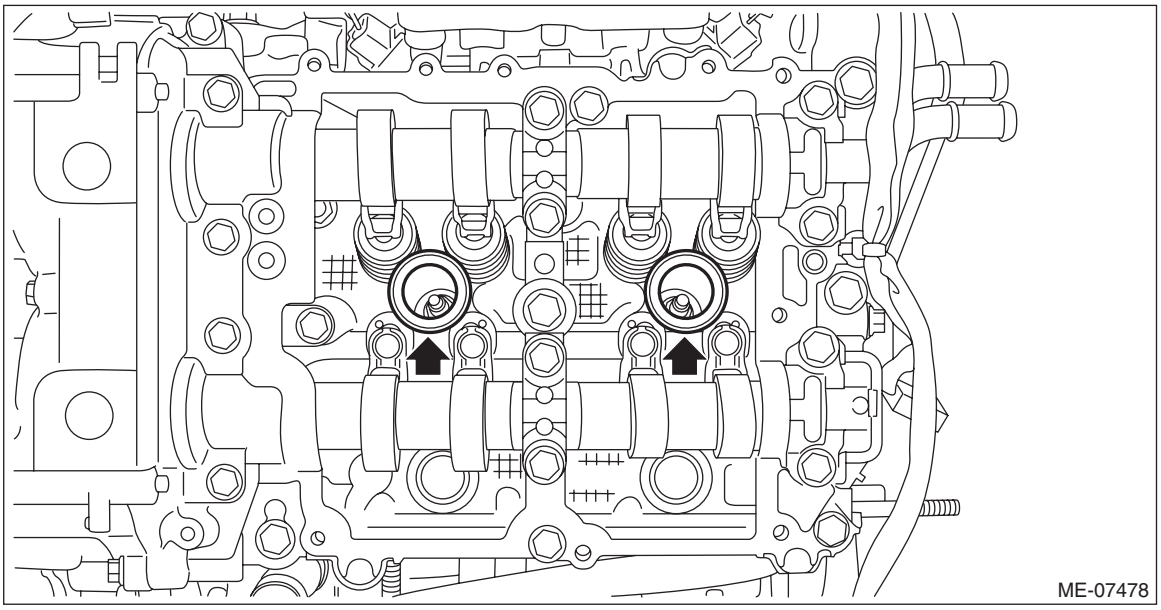
4) Remove the rocker cover LH.



5) Remove the rocker cover gasket LH, #2 spark plug pipe gasket and #4 spark plug pipe gasket, and remove the liquid gasket.

CAUTION:
• When removing the liquid gasket from engine unit using scraper, use special care not to damage the cam lobe of camshaft LH.
• If the cam lobe of camshaft LH interferes, turn the crankshaft to the position where the scraper does not touch.



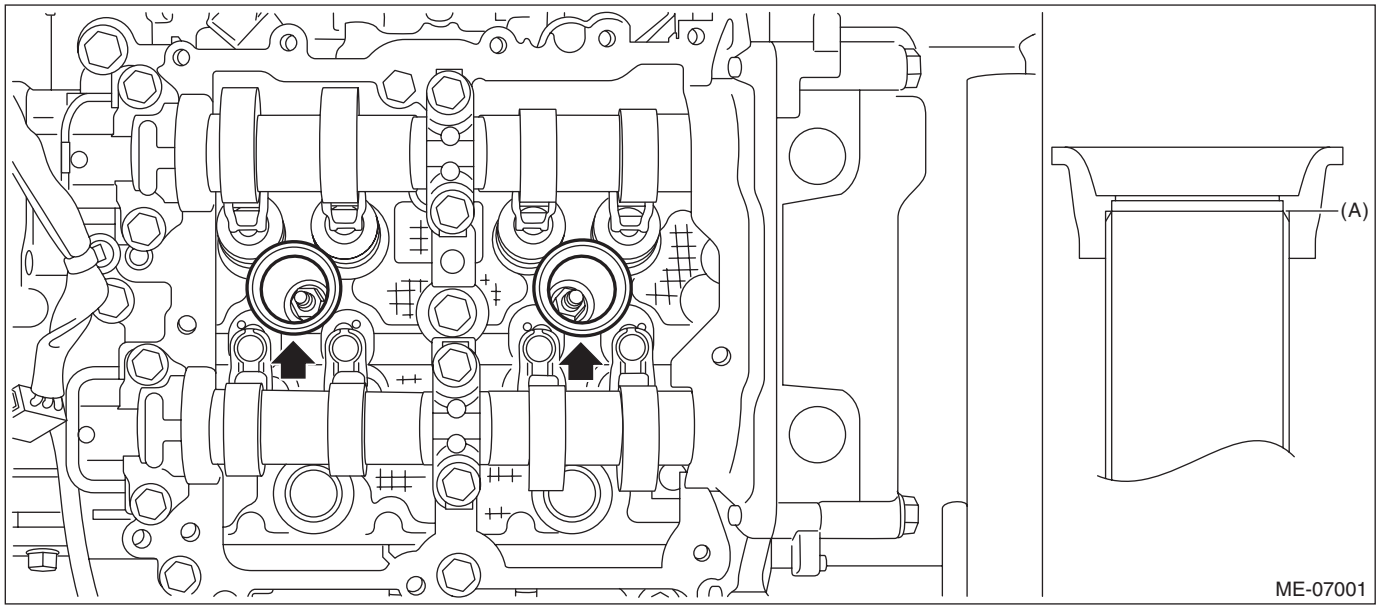


B: INSTALLATION

1. ROCKER COVER RH

1) Install the #1 spark plug pipe gasket and #3 spark plug pipe gasket to the #1 spark plug pipe and #3 spark plug pipe.

NOTE:
- Use a new #1 spark plug pipe gasket and #3 spark plug pipe gasket.
- Apply a light coat of engine oil to the #1 spark plug pipe gasket and #3 spark plug pipe gasket, and insert them onto the spark plug pipe edge (A).



2) Install the rocker cover gasket RH to the rocker cover RH.

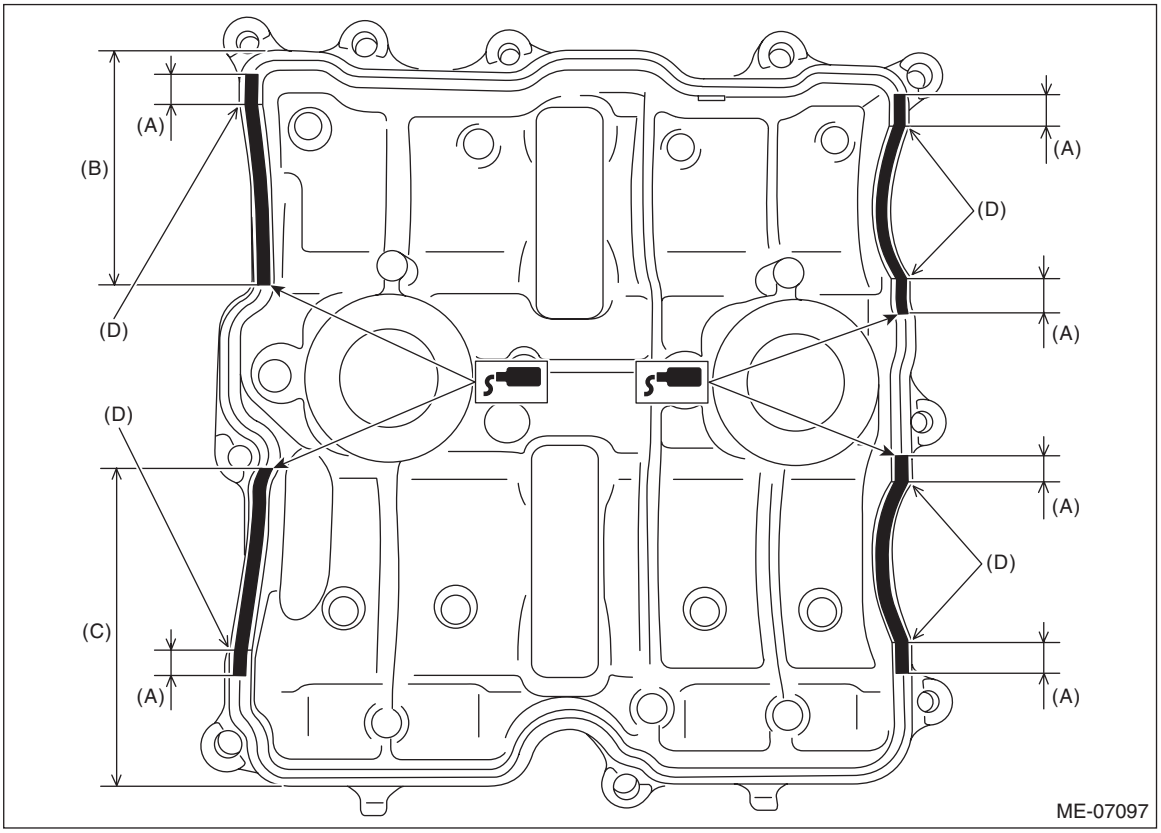
NOTE:
Use a new rocker cover gasket RH.

3) Apply liquid gasket to the mating surface of rocker cover RH as shown in the figure.

NOTE:
- Before applying liquid gasket, degrease the old liquid gasket seal surface of the engine.
- Be careful not to allow liquid gasket to be squeezed out from rocker cover RH.
- Install within 5 min. after applying liquid gasket.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

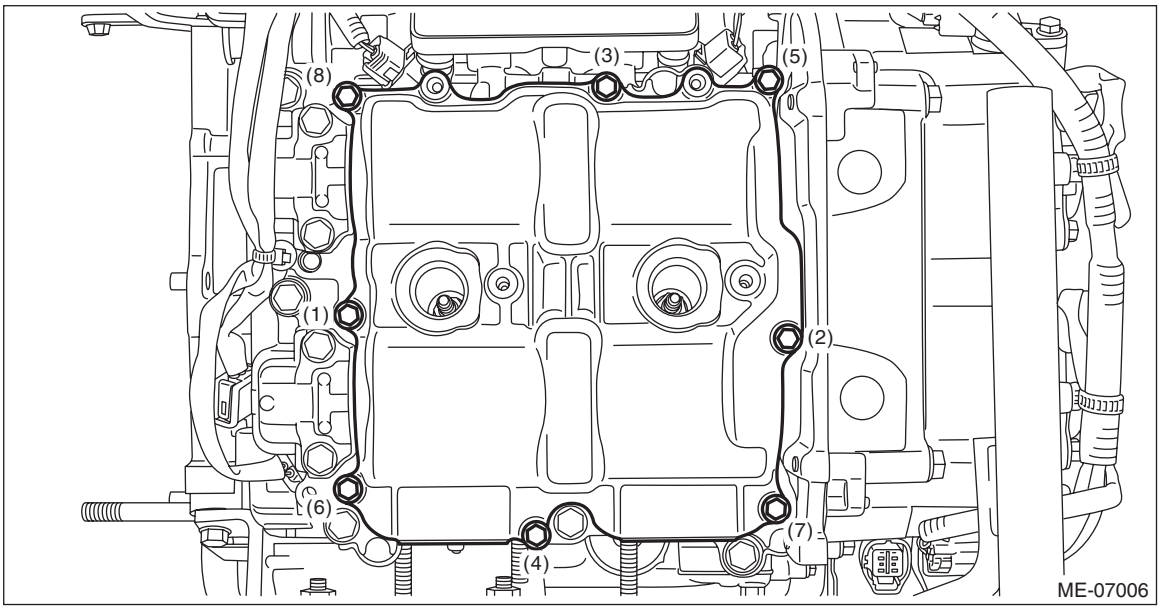
Liquid gasket applying diameter:
3.5±0.5 mm (0.1378±0.0197 in)



(A) 10 mm (0.394 in) or more
(B) 68 mm (2.677 in) or more
(C) 89 mm (3.504 in) or more
(D) Arch starting point

4) Set the rocker cover RH, and tighten the bolts in numerical order as shown in the figure.

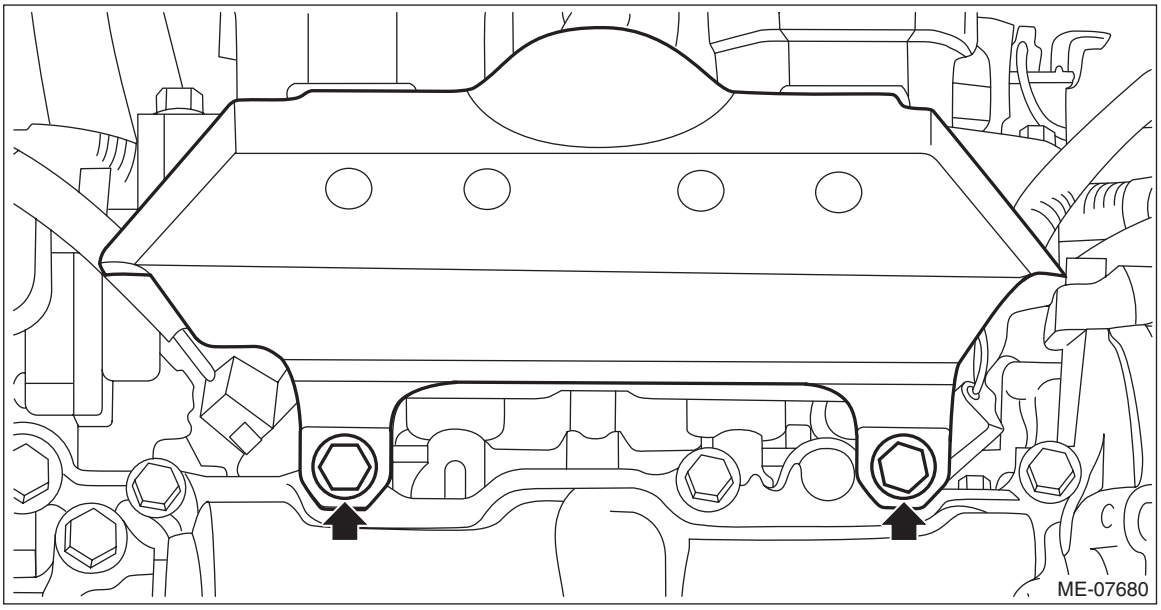
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



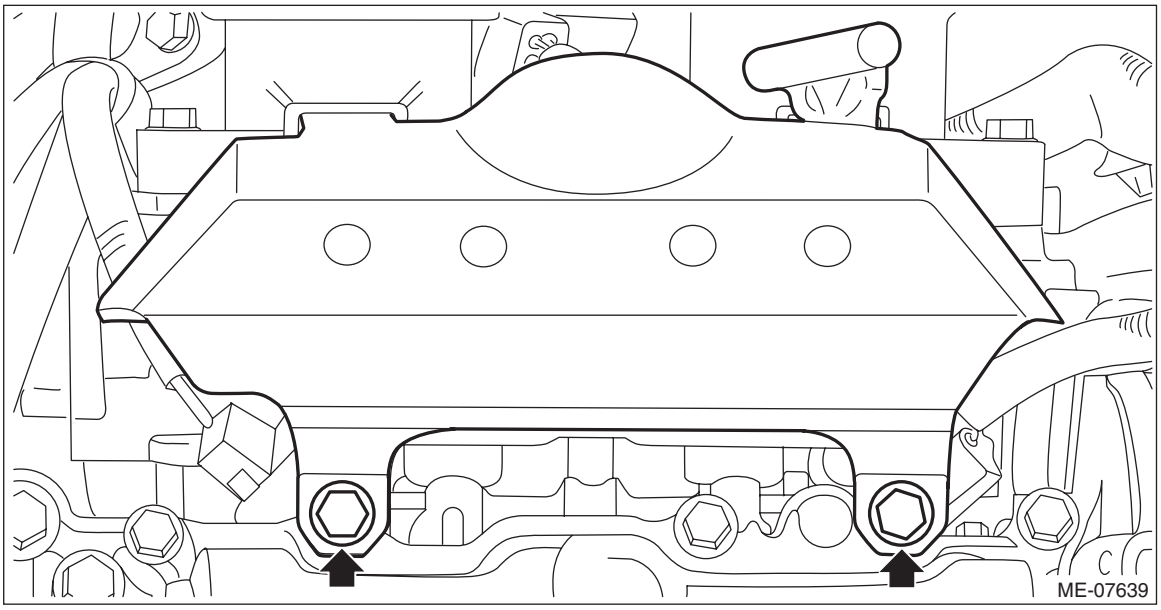
5) Install the intake manifold protector RH.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

- Gasoline engine model



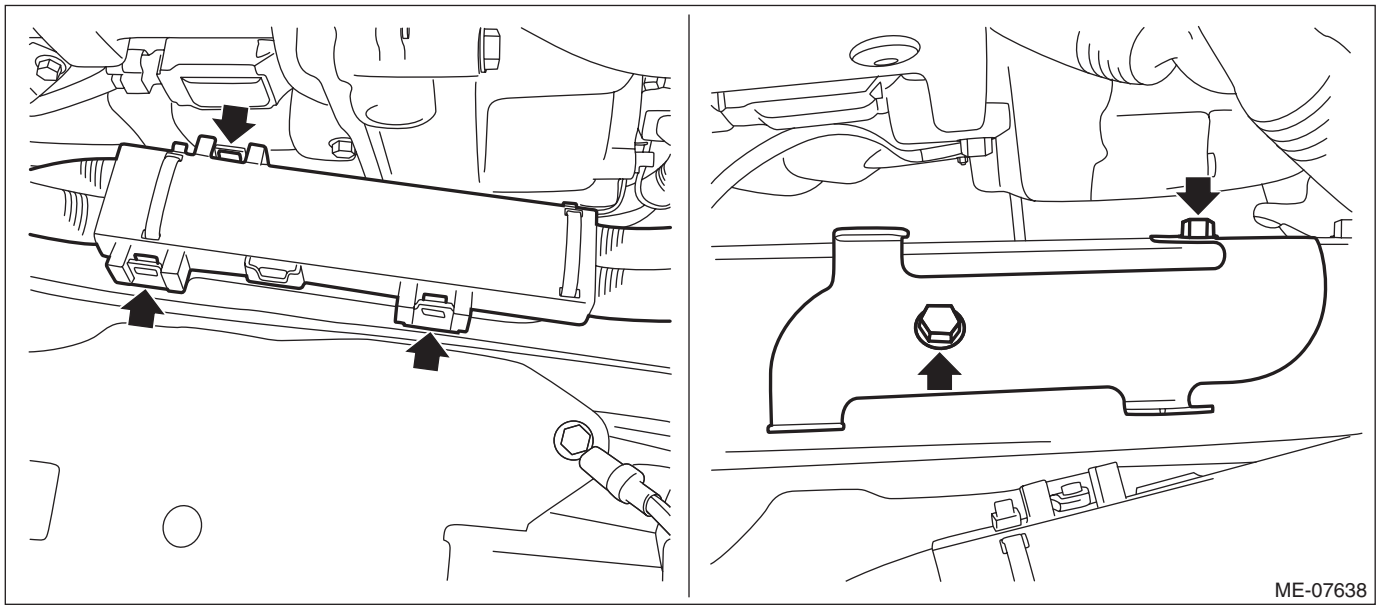
- HEV model



6) Install the #1 ignition coil and the #3 ignition coil. <Ref. to IG(H4DO(w/o HEV))-12, INSTALLATION, Ignition Coil.>
7) When working on the vehicle

NOTE:
When working on the vehicle, perform the following steps also.
(1) Install the front exhaust pipe. <Ref. to EX(H4DO(w/o HEV))-8, INSTALLATION, Front Exhaust Pipe.>
(2) Install the air intake boot. (Gasoline engine model) <Ref. to IN(H4DO(w/o HEV))-12, INSTALLATION, Air Intake Boot.>
(3) Install the air cleaner case. (Gasoline engine model) <Ref. to IN(H4DO(w/o HEV))-9, INSTALLATION, Air Cleaner Case.>
(4) Install the battery cable bracket No. 2 to the vehicle, and install the battery cable assembly to battery cable bracket No. 2. (HEV model)

Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



(5) Install the 12 volt engine restart battery. (HEV model) <Ref. to SC(H4DO(HEV))-42, 12 VOLT ENGINE RESTART BATTERY, INSTALLATION, Battery.>

(6) Install the intake duct. (HEV model) <Ref. to IN(H4DO(HEV))-17, INSTALLATION, Intake Duct.>

2. ROCKER COVER LH

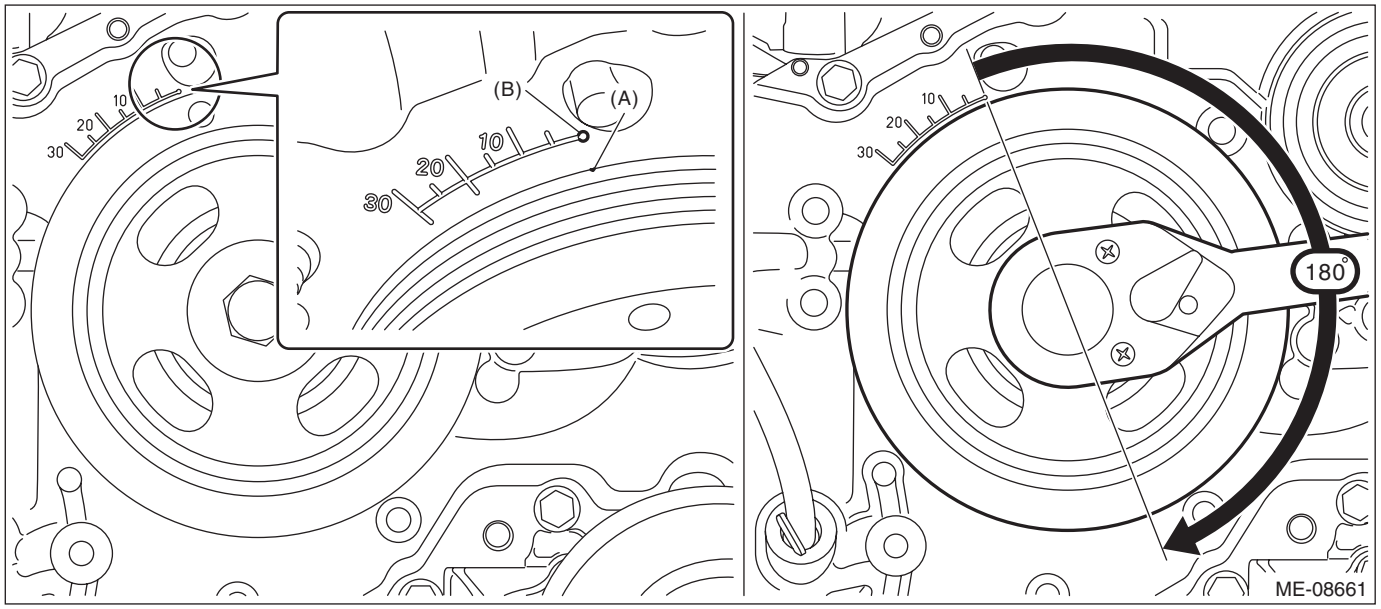
1) When working on the vehicle

NOTE:
When working on the vehicle, perform the following steps also.

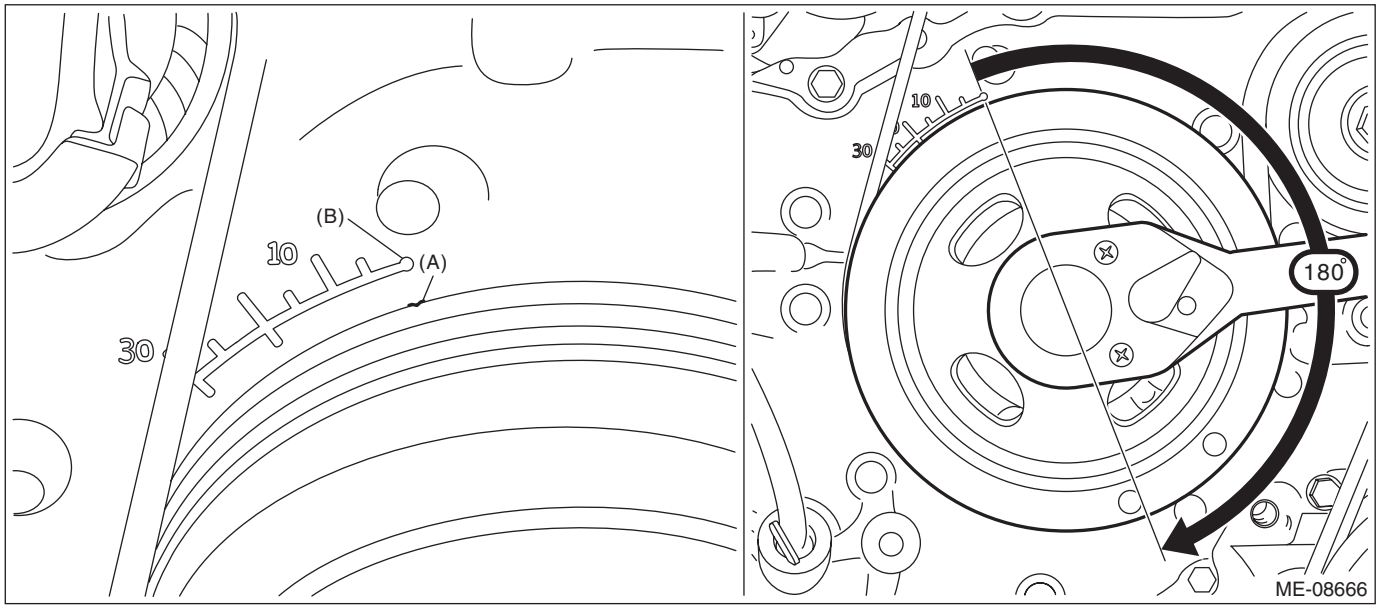
(1) Align the timing mark (A) of crank pulley to the timing gauge (B) of chain cover as shown in the figure, and turn the crankshaft by 180° clockwise from that position.

NOTE:
This procedure is required to prevent the rocker cover LH and the cam lobe of camshaft LH contacting with each other when installing the rocker cover LH.

- Gasoline engine model

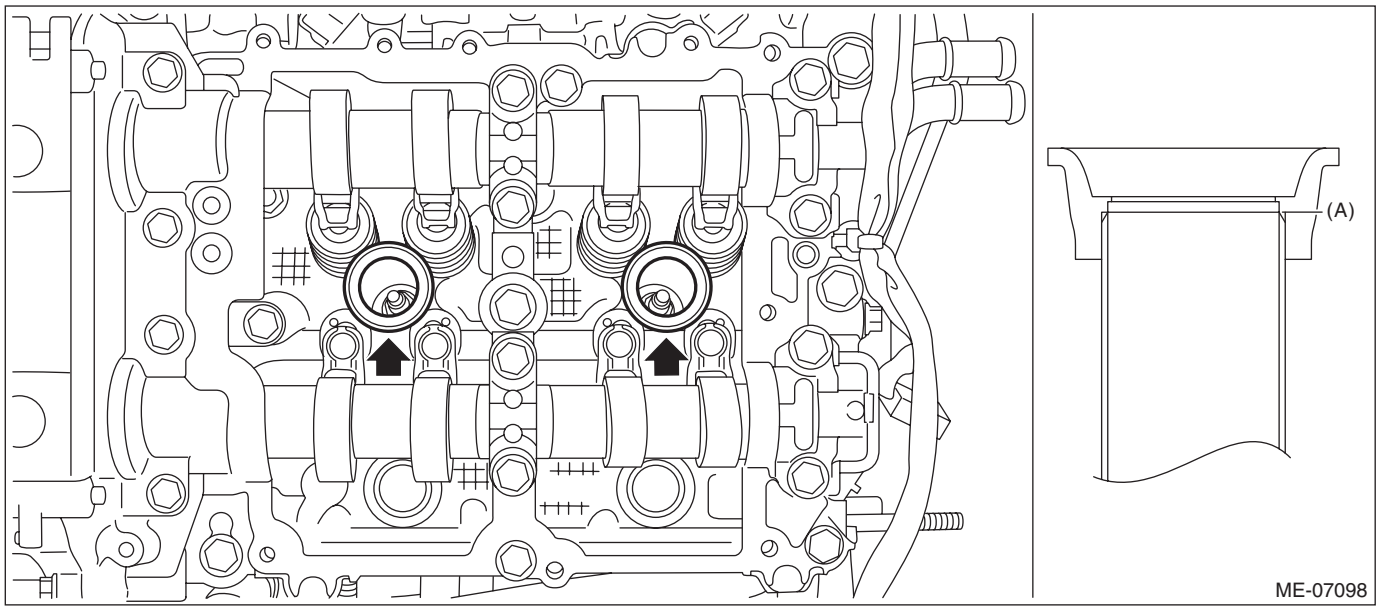


- HEV model



2) Install the #2 spark plug pipe gasket and #4 spark plug pipe gasket to the #2 spark plug pipe and #4 spark plug pipe.

NOTE:
- Use a new #2 spark plug pipe gasket and #4 spark plug pipe gasket.
- Apply a light coat of engine oil to the #2 spark plug pipe gasket and #4 spark plug pipe gasket, and insert them onto the spark plug pipe edge (A).



3) Install the rocker cover gasket LH to the rocker cover LH.

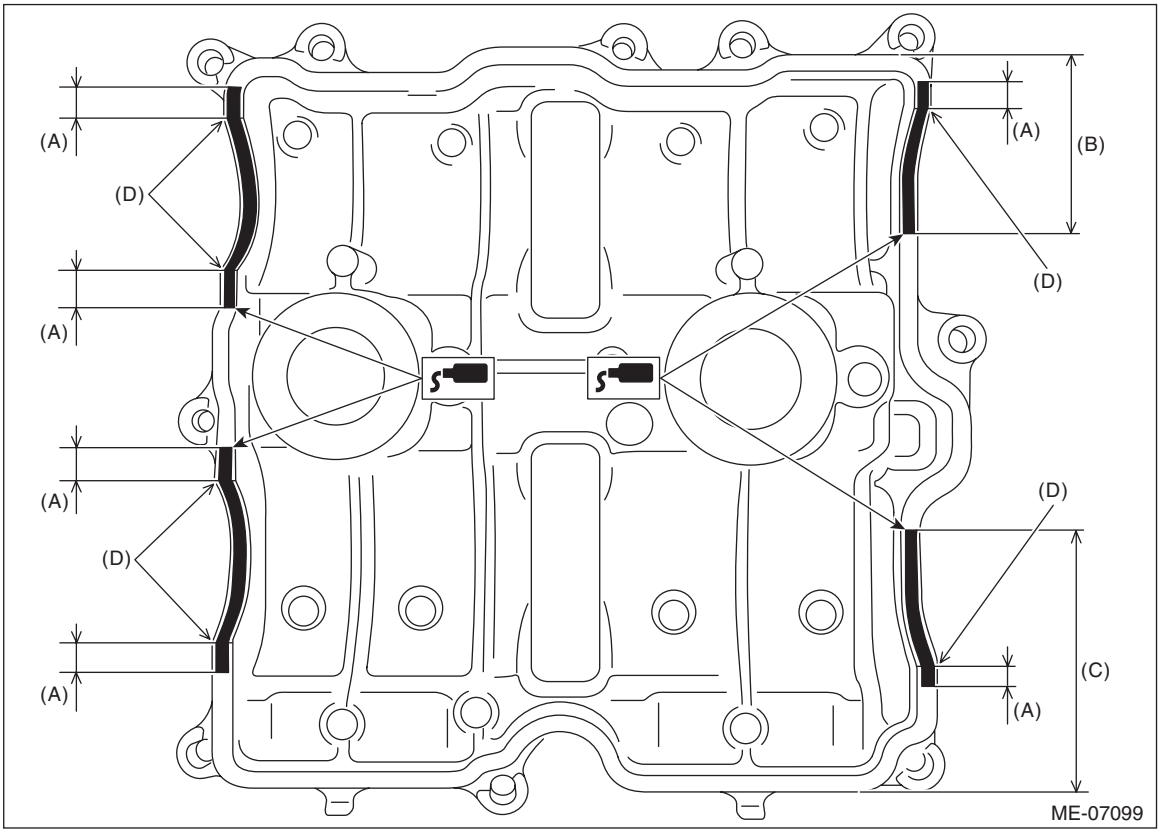
NOTE:
Use a new rocker cover gasket LH.

4) Apply liquid gasket to the mating surface of rocker cover LH as shown in the figure.

NOTE:
- Before applying liquid gasket, degrease the old liquid gasket seal surface of the engine.
- Be careful not to allow liquid gasket to be squeezed out from rocker cover LH.
- Install within 5 min. after applying liquid gasket.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

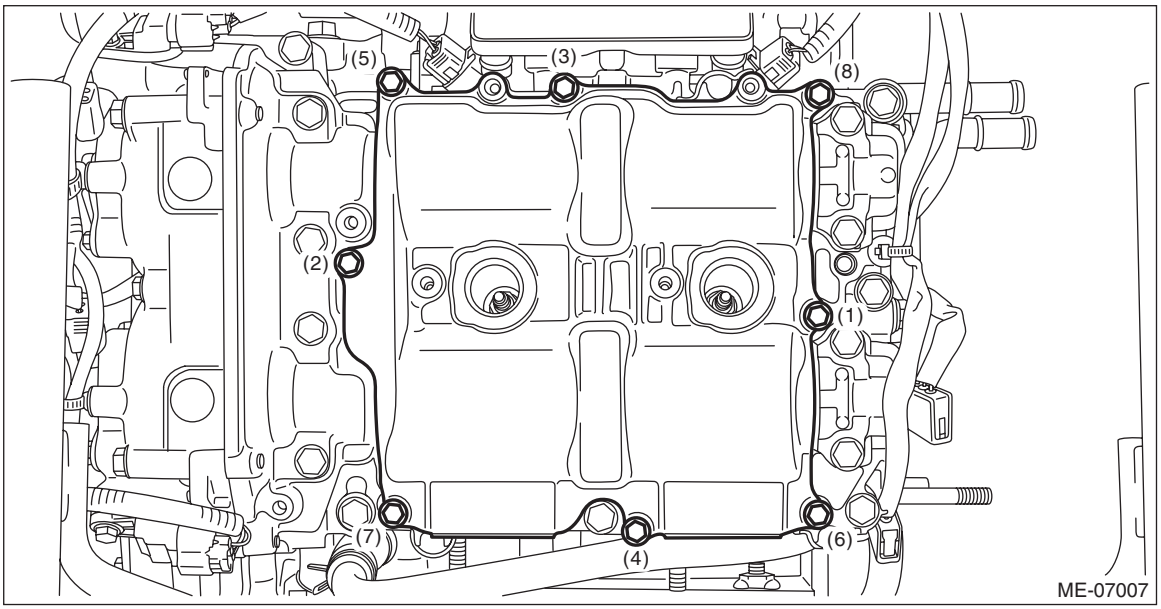
Liquid gasket applying diameter:
3.5±0.5 mm (0.1378±0.0197 in)



(A) 10 mm (0.394 in) or more
(B) 51 mm (2.008 in) or more
(C) 73 mm (2.874 in) or more
(D) Arch starting point

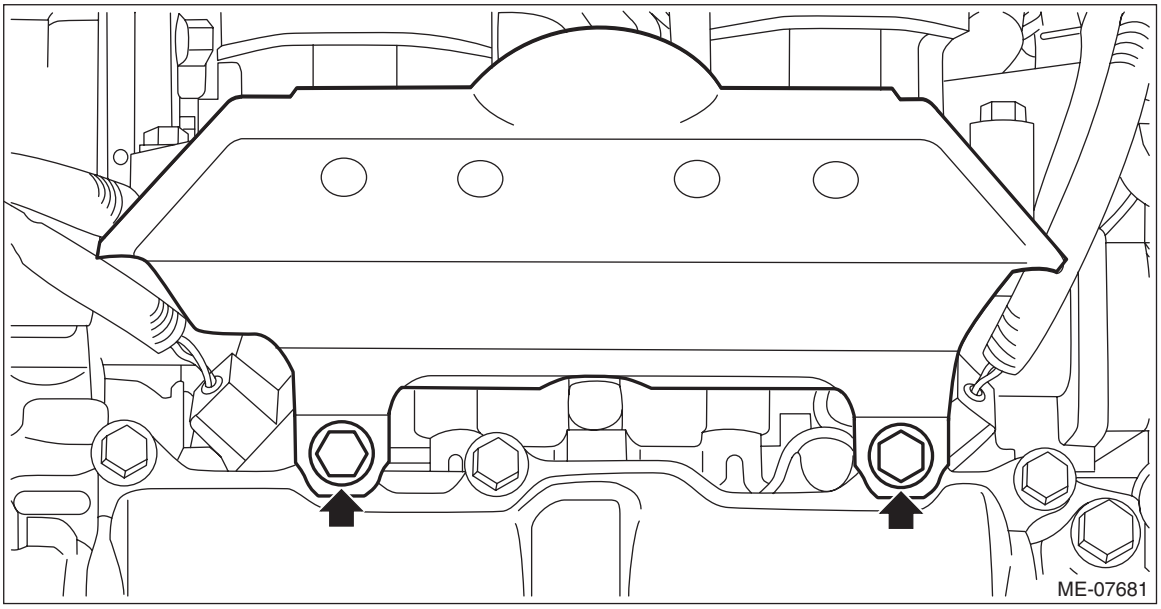
5) Set the rocker cover LH, and tighten the bolts in numerical order as shown in the figure.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



6) Install the intake manifold protector LH.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



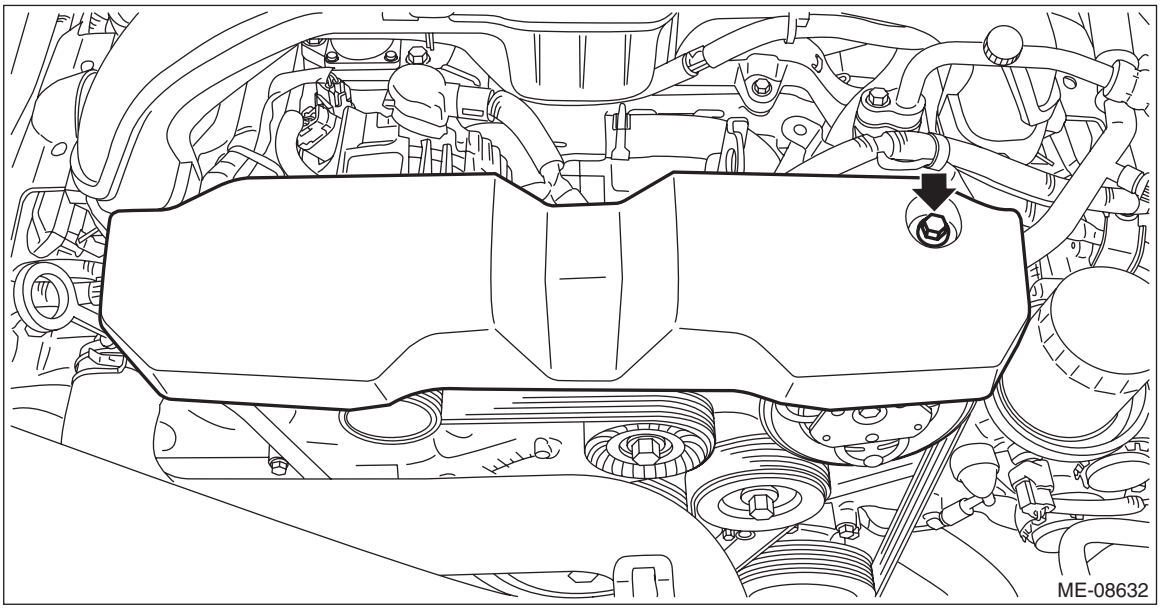
7) Install the #2 ignition coil and the #4 ignition coil. <Ref. to IG(H4DO(w/o HEV))-12, INSTALLATION, Ignition Coil.>

8) When working on the vehicle

NOTE:
When working on the vehicle, perform the following steps also.

(1) Install the air intake duct. <Ref. to IN(H4DO(w/o HEV))-13, INSTALLATION, Air Intake Duct.> <Ref. to IN(H4DO(HEV))-15, INSTALLATION, Air Intake Duct.>
(2) Install the battery. (Gasoline engine model) <Ref. to SC(H4DO(w/o HEV))-52, INSTALLATION, Battery.>
(3) Install the V-belt cover. (Gasoline engine model)

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



(4) Install the 12 volt auxiliary battery. (HEV model) <Ref. to SC(H4DO(HEV))-41, 12 VOLT AUXILIARY BATTERY, INSTALLATION, Battery.>
(5) Install the collector cover. (HEV model)

C: INSPECTION

Check that the rocker cover does not have deformation, cracks and any other damage.

19.Camshaft

A: REMOVAL

1. CAMSHAFT RH

The camshaft RH and cam carrier are designed as removing as a unit. Refer to “Cam Carrier” for removal procedures of camshaft RH. <Ref. to ME(H4DO(w/o HEV))-220, CAM CARRIER RH, REMOVAL, Cam Carrier.> <Ref. to ME(H4DO(w/o HEV))-250, CAM CARRIER RH, DISASSEMBLY, Cam Carrier.>

2. CAMSHAFT LH

The camshaft LH and cam carrier are designed as removing as a unit. Refer to “Cam Carrier” for removal procedures of camshaft LH. <Ref. to ME(H4DO(w/o HEV))-225, CAM CARRIER LH, REMOVAL, Cam Carrier.> <Ref. to ME(H4DO(w/o HEV))-252, CAM CARRIER LH, DISASSEMBLY, Cam Carrier.>

B: INSTALLATION

1. CAMSHAFT RH

The camshaft RH and cam carrier are designed as installing as a unit. Refer to “Cam Carrier” for installation procedures of camshaft RH. <Ref. to ME(H4DO(w/o HEV))-253, CAM CARRIER RH, ASSEMBLY, Cam Carrier.> <Ref. to ME(H4DO(w/o HEV))-230, CAM CARRIER RH, INSTALLATION, Cam Carrier.>

2. CAMSHAFT LH

The camshaft LH and cam carrier are designed as installing as a unit. Refer to “Cam Carrier” for installation procedures of camshaft LH. <Ref. to ME(H4DO(w/o HEV))-255, CAM CARRIER LH, ASSEMBLY, Cam Carrier.> <Ref. to ME(H4DO(w/o HEV))-240, CAM CARRIER LH, INSTALLATION, Cam Carrier.>

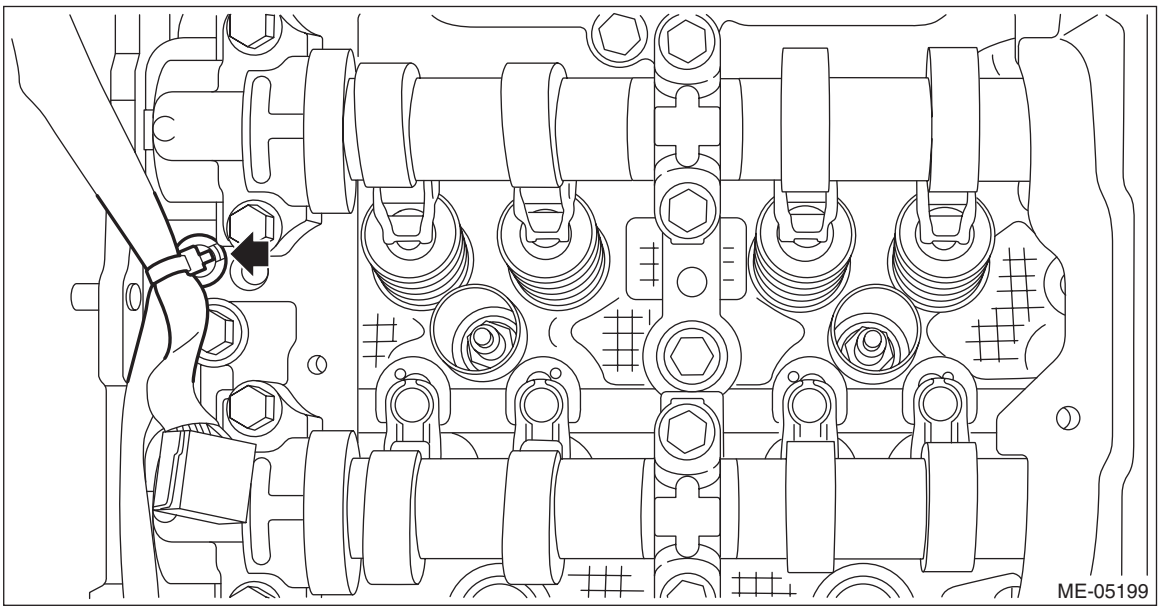
20.Cam Carrier

A: REMOVAL

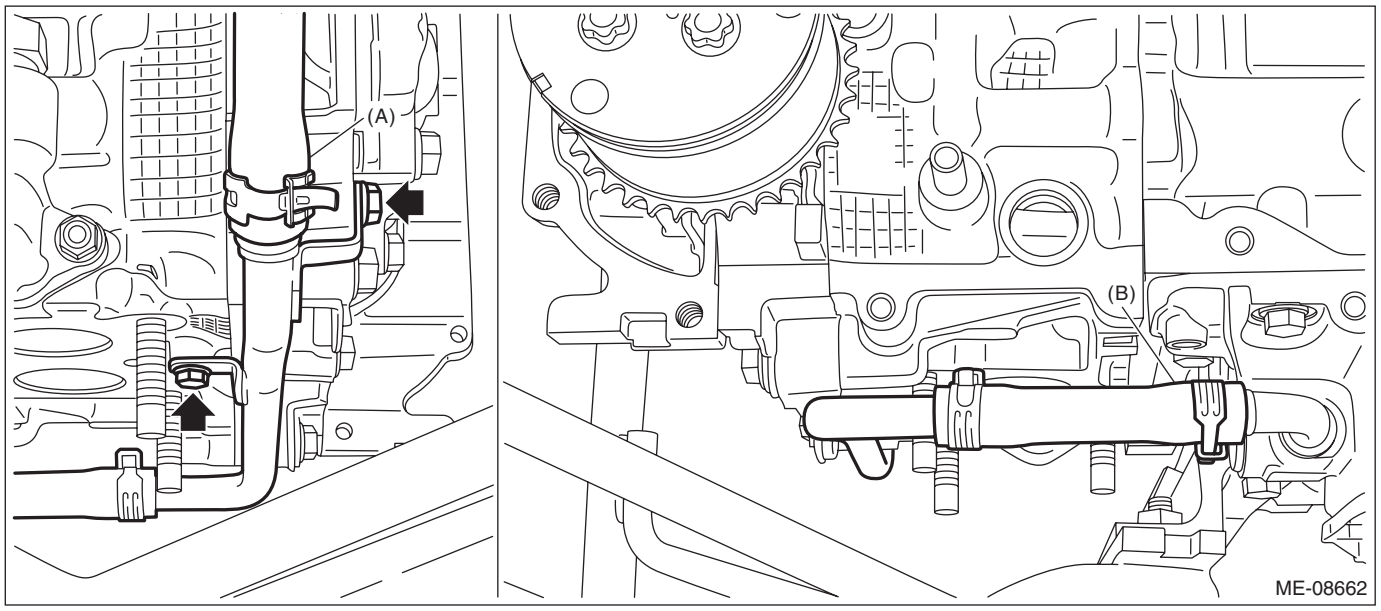
1. CAM CARRIER RH

1) Remove the engine from the vehicle. <Ref. to ME(H4DO(w/o HEV))-55, REMOVAL, Engine Assembly.>
2) Remove the chain cover. <Ref. to ME(H4DO(w/o HEV))-149, REMOVAL, Chain Cover.>
3) Remove the timing chain RH. <Ref. to ME(H4DO(w/o HEV))-169, TIMING CHAIN RH, REMOVAL, Timing Chain Assembly.>
4) Remove the cam sprocket RH. <Ref. to ME(H4DO(w/o HEV))-191, CAM SPROCKET RH, REMOVAL, Cam Sprocket.>

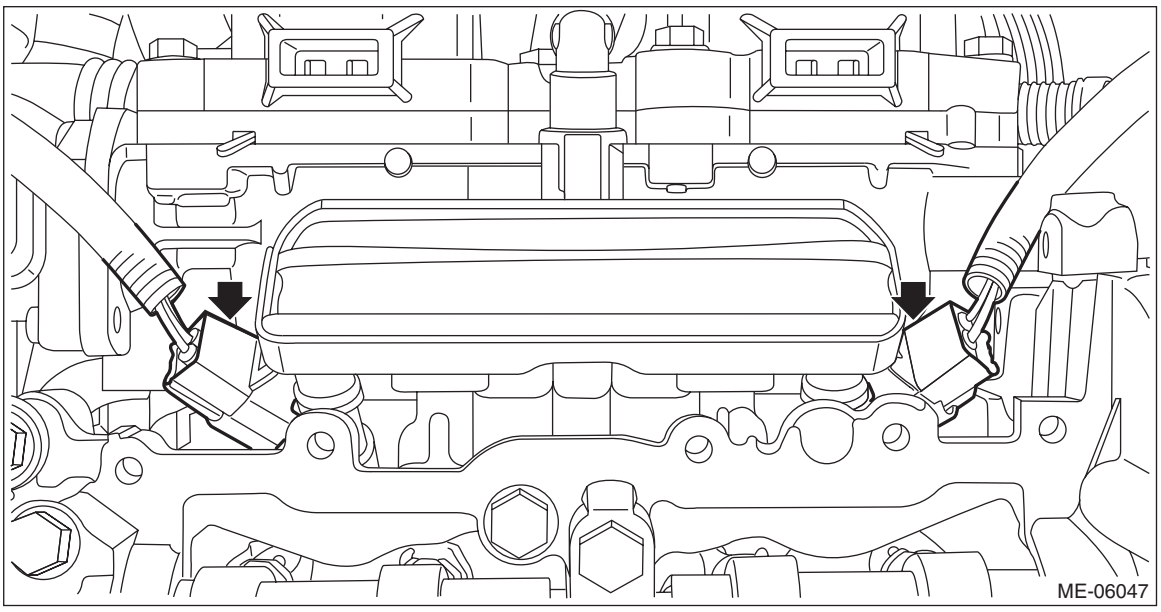
NOTE:
This procedure is required only when disassembling the cam carrier RH.
5) Remove the rocker cover RH. <Ref. to ME(H4DO(w/o HEV))-202, ROCKER COVER RH, REMOVAL, Rocker Cover.>
6) Remove the clip holding the engine harness from cam carrier RH.



7) Disconnect the engine coolant inlet hose (A) from the water pipe assembly RH.
8) Disconnect the water pipe hose (B) from oil pan upper, and remove the water pipe assembly RH.

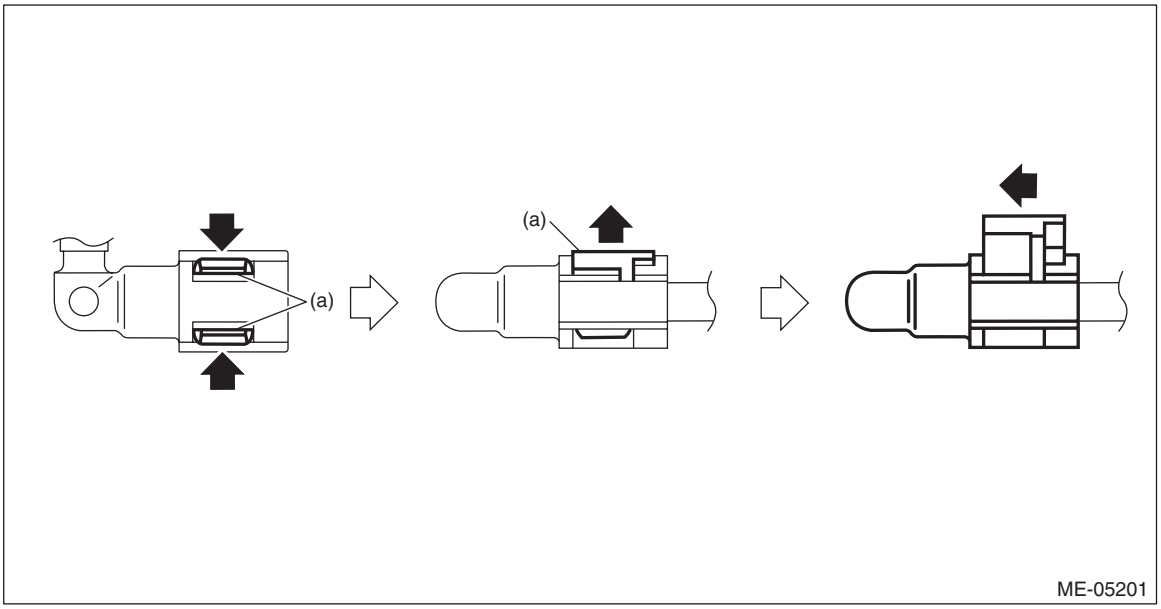


9) Remove the fuel pipe RH and the fuel injector RH.
(1) Disconnect the connector from fuel injector RH.

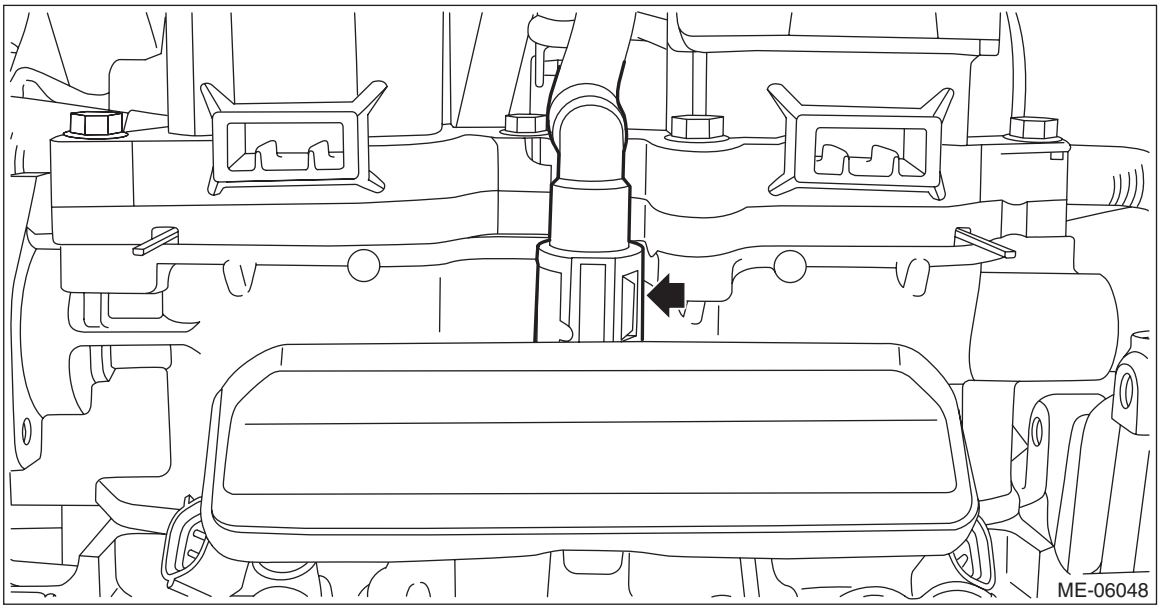


(2) Disconnect the quick connector from fuel pipe RH.

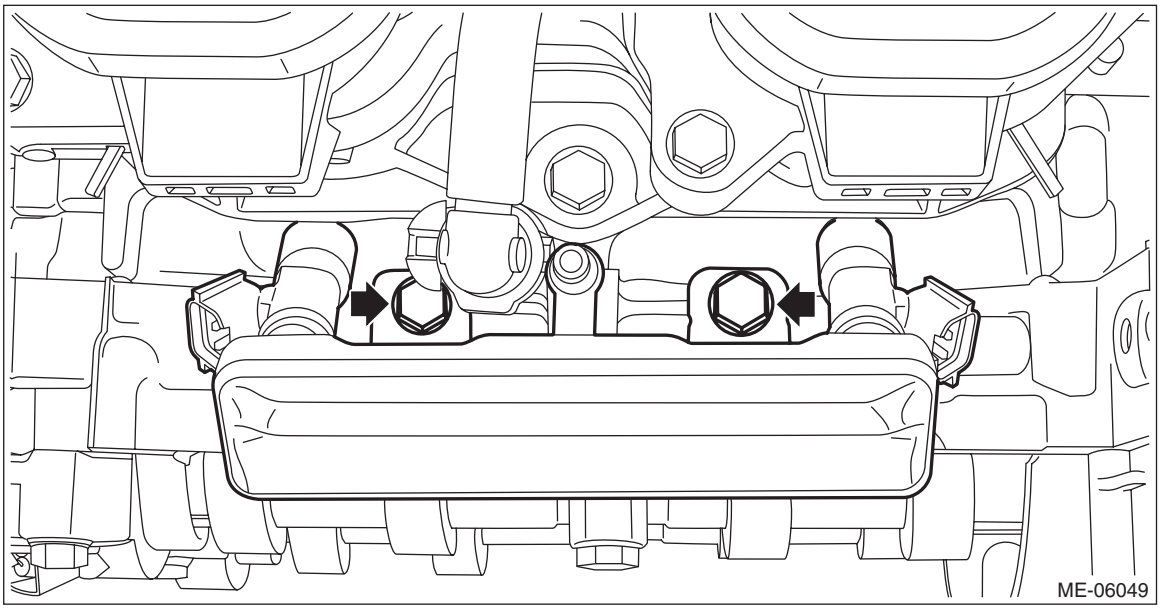
NOTE:
Disconnect the quick connector as shown in the figure.



(a) Slider



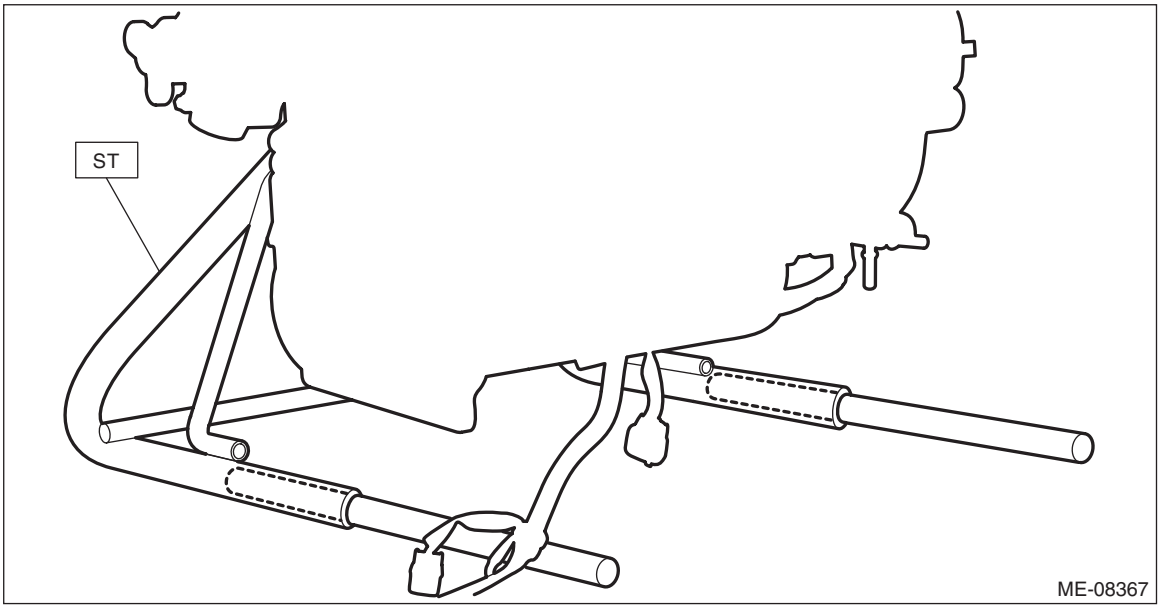
(3) Remove the bolts securing the fuel pipe RH, and remove the fuel pipe RH and the fuel injector RH.



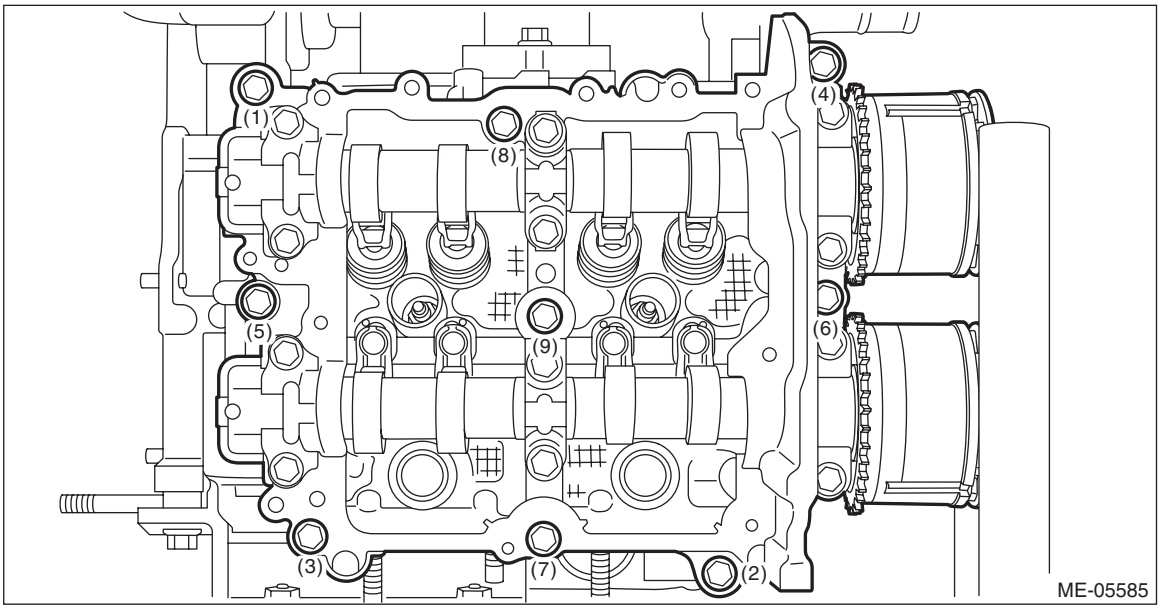
10) Insert the steel rods into ST, and set the engine so that the camshaft RH is facing up.

CAUTION:
• If the engine is standing on one side without inserting the steel rod into ST, engine may lose balance and fall down. Be sure to insert the steel rod into ST to extend the length.
• Use the steel rod with enough strength.
• Be careful not to pinch the engine harness with ST.

ST 499817100 ENGINE STAND

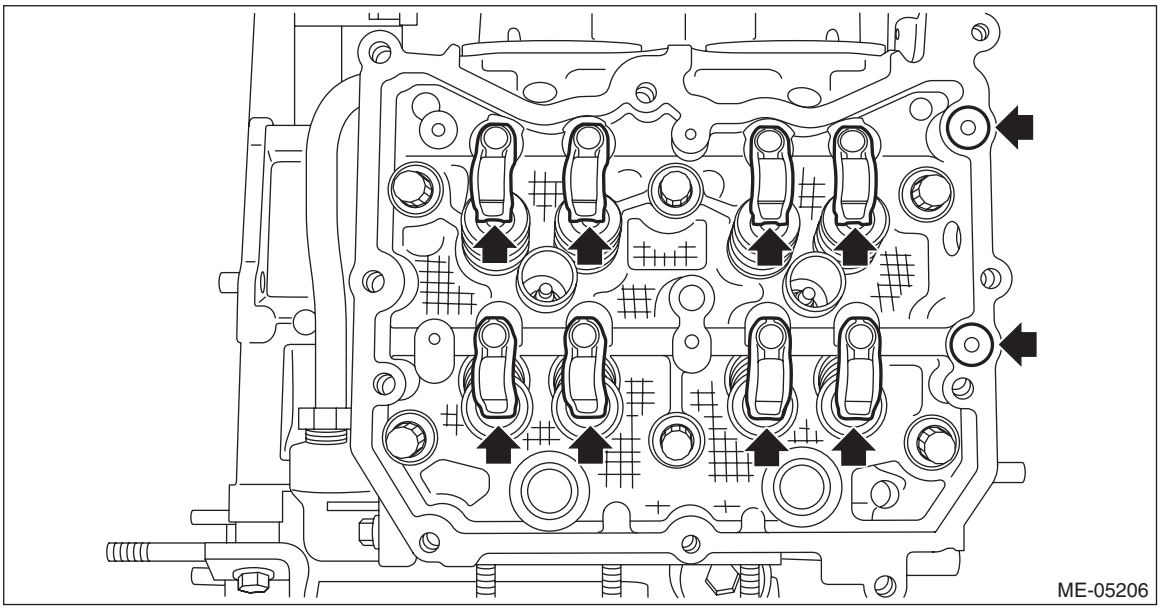


11) Loosen the bolts holding the cam carrier RH equally, a little at a time in numerical sequence as shown in the figure and remove the cam carrier RH.



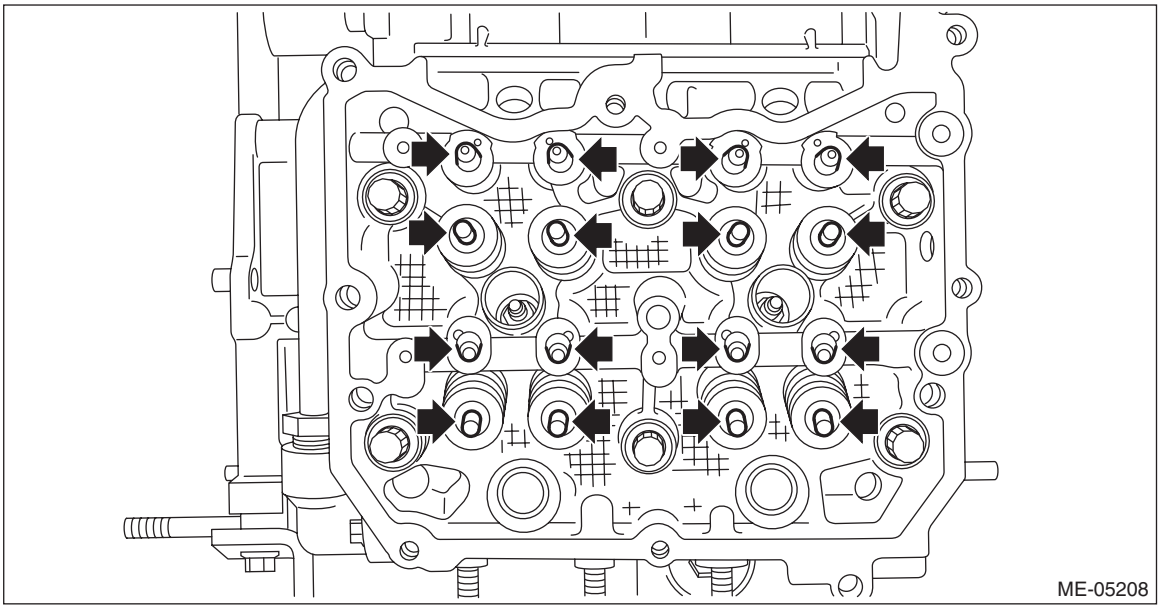
12) Remove the O-ring and the roller rocker arm from cylinder head RH.

NOTE:
Be careful not to confuse the roller rocker arms.



13) Remove the valve shim and the roller rocker arm pivot from cylinder head RH.

NOTE:
Be careful not to confuse the valve shim and the roller rocker arm pivot.

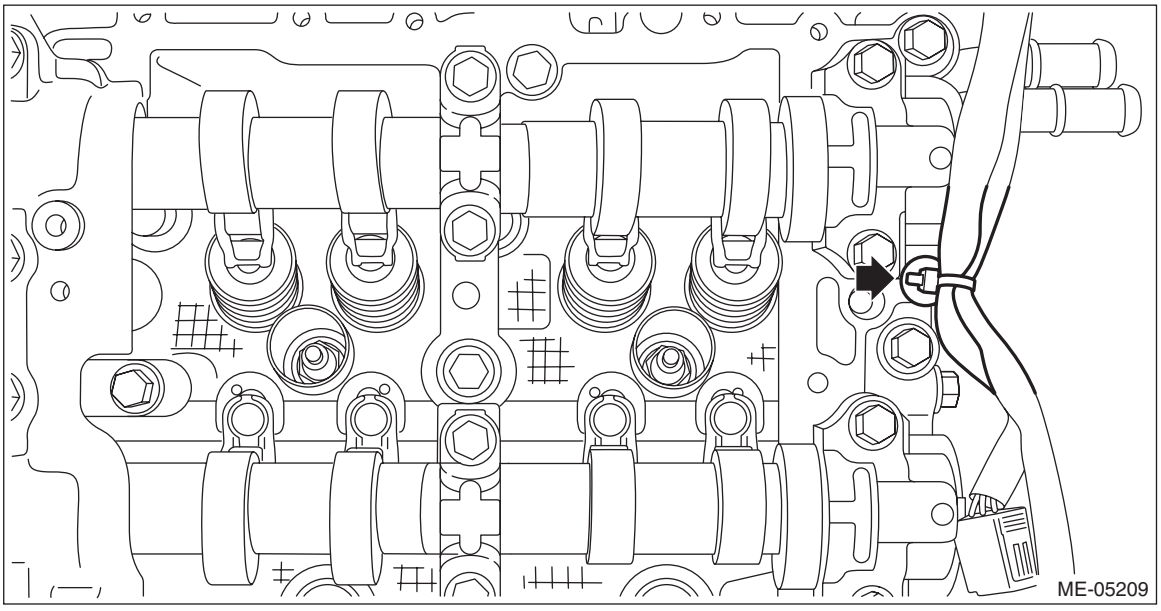


14) Remove the liquid gasket from cam carrier RH and cylinder head RH.

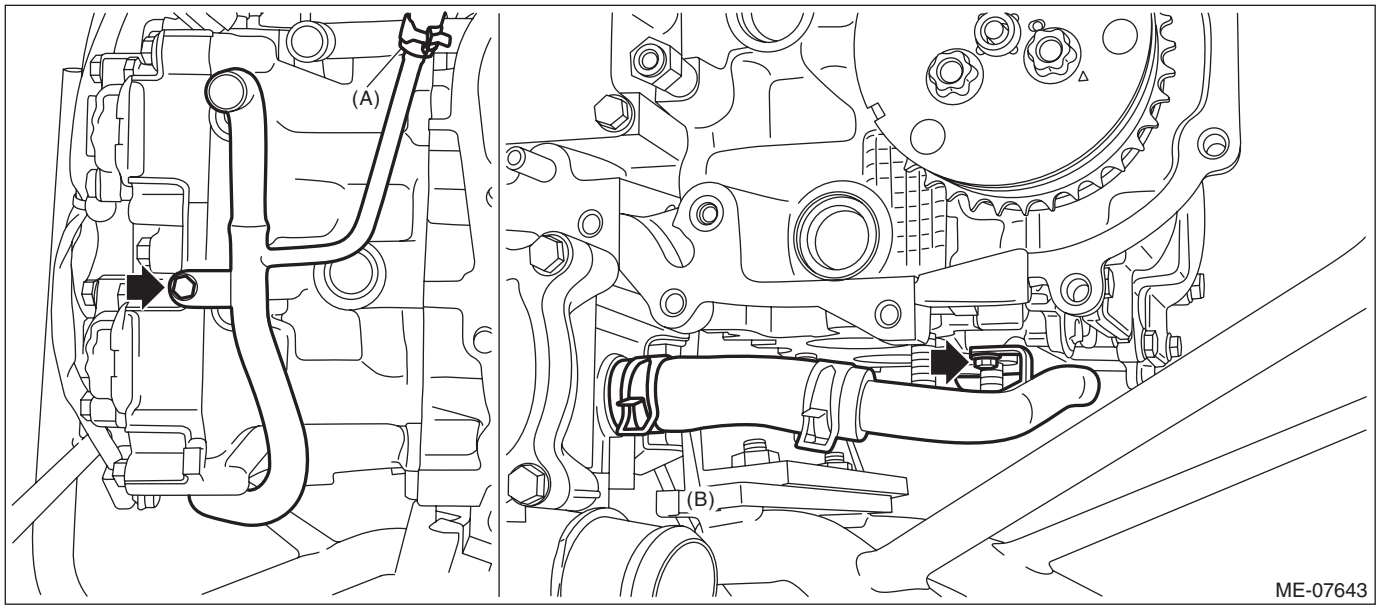
2. CAM CARRIER LH

1) Remove the engine from the vehicle. <Ref. to ME(H4DO(w/o HEV))-55, REMOVAL, Engine Assembly.>
2) Remove the chain cover. <Ref. to ME(H4DO(w/o HEV))-149, REMOVAL, Chain Cover.>
3) Remove the timing chain LH. <Ref. to ME(H4DO(w/o HEV))-171, TIMING CHAIN LH, REMOVAL, Timing Chain Assembly.>
4) Remove the cam sprocket LH. <Ref. to ME(H4DO(w/o HEV))-193, CAM SPROCKET LH, REMOVAL, Cam Sprocket.>

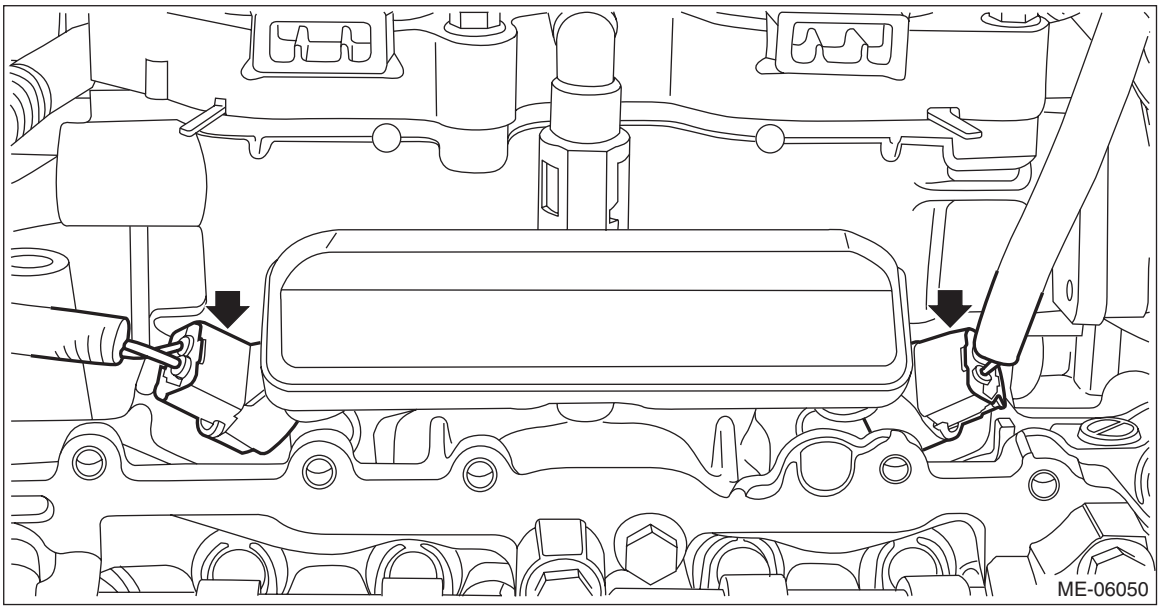
NOTE:
This procedure is required only when disassembling the cam carrier LH.
5) Remove the rocker cover LH. <Ref. to ME(H4DO(w/o HEV))-206, ROCKER COVER LH, REMOVAL, Rocker Cover.>
6) Remove the clip holding the engine harness from cam carrier LH.



7) Disconnect the preheater hose (A) from the water pipe assembly LH, and remove the water pipe assembly LH.
8) Disconnect the water pipe hose (B) from the oil pan upper.

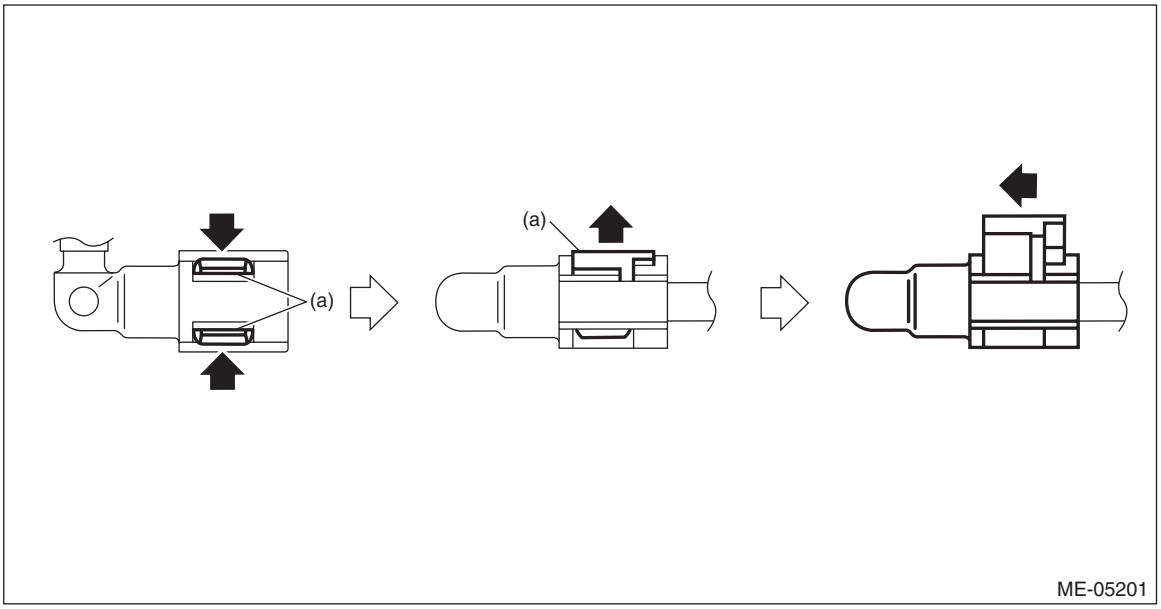


9) Remove the fuel pipe LH and the fuel injector LH.
(1) Disconnect the connector from fuel injector LH.

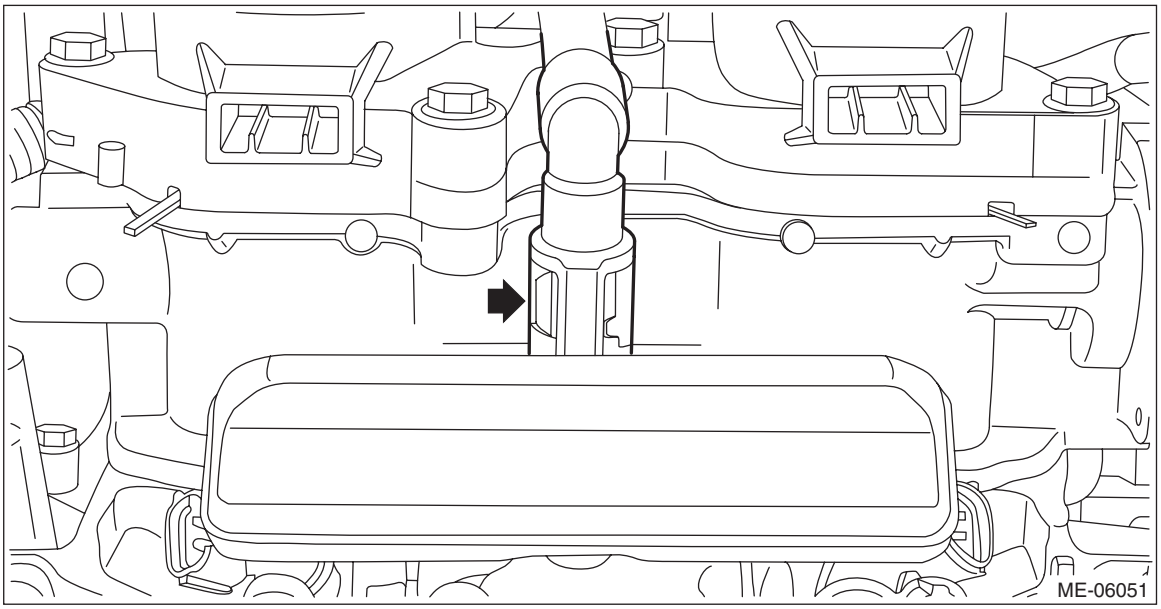


(2) Disconnect the quick connector from fuel pipe LH.

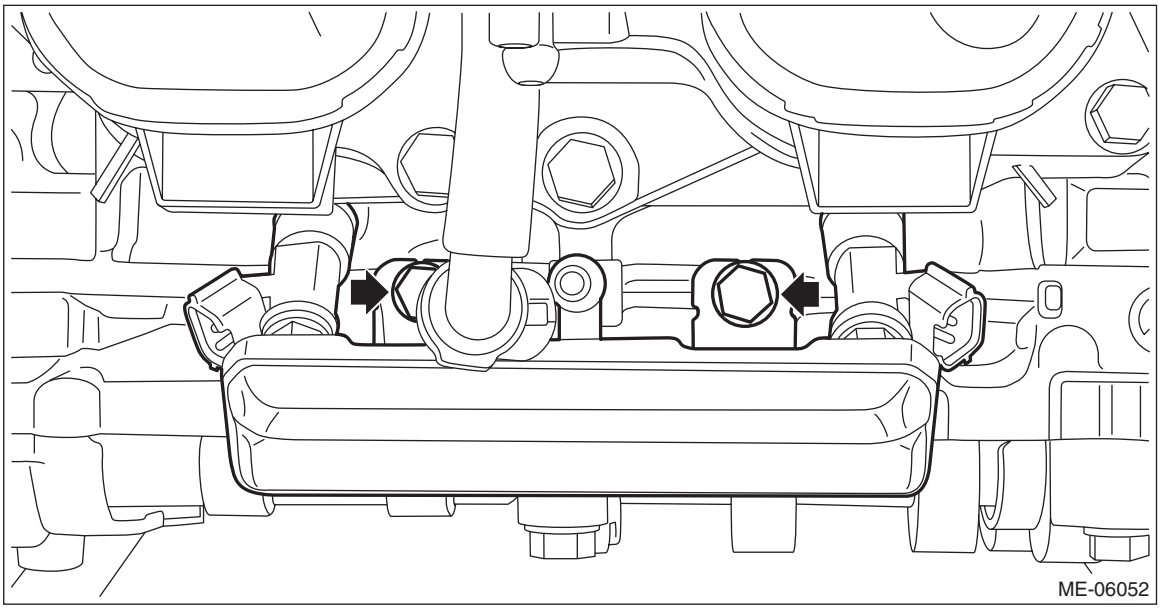
NOTE:
Disconnect the quick connector as shown in the figure.



(a) Slider



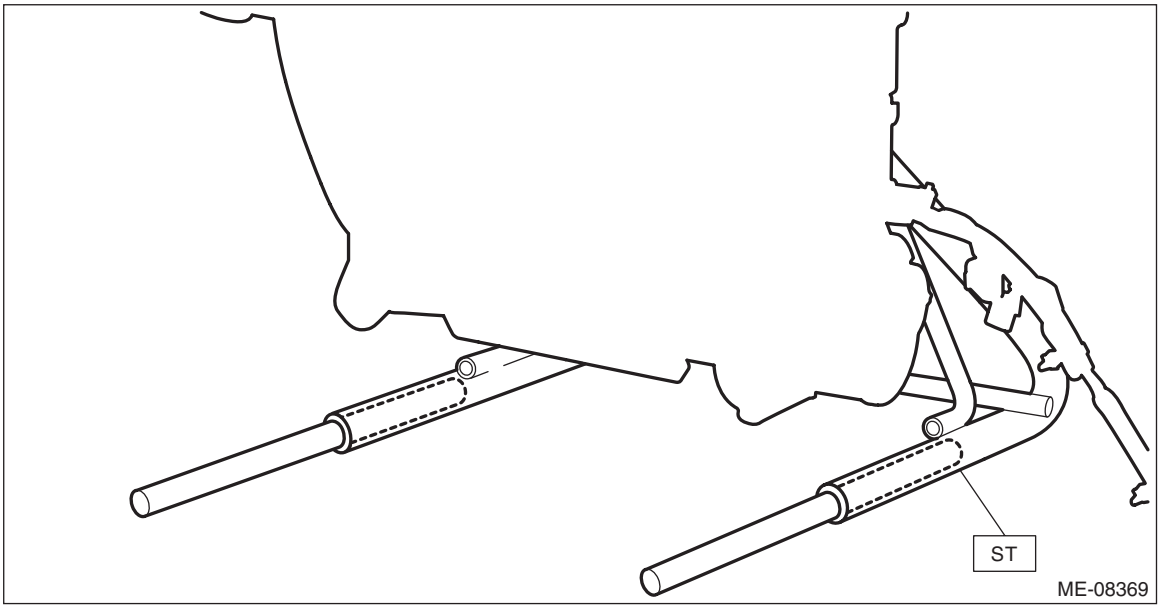
(3) Remove the bolts securing the fuel pipe LH, and remove the fuel pipe LH and the fuel injector LH.



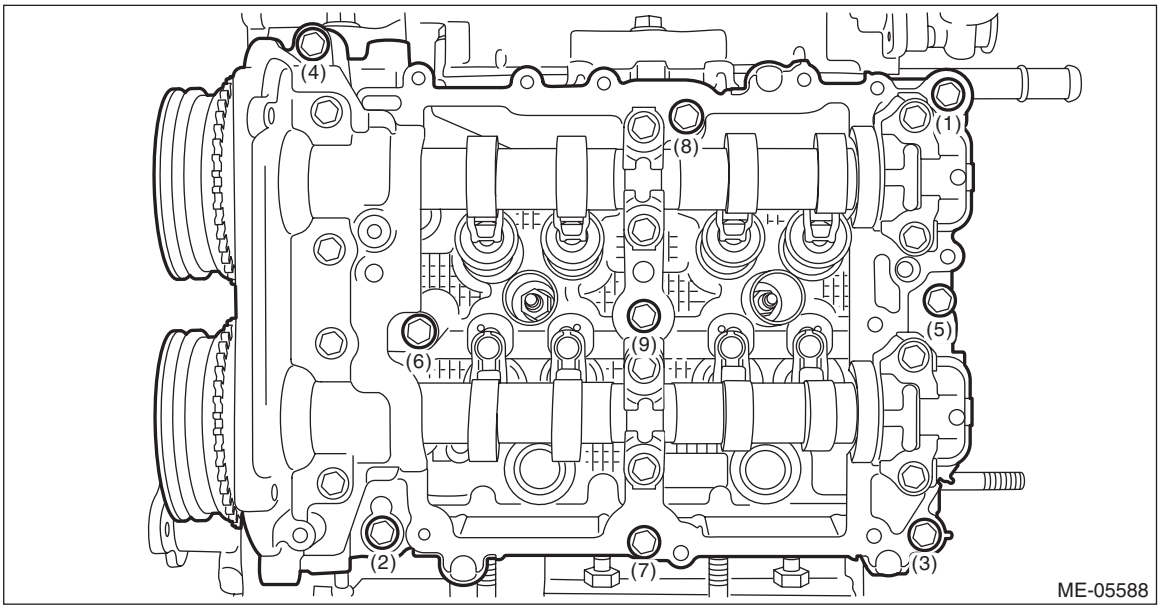
10) Insert the steel rods into ST, and set the engine so that the camshaft LH is facing up.

CAUTION:
• If the engine is standing on one side without inserting the steel rod into ST, engine may lose balance and fall down. Be sure to insert the steel rod into ST to extend the length.
• Use the steel rod with enough strength.
• Be careful not to pinch the engine harness with ST.

ST 499817100 ENGINE STAND

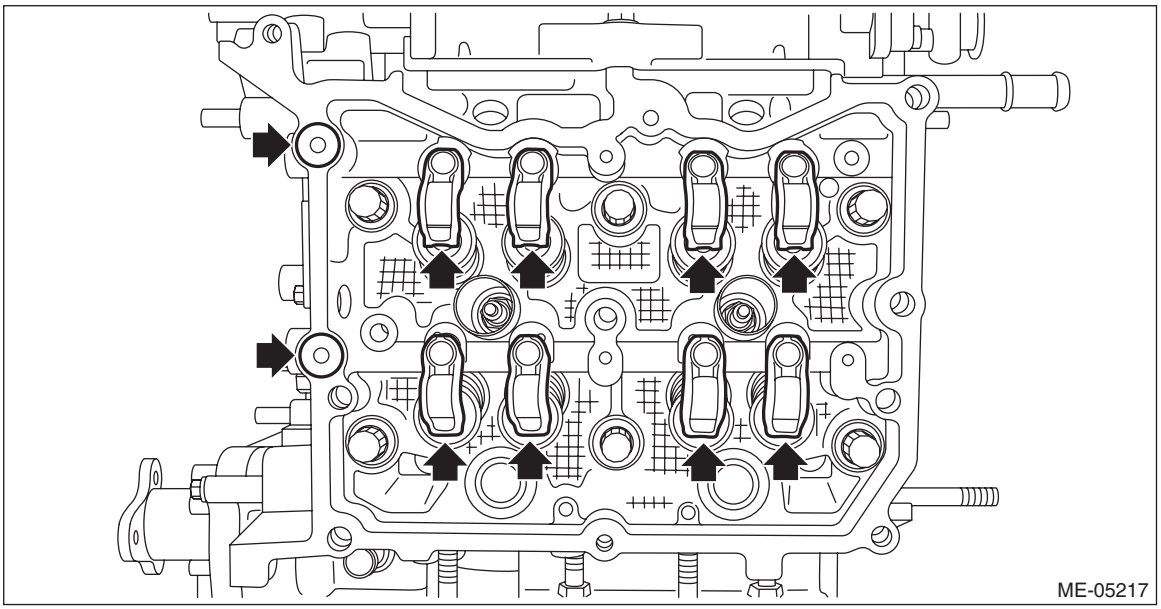


11) Loosen the bolts holding the cam carrier LH equally, a little at a time in numerical sequence as shown in the figure and remove the cam carrier LH.



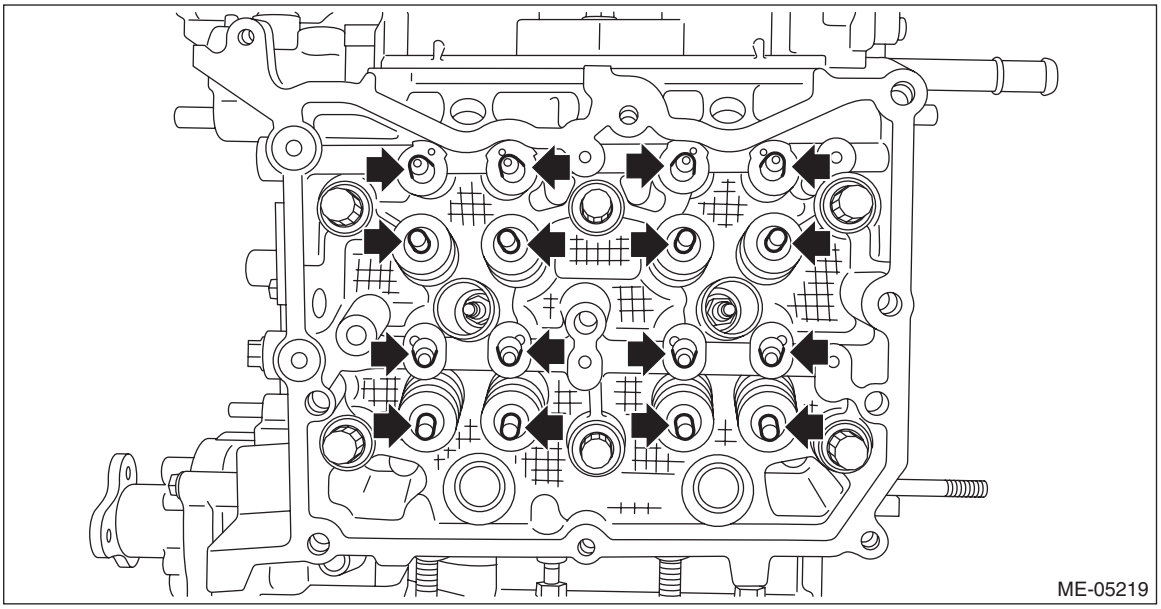
12) Remove the O-ring and the roller rocker arm from cylinder head LH.

NOTE:
Be careful not to confuse the roller rocker arms.



13) Remove the valve shim and the roller rocker arm pivot from cylinder head LH.

NOTE:
Be careful not to confuse the valve shim and the roller rocker arm pivot.



14) Remove the liquid gasket from cam carrier LH and cylinder head LH.

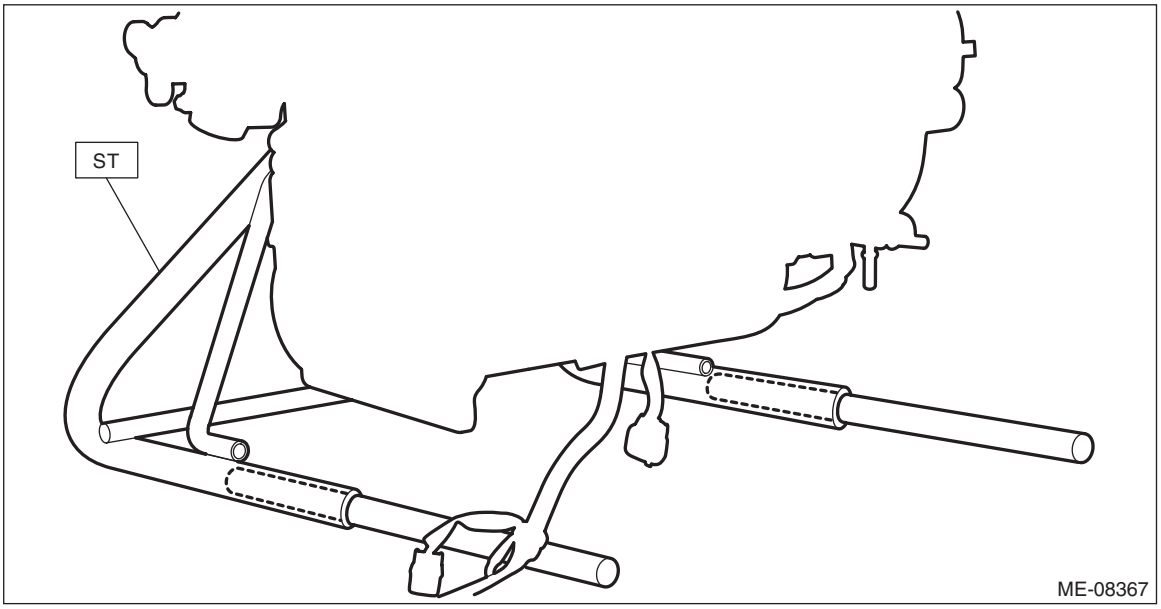
B: INSTALLATION

1. CAM CARRIER RH

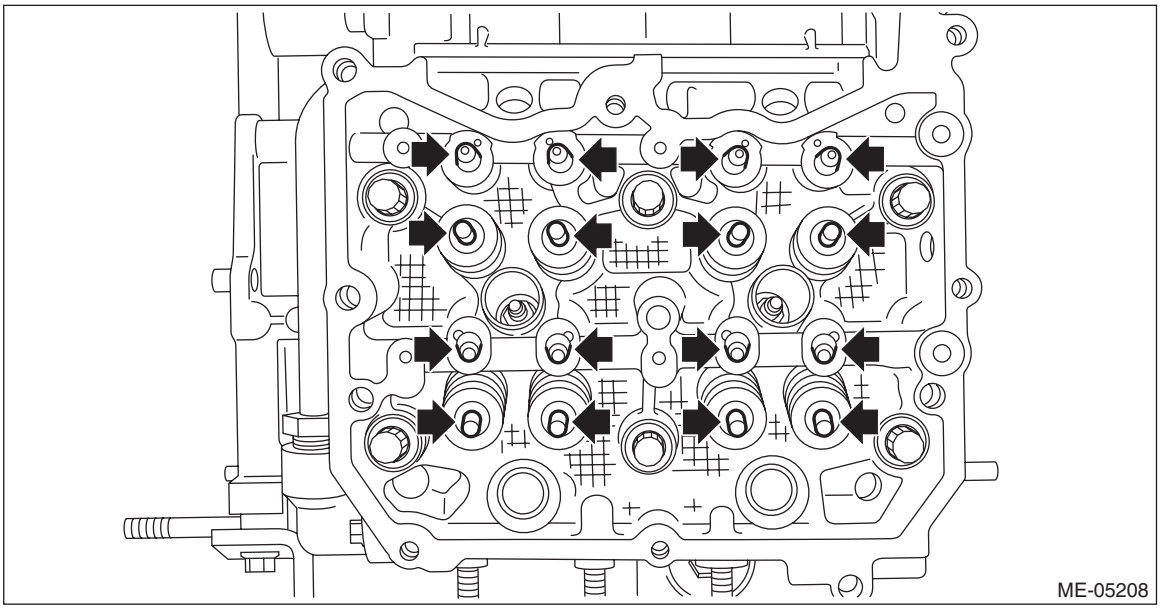
1) Insert the steel rods into ST, and set the engine so that the camshaft RH is facing up.

CAUTION:
• If the engine is standing on one side without inserting the steel rod into ST, engine may lose balance and fall down. Be sure to insert the steel rod into ST to extend the length.
• Use the steel rod with enough strength.
• Be careful not to pinch the engine harness with ST.

ST 499817100 ENGINE STAND

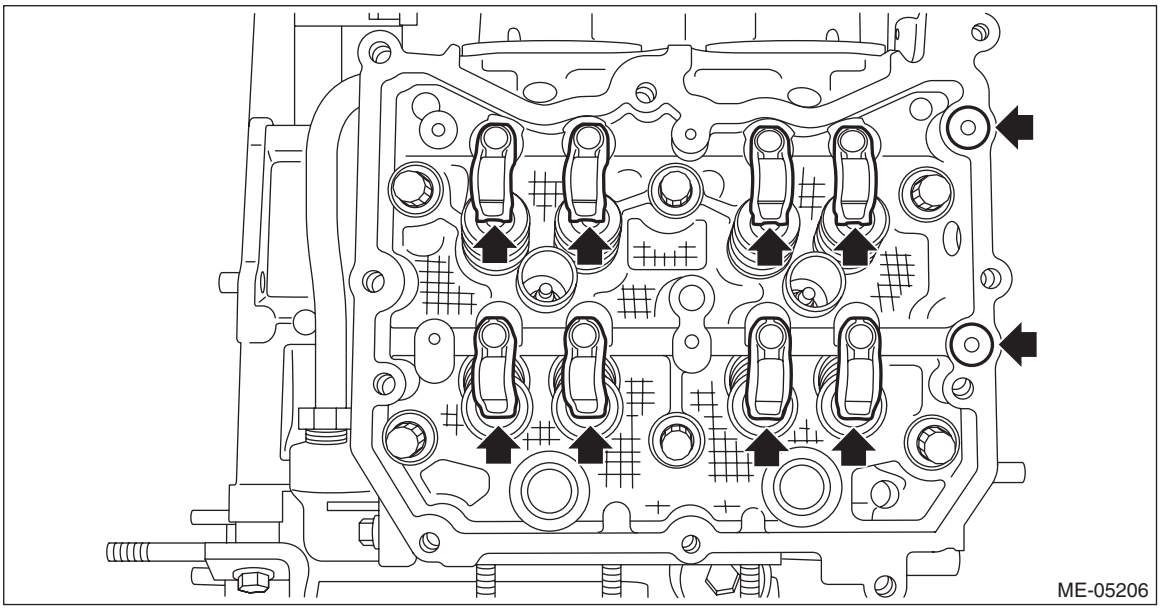


2) Apply engine oil to the valve shim and the roller rocker arm pivot, and install the valve shim and the roller rocker arm pivot to the cylinder head RH.



3) Apply engine oil to the O-ring and the roller rocker arm, and install the O-ring and the roller rocker arm to the cylinder head RH.

NOTE:
Use new O-rings.

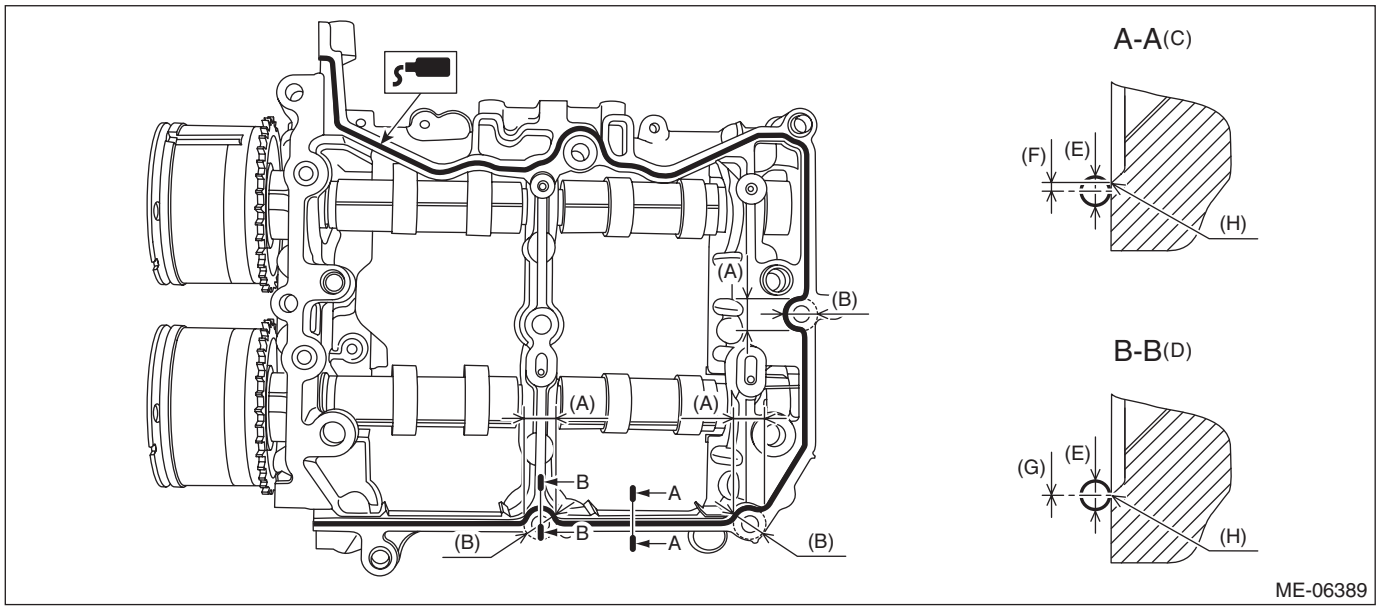


4) Apply liquid gasket to the mating surface of cam carrier RH as shown in the figure.

NOTE:
- Before applying liquid gasket, degrease the old liquid gasket seal surface of the cylinder head RH and cam carrier RH.
- Install within 5 min. after applying liquid gasket.

Liquid gasket:
THREE BOND 1217G (Part No. 0877Y0100), THREE BOND 1217H or equivalent

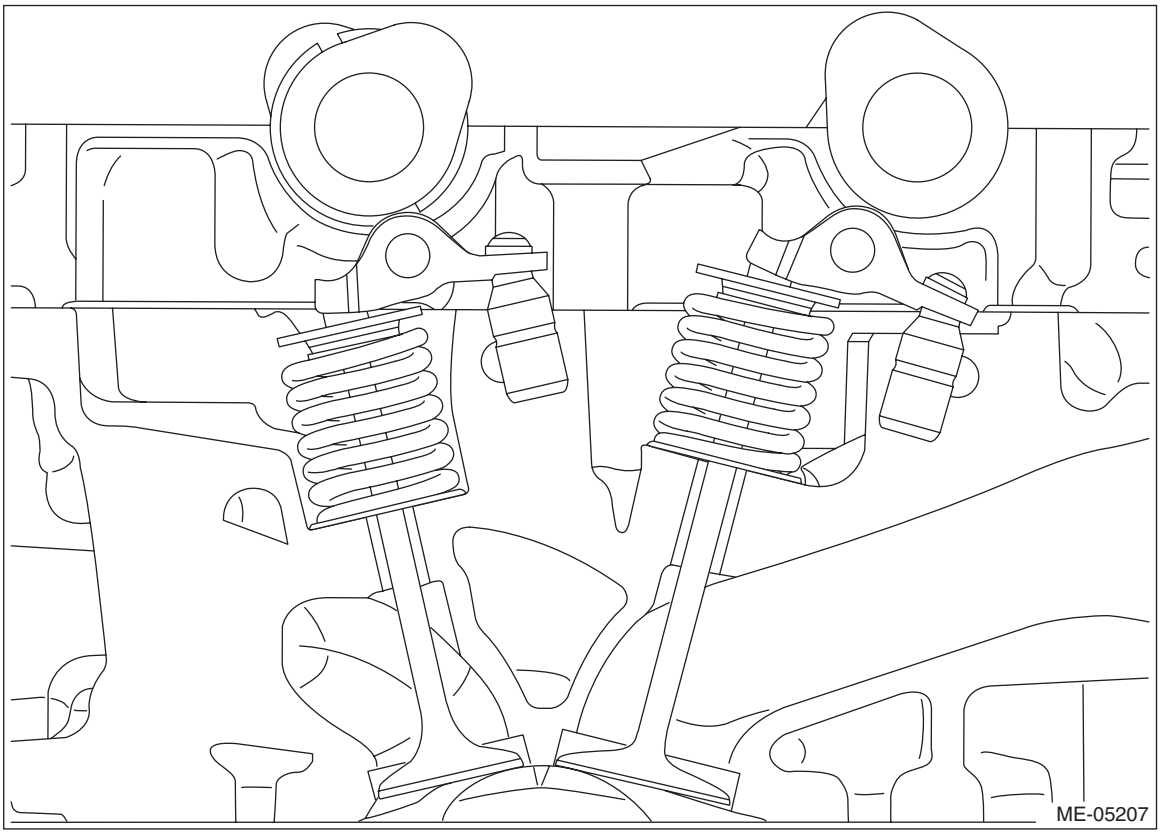
Liquid gasket applying diameter:
3.1±0.5 mm (0.1220±0.0197 in)

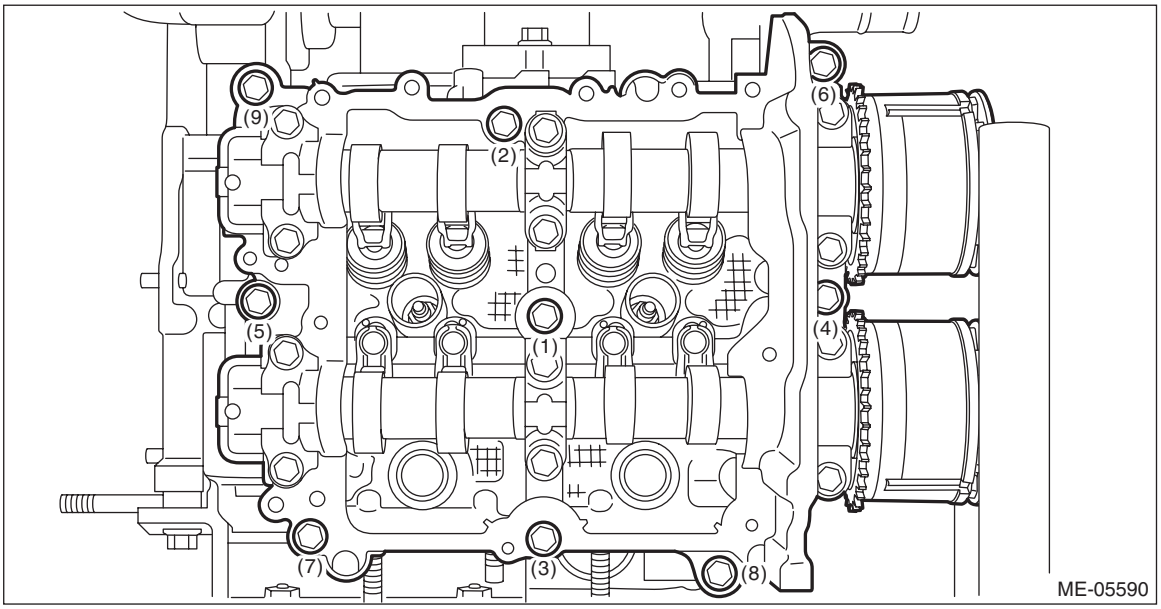


(A)	Range A	(D)	Liquid gasket applying position of mating surfaces of range A	(G)	0±0.5 mm (0±0.0197 in)
(B)	ϕ18 mm (0.7087 in)	(E)	ϕ3.1±0.5 mm (0.1220±0.0197 in)	(H)	Chamfer edge
(C)	Liquid gasket applying position of mating surfaces other than range A	(F)	1 mm (0.0394 in) or less		

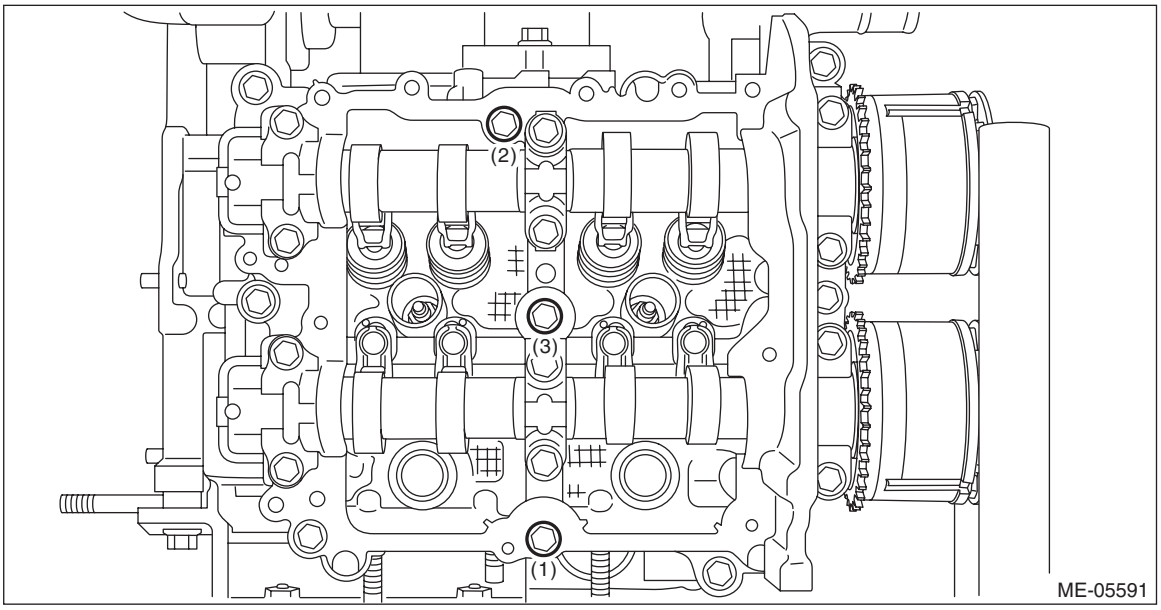
5) Install the cam carrier RH to the cylinder head RH.
   (1) Mount the cam carrier RH, then tighten all bolts with a torque of 18 N·m (1.8 kgf-m, 13.3 ft-lb) in numerical order as shown in the figure.

NOTE:
Set the intake camshaft RH and the exhaust camshaft RH to the zero-lift position.

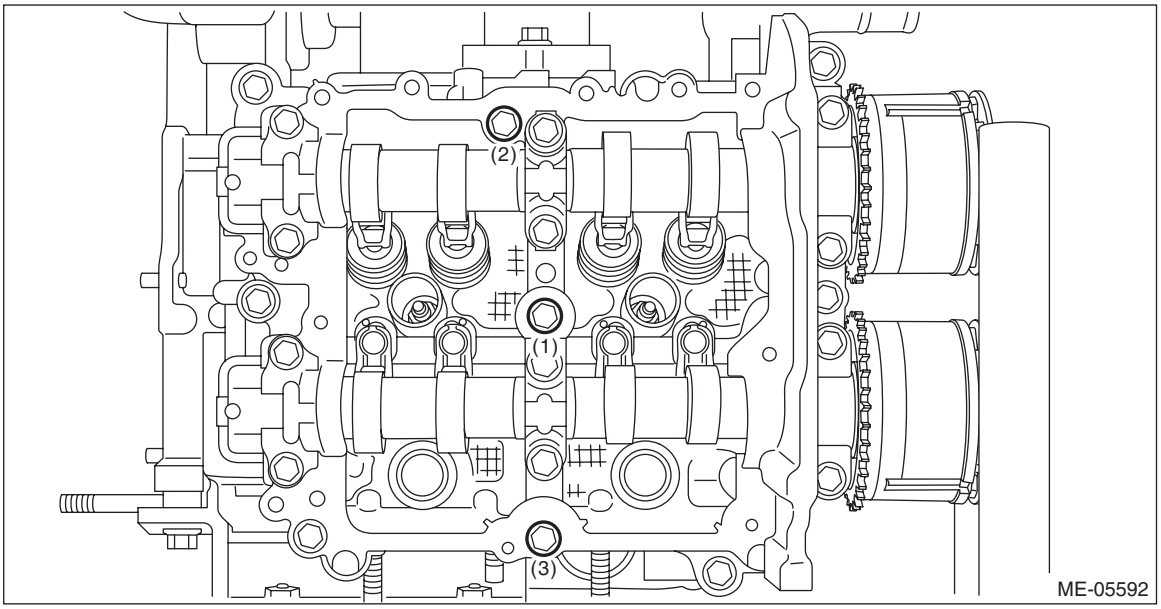




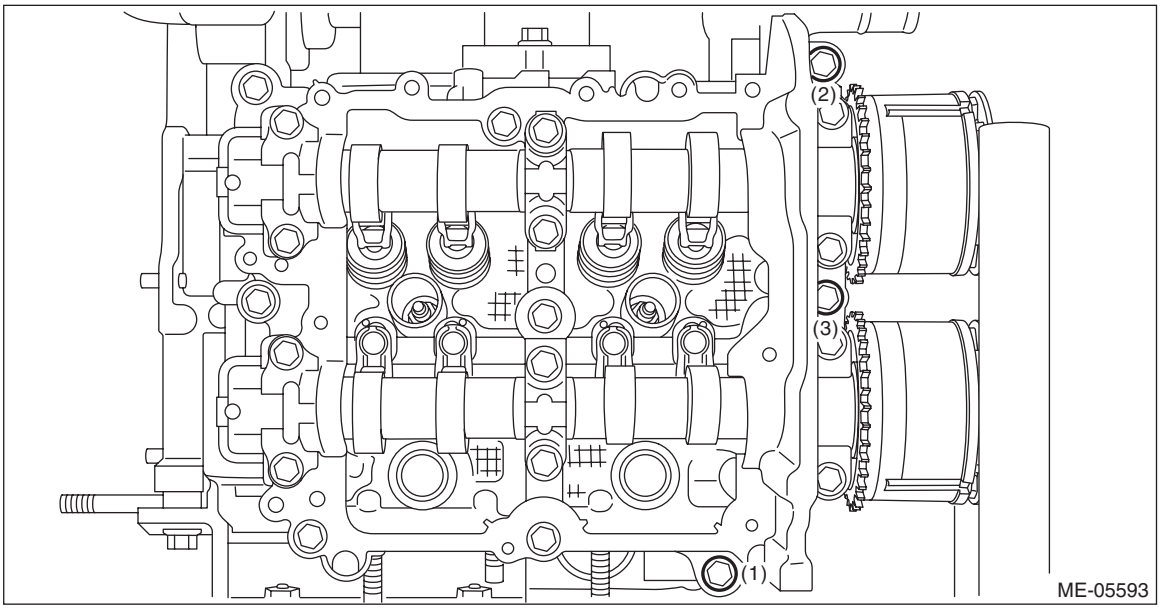
(2) Loosen the bolts (3 places) by 180° in numerical order as shown in the figure.



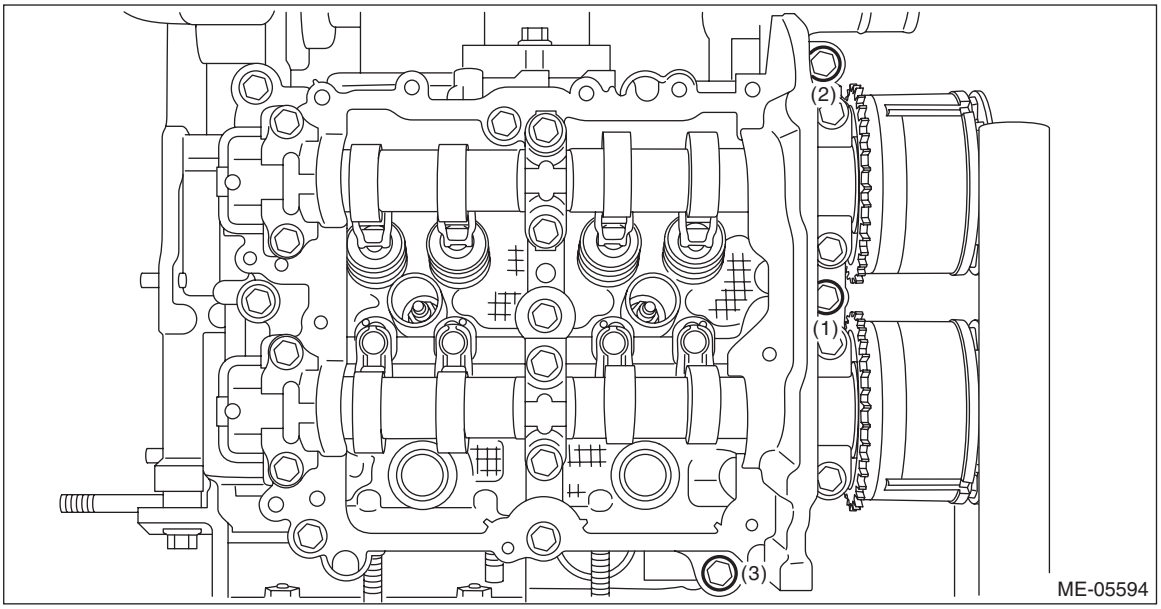
(3) Tighten the bolts (3 places) with a torque of 18 N·m (1.8 kgf-m, 13.3 ft-lb) in numerical order as shown in the figure.



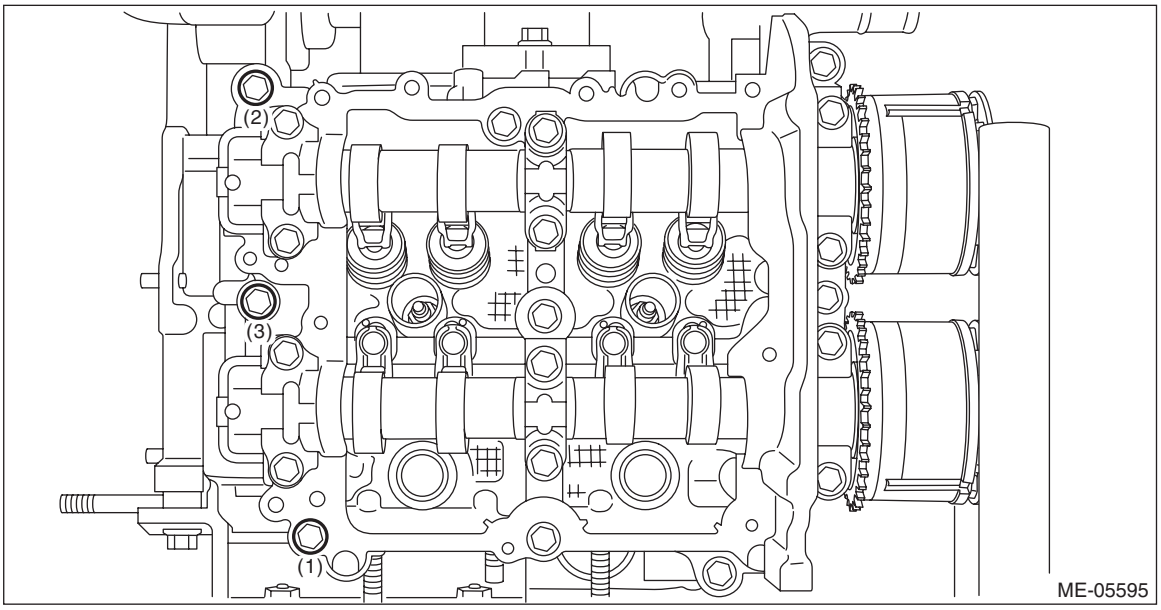
(4) Loosen the bolts (3 places) by 180° in numerical order as shown in the figure.



(5) Tighten the bolts (3 places) with a torque of 18 N·m (1.8 kgf-m, 13.3 ft-lb) in numerical order as shown in the figure.

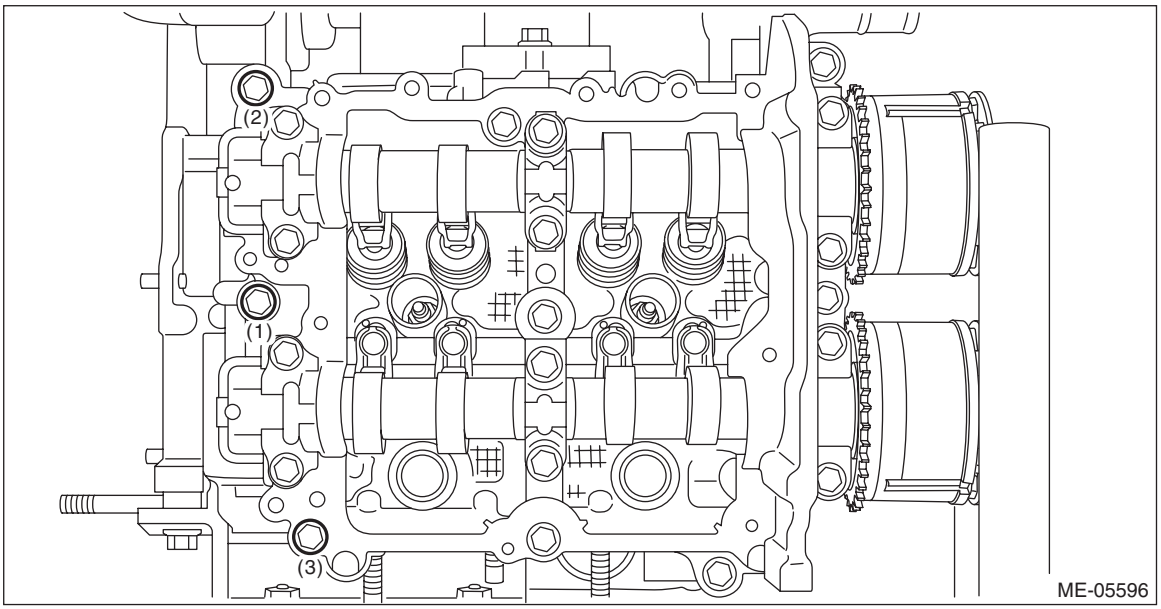


(6) Loosen the bolts (3 places) by 180° in numerical order as shown in the figure.



(7) Tighten the bolts (3 places) with a torque of 18 N·m (1.8 kgf-m, 13.3 ft-lb) in numerical order as shown in the figure.

NOTE:
After tightening, if the liquid gasket is squeezed out onto the seal surface of the chain cover, completely remove any squeezed-out liquid gasket.



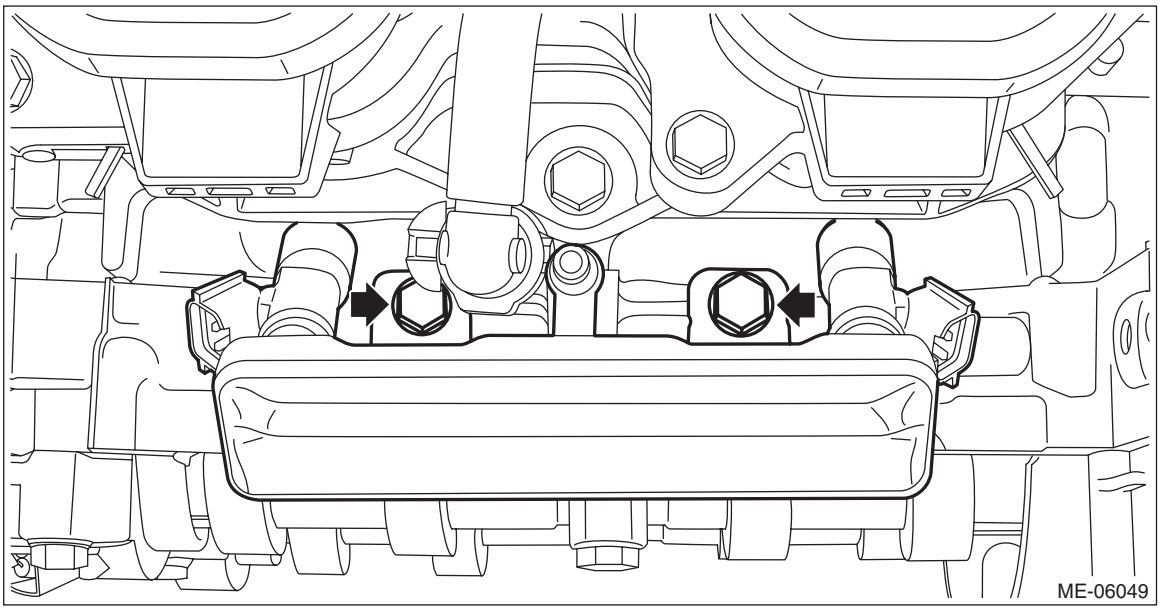
6) Set the part so that the intake manifold is on the upper side.
7) Install the cam sprocket RH. <Ref. to ME(H4DO(w/o HEV))-195, CAM SPROCKET RH, INSTALLATION, Cam Sprocket.>

NOTE:
This procedure is required only when the cam carrier RH is removed for disassembly.
8) Check the cam clearance. <Ref. to ME(H4DO(w/o HEV))-51, WHEN TIMING CHAIN ASSEMBLY IS REMOVED, INSPECTION, Cam Clearance.>
9) Install the timing chain RH. <Ref. to ME(H4DO(w/o HEV))-184, TIMING CHAIN RH, INSTALLATION, Timing Chain Assembly.>

10) Install the fuel pipe RH and the fuel injector RH.
(1) Install the fuel pipe RH and the fuel injector RH, and install the bolts which secure the fuel pipe RH.

NOTE:
- Use new O-rings, rubbers, seal rings, and fuel injector holder.
- Refer to “Fuel Injector” for removal and installation procedure of fuel injector holder. <Ref. to FU(H4DO(HEV))-69, REMOVAL, Fuel Injector.> <Ref. to FU(H4DO(HEV))-72, INSTALLATION, Fuel Injector.>

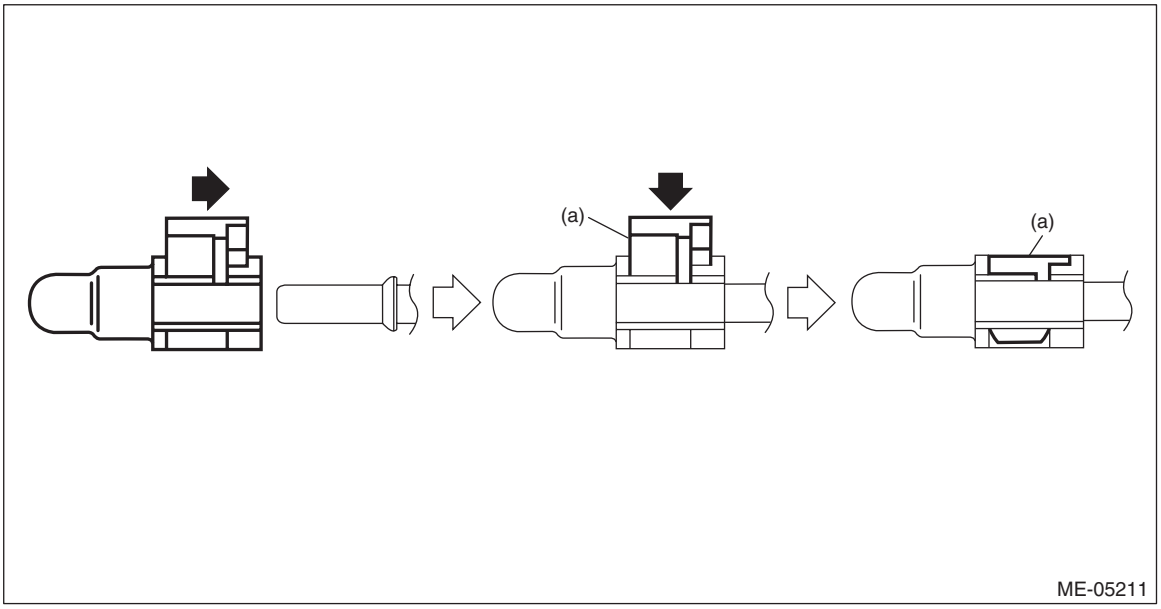
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



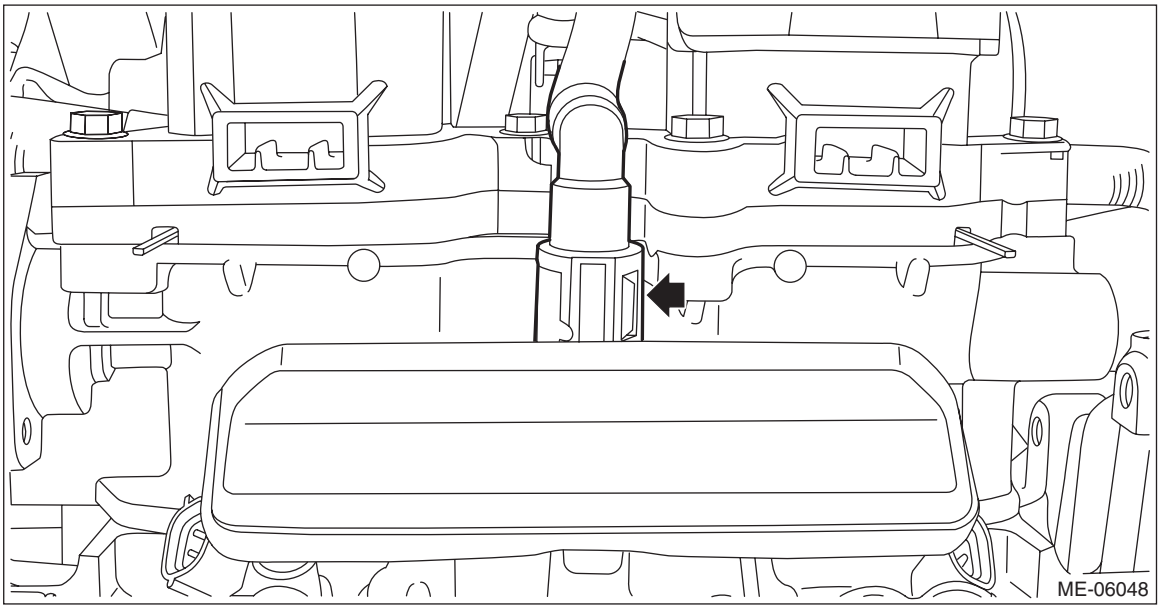
(2) Connect the quick connector to the fuel pipe RH.

CAUTION:
• Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
• When connecting the quick connector, make sure to insert the pipe all the way in before locking the slider.
• When it is difficult to lock the slider, check that the pipe is fully inserted.
• Make sure that the quick connector is securely connected.

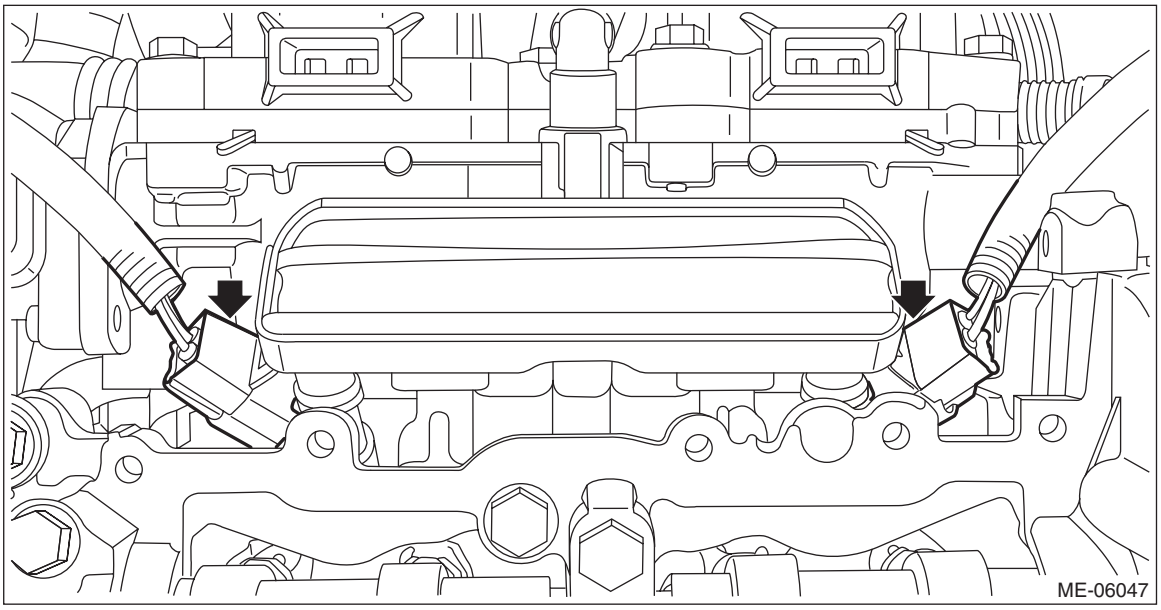
NOTE:
Connect the quick connector as shown in the figure.



(a) Slider

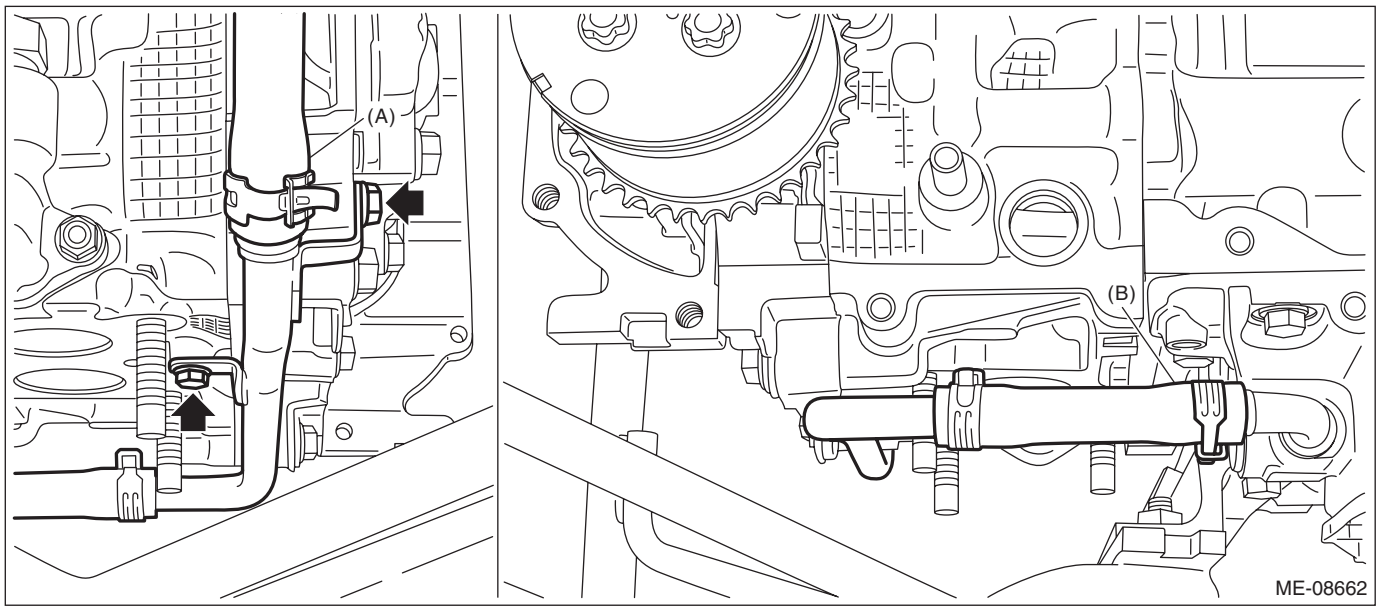


(3) Connect the connectors to the fuel injector RH.

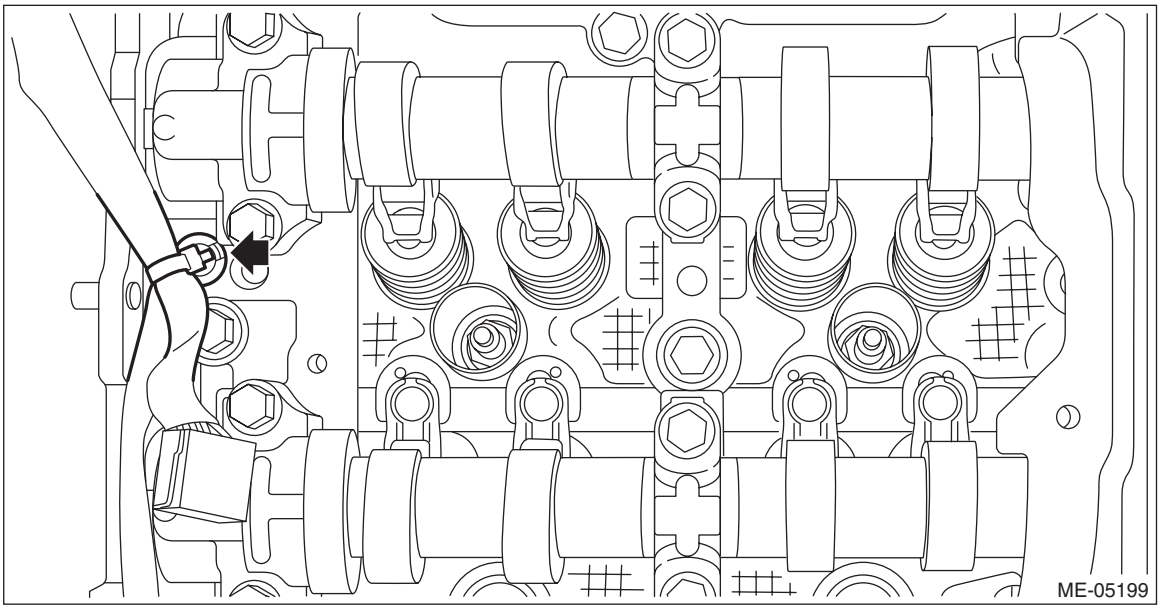


11) Connect the water pipe hose (B) to the oil pan upper.
12) Install the water pipe assembly RH and connect the engine coolant inlet hose (A) to the water pipe assembly RH.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



13) Secure the engine harness to the cam carrier RH with a clip.



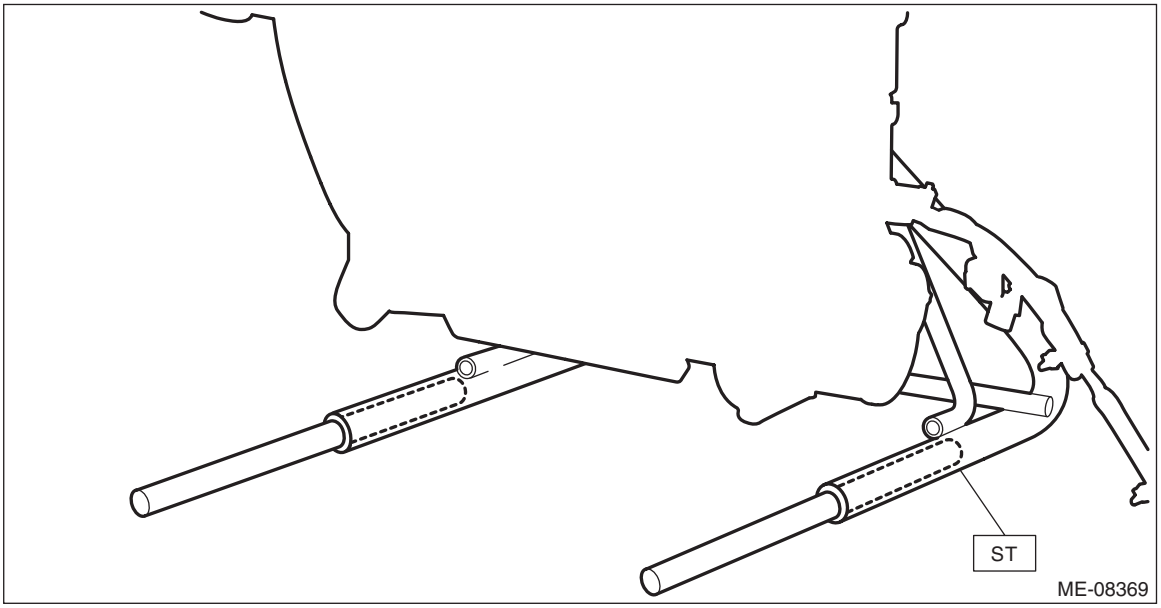
14) Install the rocker cover RH. <Ref. to ME(H4DO(w/o HEV))-210, ROCKER COVER RH, INSTALLATION, Rocker Cover.>
15) Install the chain cover. <Ref. to ME(H4DO(w/o HEV))-156, INSTALLATION, Chain Cover.>
16) Install the engine to the vehicle. <Ref. to ME(H4DO(w/o HEV))-88, INSTALLATION, Engine Assembly.>

2. CAM CARRIER LH

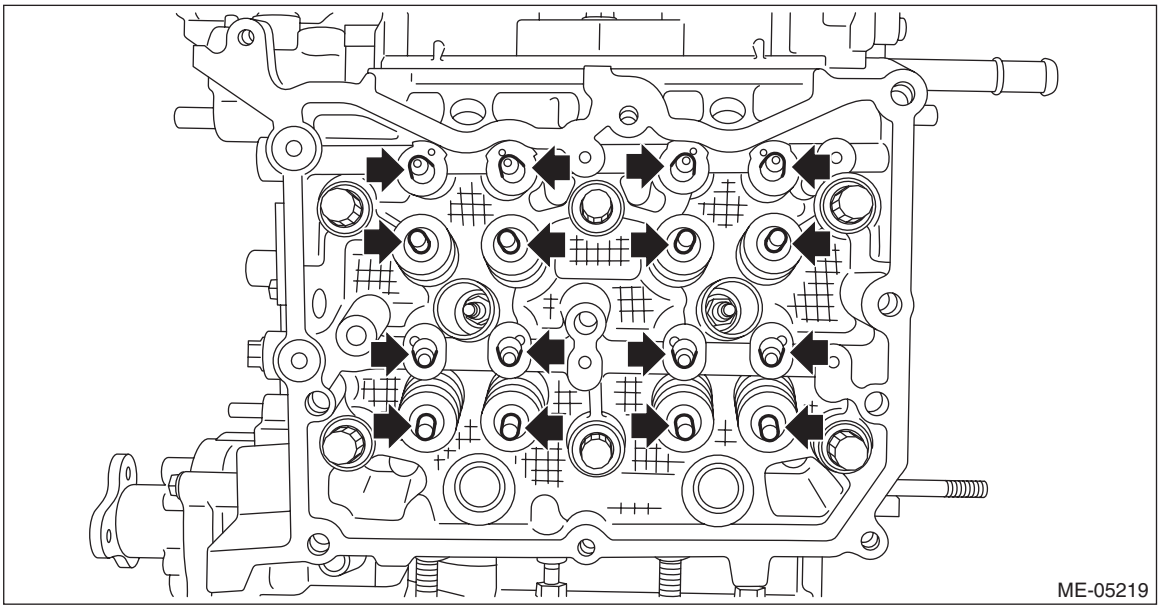
1) Insert the steel rods into ST, and set the engine so that the camshaft LH is facing up.

CAUTION:
• If the engine is standing on one side without inserting the steel rod into ST, engine may lose balance and fall down. Be sure to insert the steel rod into ST to extend the length.
• Use the steel rod with enough strength.
• Be careful not to pinch the engine harness with ST.

ST 499817100 ENGINE STAND

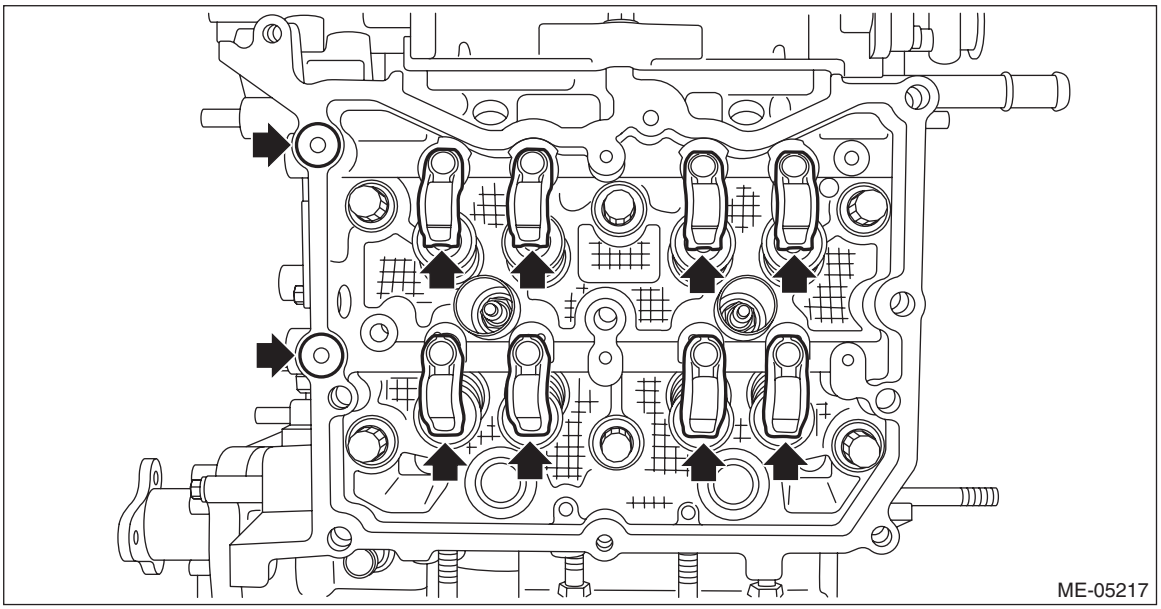


2) Apply engine oil to the valve shim and the roller rocker arm pivot, and install the valve shim and the roller rocker arm pivot to the cylinder head LH.



3) Apply engine oil to the O-ring and the roller rocker arm, and install the O-ring and the roller rocker arm to the cylinder head LH.

NOTE:
Use new O-rings.

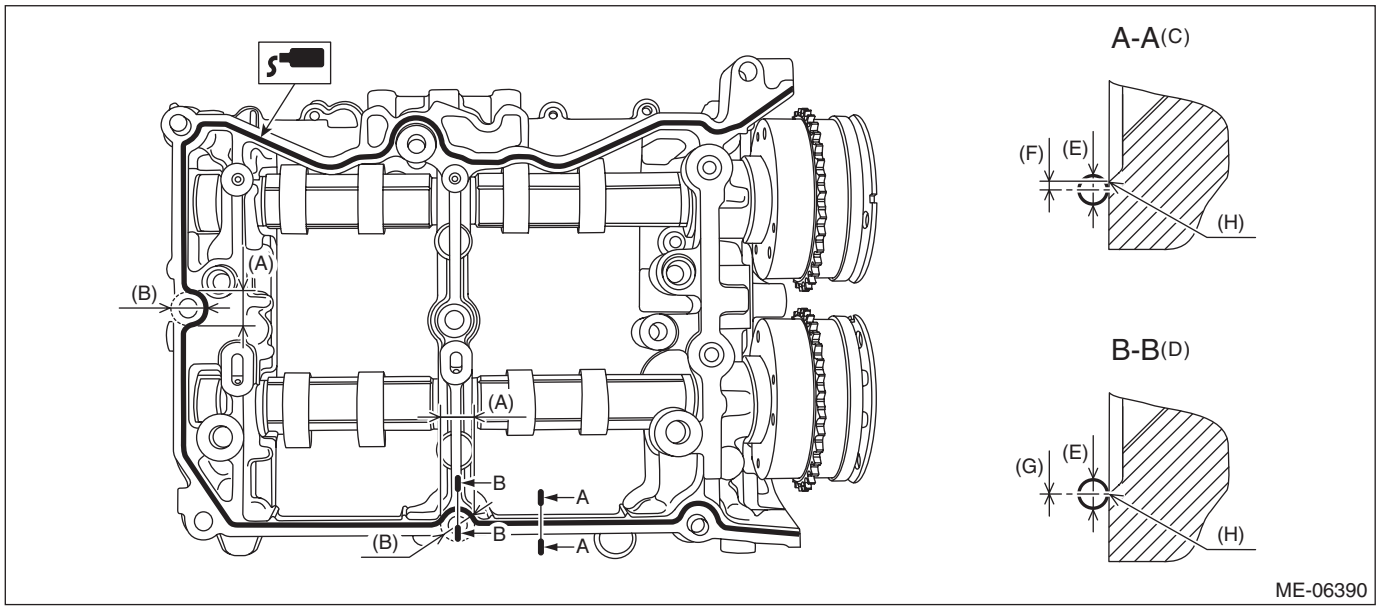


4) Apply liquid gasket to the mating surface of cam carrier LH as shown in the figure.

NOTE:
- Before applying liquid gasket, degrease the old liquid gasket seal surface of the cylinder head LH and cam carrier LH.
- Install within 5 min. after applying liquid gasket.

Liquid gasket:
THREE BOND 1217G (Part No. 0877Y0100), THREE BOND 1217H or equivalent

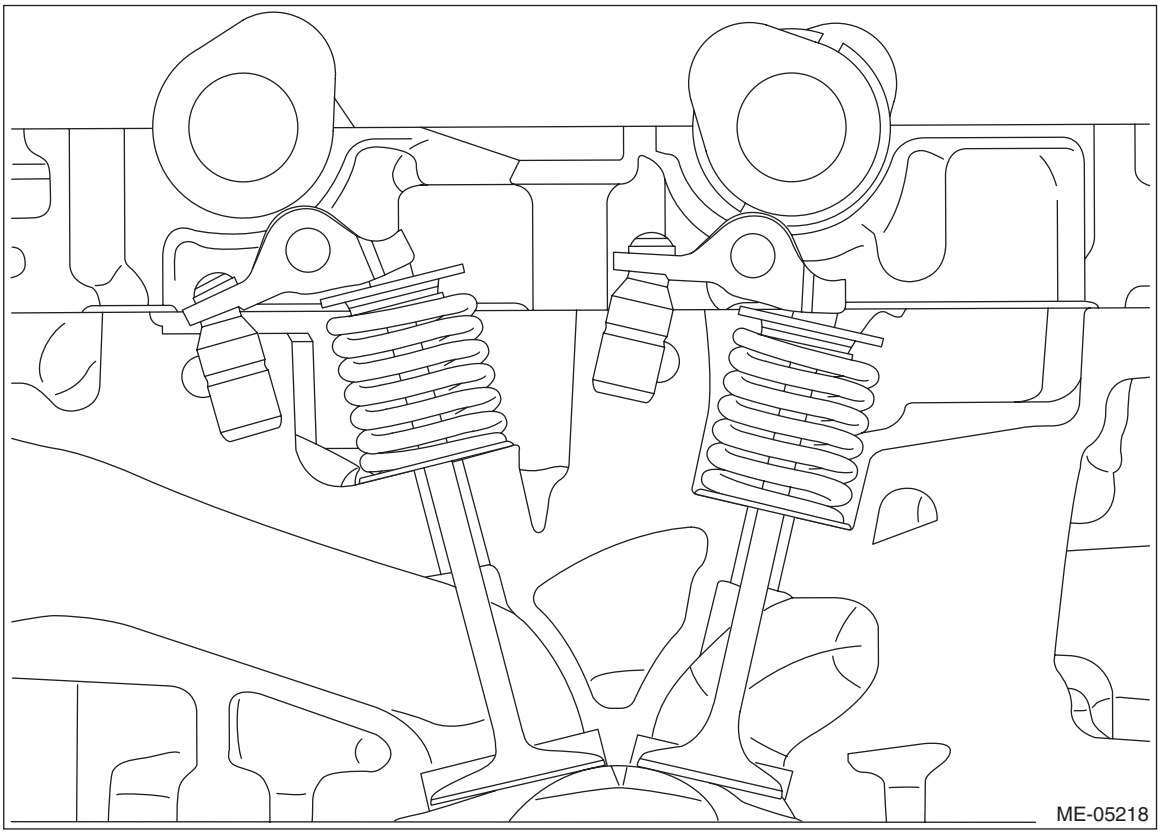
Liquid gasket applying diameter:
3.1±0.5 mm (0.1220±0.0197 in)

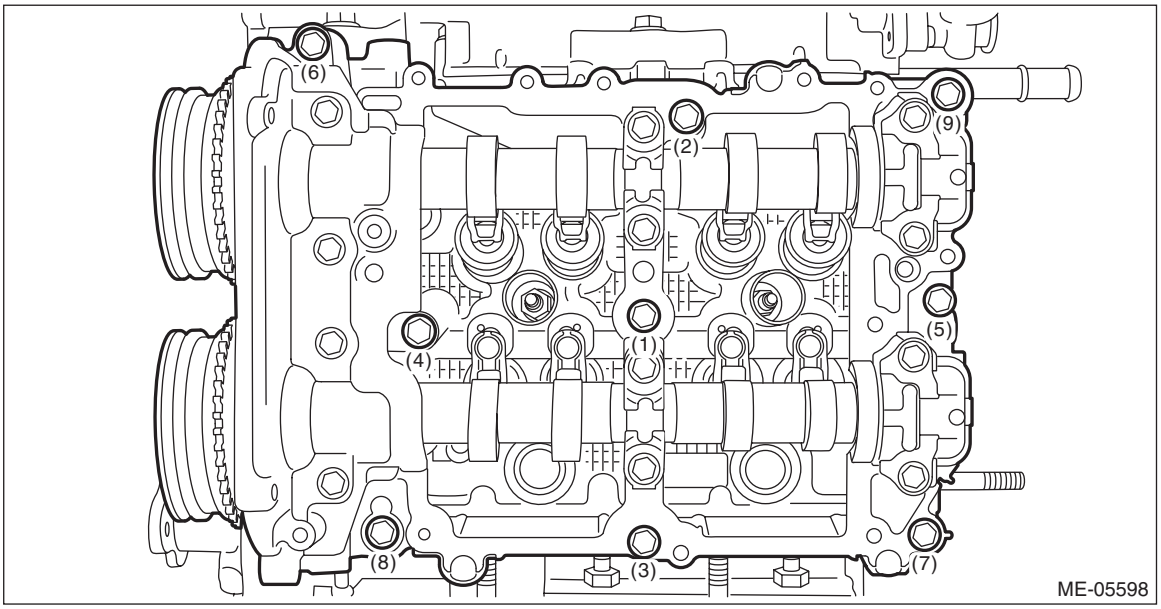


(A)	Range A	(D)	Liquid gasket applying position of mating surfaces of range A	(G)	0±0.5 mm (0±0.0197 in)
(B)	ϕ18 mm (0.7087 in)	(E)	ϕ3.1±0.5 mm (0.1220±0.0197 in)	(H)	Chamfer edge
(C)	Liquid gasket applying position of mating surfaces other than range A	(F)	1 mm (0.0394 in) or less		

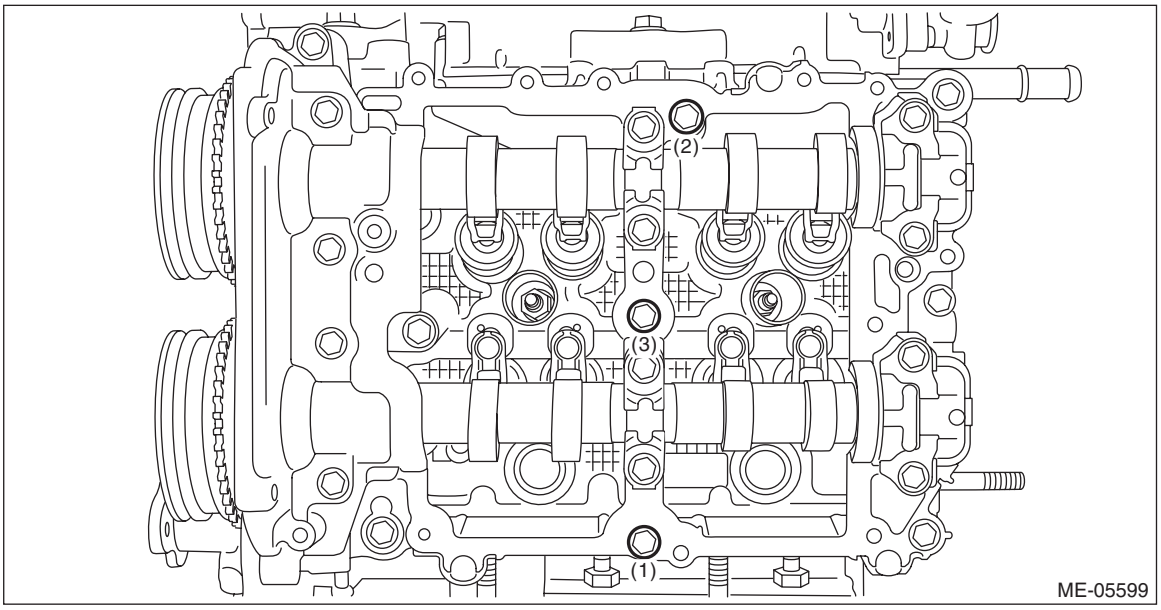
5) Install the cam carrier LH to the cylinder head LH.
   (1) Mount the cam carrier LH, then tighten all bolts with a torque of 18 N·m (1.8 kgf-m, 13.3 ft-lb) in numerical order as shown in the figure.

NOTE:
Set the intake camshaft LH and the exhaust camshaft LH to the zero-lift position.

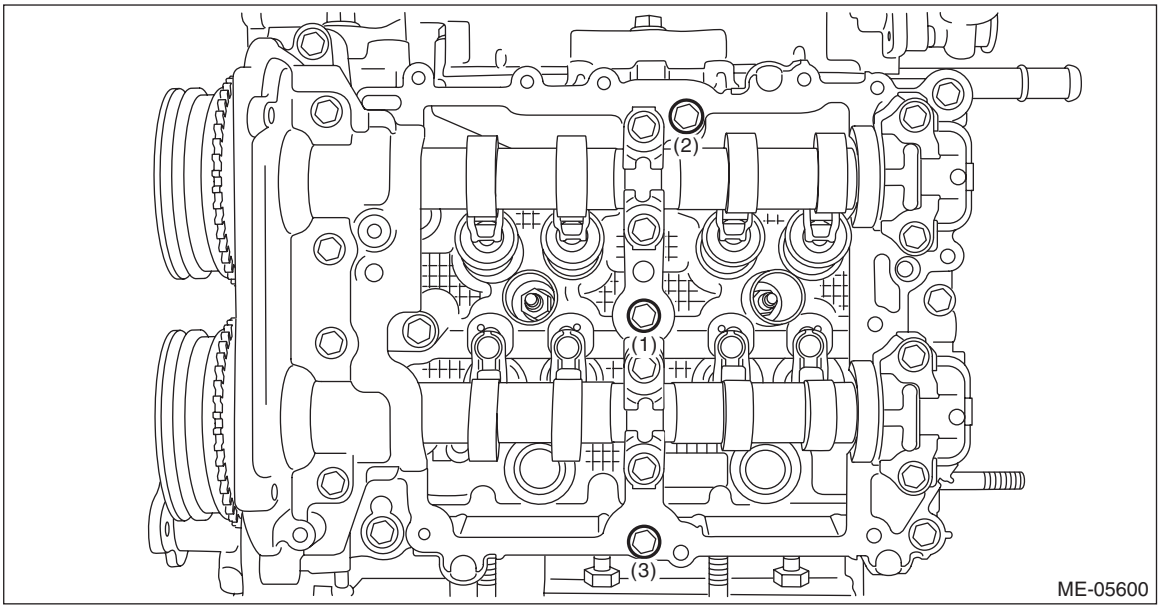




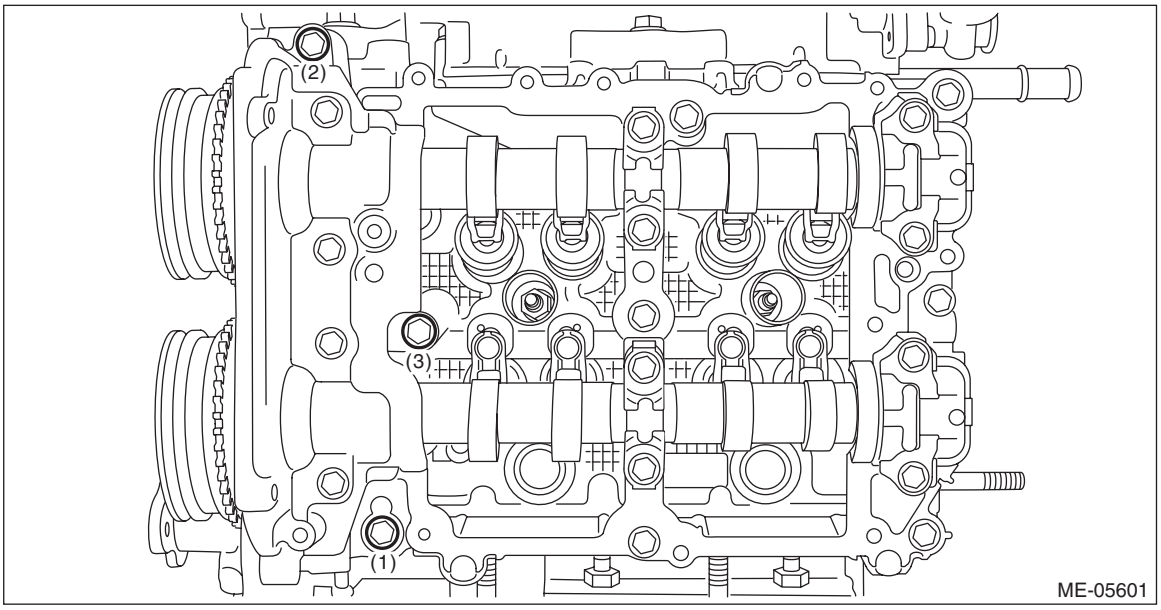
(2) Loosen the bolts (3 places) by 180° in numerical order as shown in the figure.



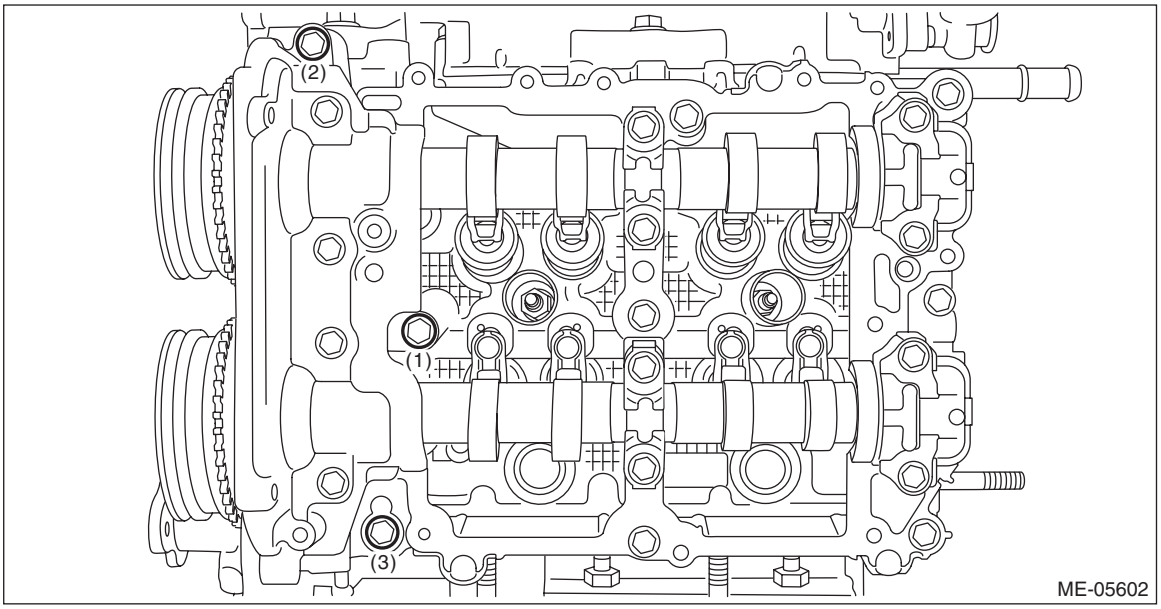
(3) Tighten the bolts (3 places) with a torque of 18 N·m (1.8 kgf-m, 13.3 ft-lb) in numerical order as shown in the figure.



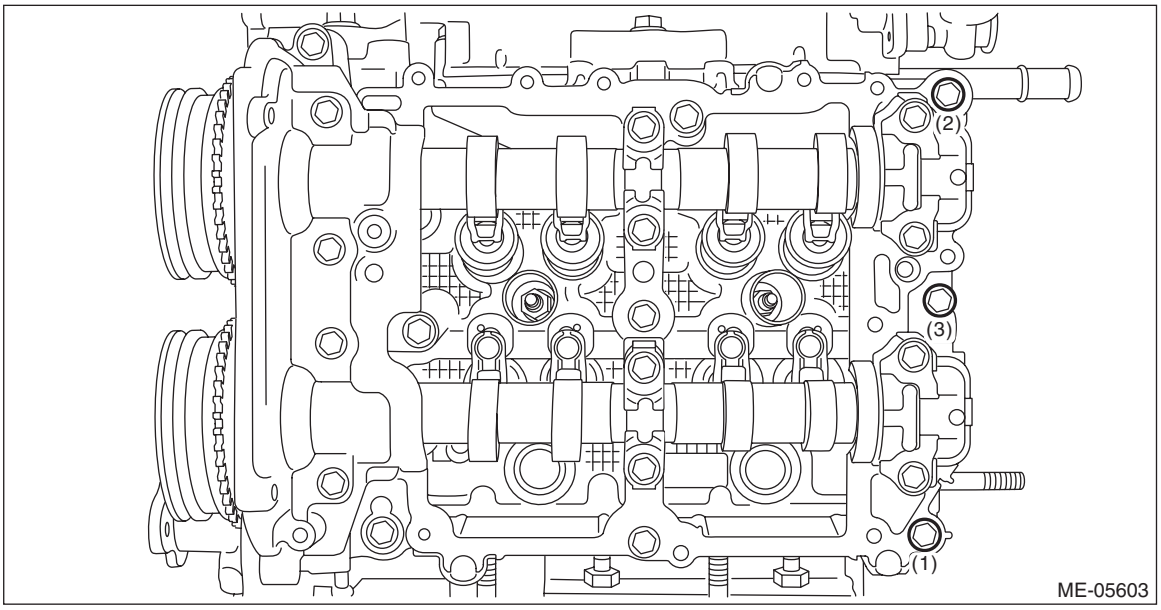
(4) Loosen the bolts (3 places) by 180° in numerical order as shown in the figure.



(5) Tighten the bolts (3 places) with a torque of 18 N·m (1.8 kgf-m, 13.3 ft-lb) in numerical order as shown in the figure.

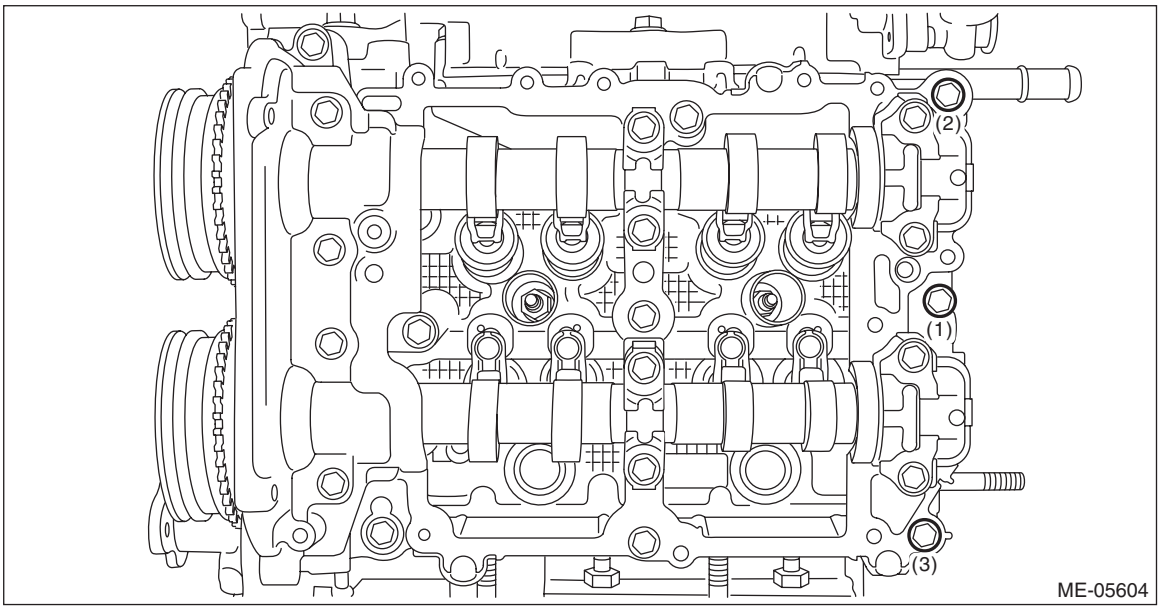


(6) Loosen the bolts (3 places) by 180° in numerical order as shown in the figure.



(7) Tighten the bolts (3 places) with a torque of 18 N·m (1.8 kgf-m, 13.3 ft-lb) in numerical order as shown in the figure.

NOTE:
After tightening, if the liquid gasket is squeezed out onto the seal surface of the chain cover, completely remove any squeezed-out liquid gasket.

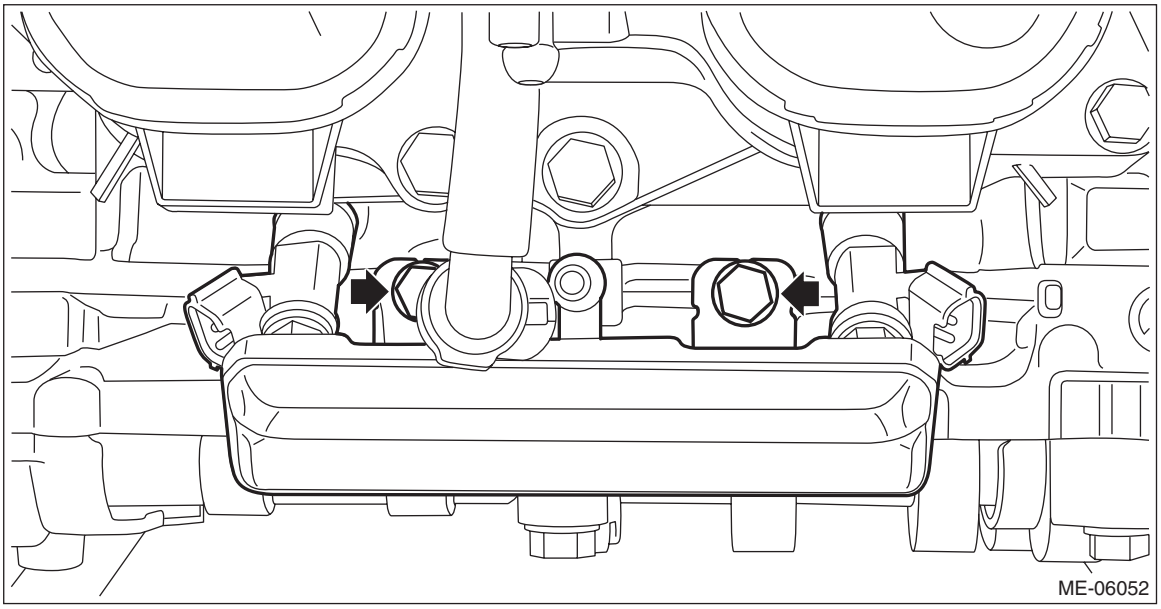


6) Set the part so that the intake manifold is on the upper side.
7) Install the cam sprocket LH. <Ref. to ME(H4DO(w/o HEV))-198, CAM SPROCKET LH, INSTALLATION, Cam Sprocket.>

NOTE:
This procedure is required only when the cam carrier LH is removed for disassembly.
8) Check the cam clearance. <Ref. to ME(H4DO(w/o HEV))-51, WHEN TIMING CHAIN ASSEMBLY IS REMOVED, INSPECTION, Cam Clearance.>
9) Install timing chain LH. <Ref. to ME(H4DO(w/o HEV))-176, TIMING CHAIN LH, INSTALLATION, Timing Chain Assembly.>

10) Install the fuel pipe LH and the fuel injector LH.
(1) Install the fuel pipe LH and the fuel injector LH, and install the bolts which secure the fuel pipe LH.
• Use new O-rings, rubbers, seal rings, and fuel injector holder.
• Refer to “Fuel Injector” for removal and installation procedure of fuel injector holder. <Ref. to FU(H4DO(HEV))-69, REMOVAL, Fuel Injector.> <Ref. to FU(H4DO(HEV))-72, INSTALLATION, Fuel Injector.>

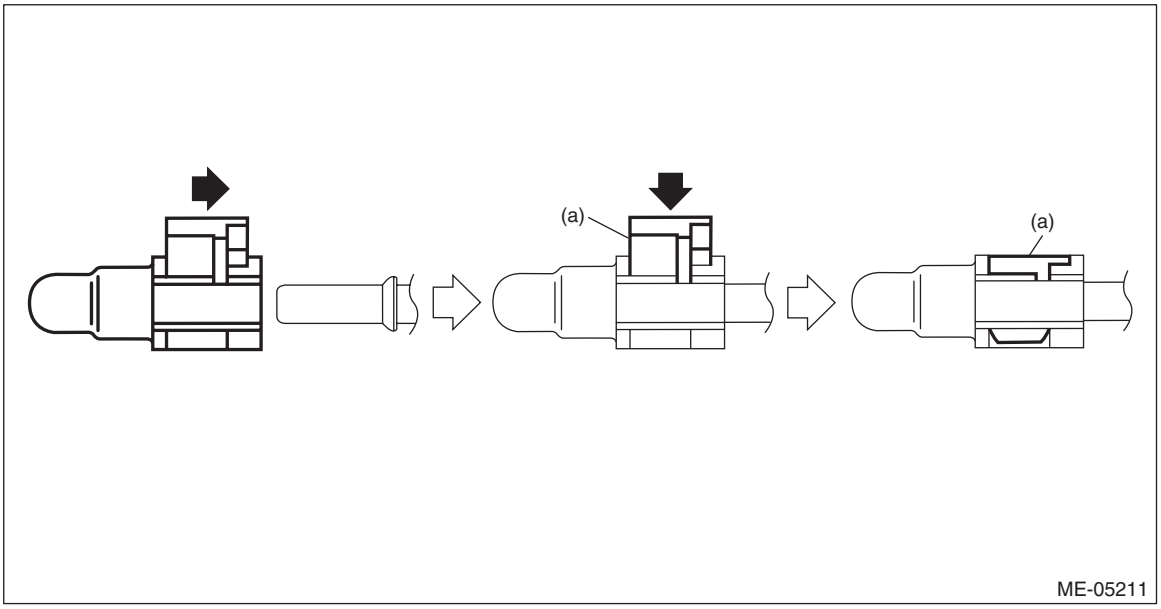
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



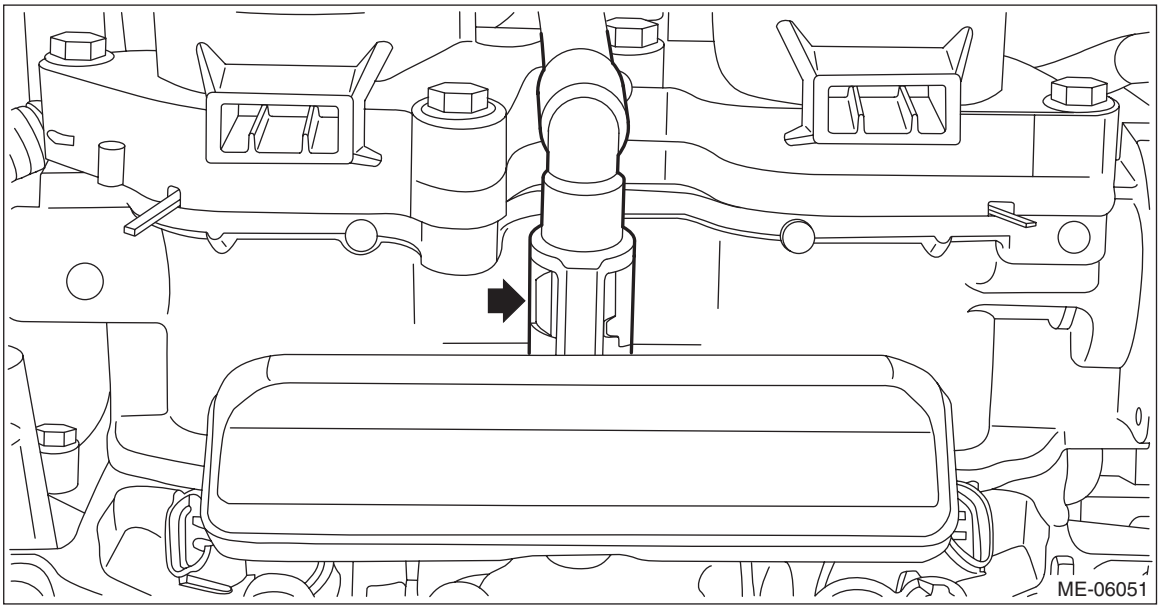
(2) Connect the quick connector to the fuel pipe LH.

CAUTION:
• Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
• When connecting the quick connector, make sure to insert the pipe all the way in before locking the slider.
• When it is difficult to lock the slider, check that the pipe is fully inserted.
• Make sure that the quick connector is securely connected.

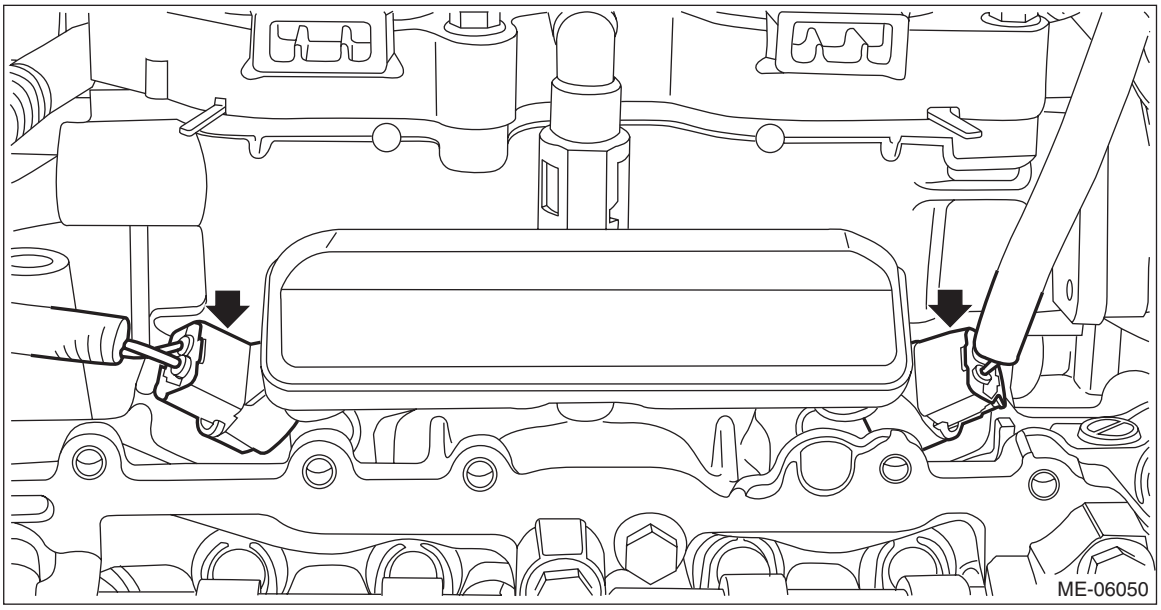
NOTE:
Connect the quick connector as shown in the figure.



(a) Slider



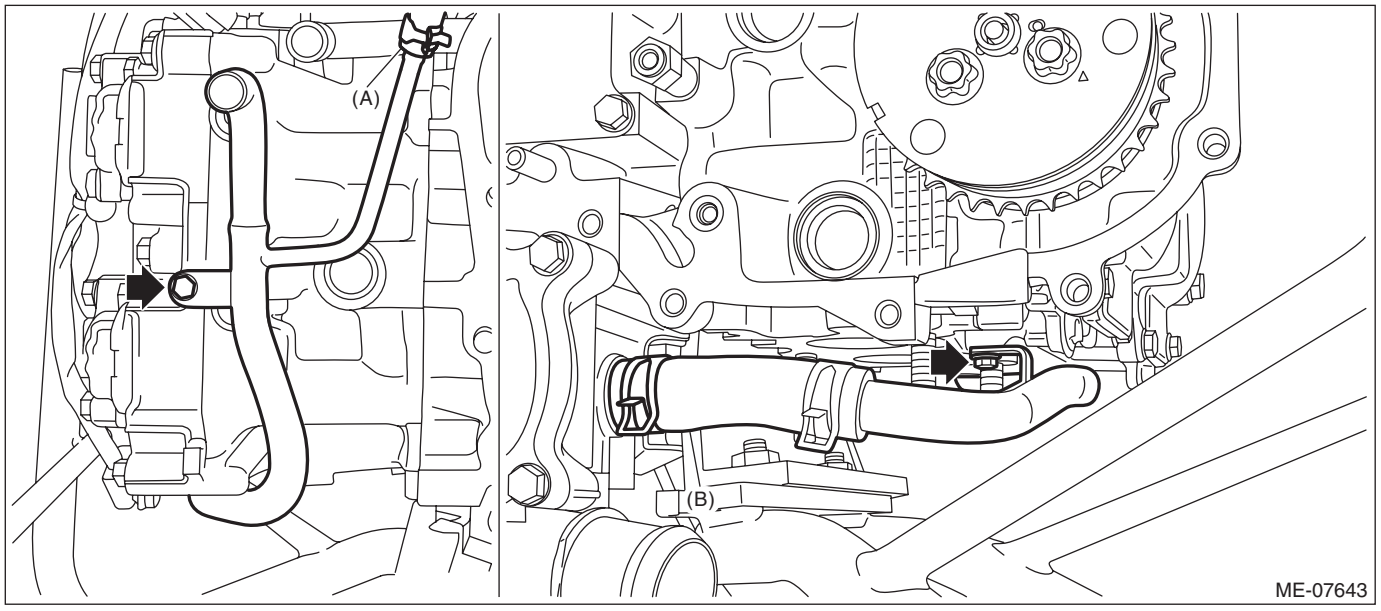
(3) Connect the connectors to the fuel injector LH.



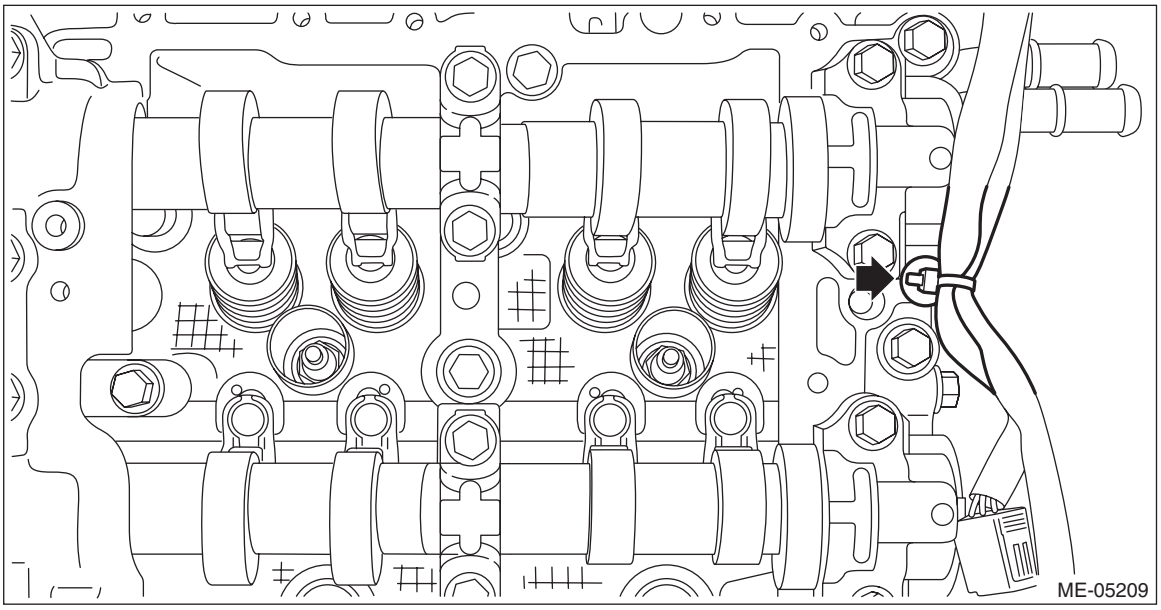
11) Connect the water pipe hose (B) to the oil pan upper, and install the water pipe assembly LH.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

12) Connect the preheater hose (A) to the water pipe assembly LH.



13) Secure the engine harness to the cam carrier LH with a clip.



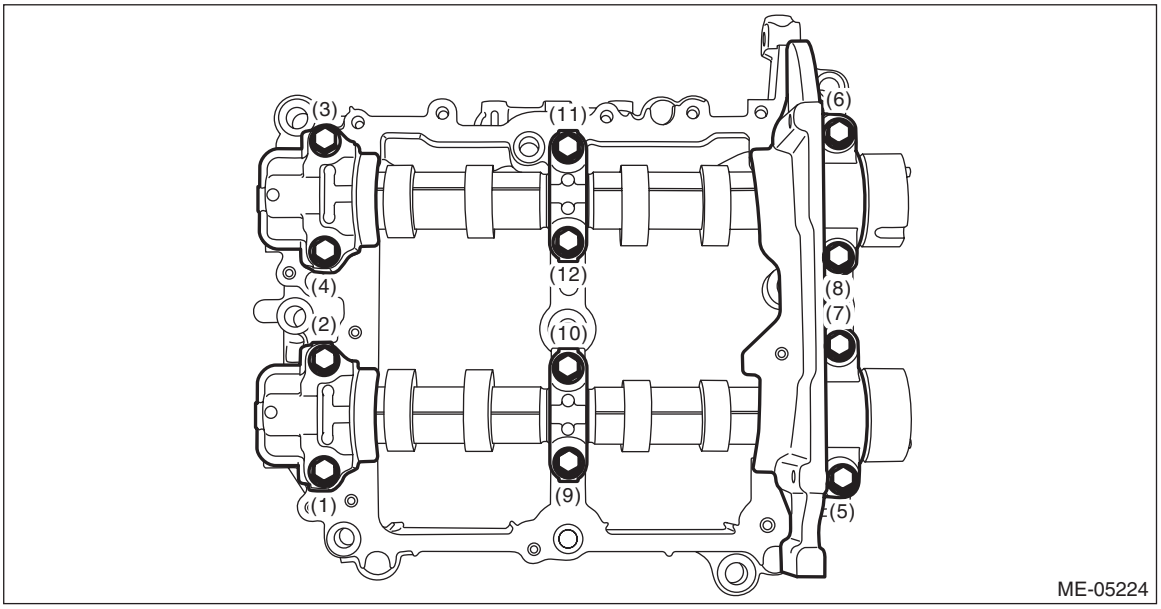
14) Install the rocker cover LH. <Ref. to ME(H4DO(w/o HEV))-214, ROCKER COVER LH, INSTALLATION, Rocker Cover.>
15) Install the chain cover. <Ref. to ME(H4DO(w/o HEV))-156, INSTALLATION, Chain Cover.>
16) Install the engine to the vehicle. <Ref. to ME(H4DO(w/o HEV))-88, INSTALLATION, Engine Assembly.>

C: DISASSEMBLY

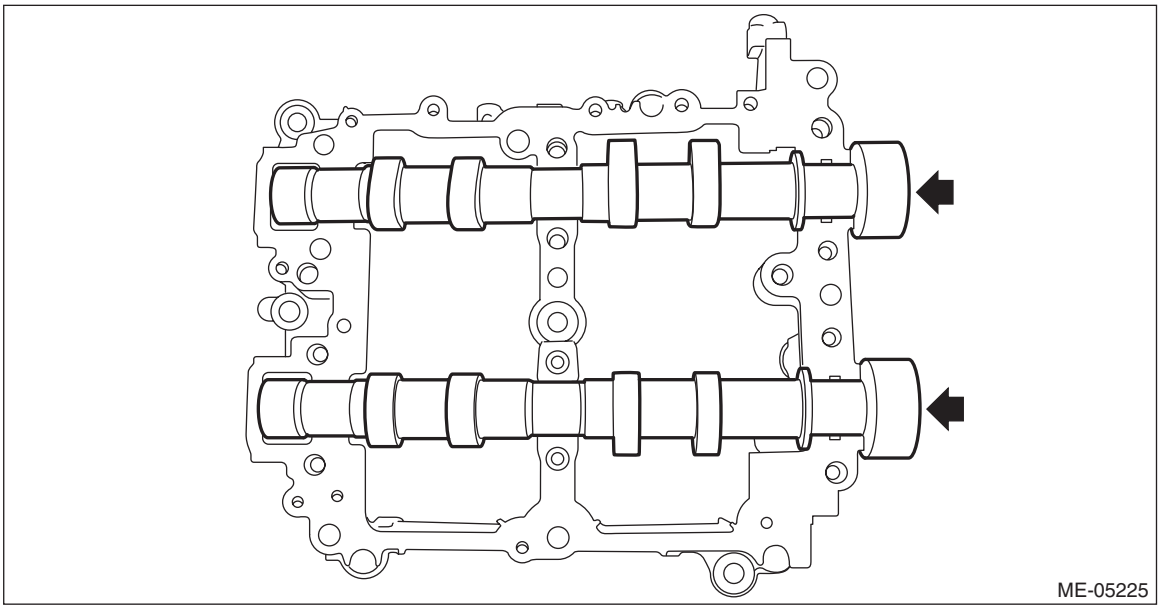
1. CAM CARRIER RH

1) Loosen the bolts (front camshaft cap RH, intake center camshaft cap RH, intake rear camshaft cap RH, exhaust center camshaft cap RH, and exhaust rear camshaft cap RH) equally, a little at a time in numerical sequence as shown in the figure, and remove each camshaft cap.

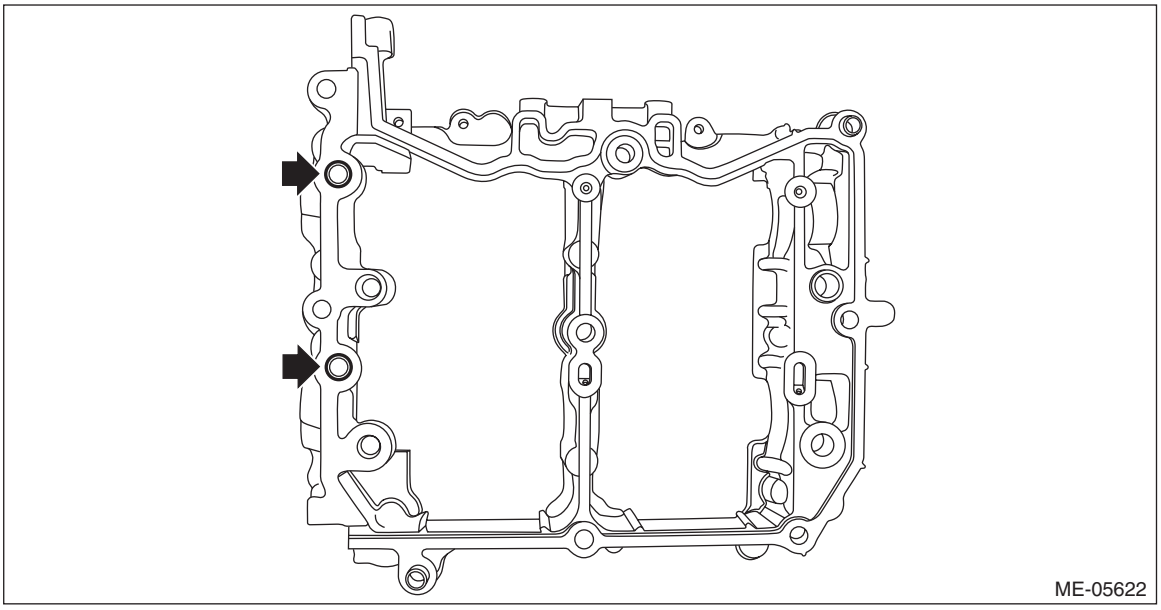
NOTE:
Arrange camshaft caps in order so that they can be installed in their original positions.



2) Remove the intake camshaft RH and the exhaust camshaft RH from cam carrier RH.



3) Remove the filter from cam carrier RH.

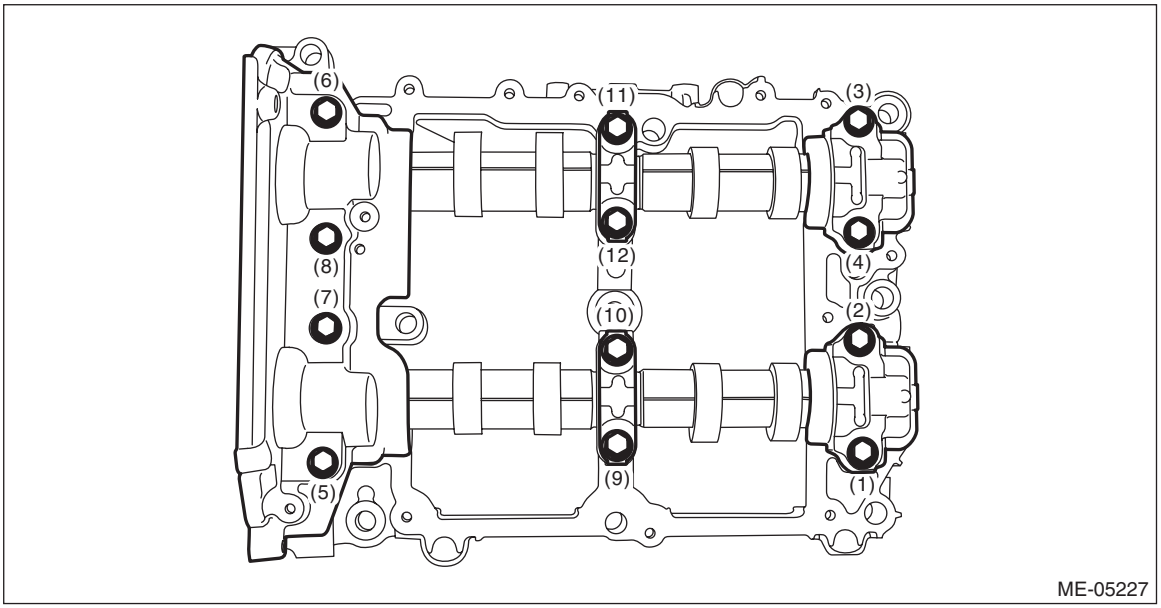


4) Remove the liquid gasket from cam carrier RH and front camshaft cap RH, intake rear camshaft cap RH and exhaust rear camshaft cap RH.

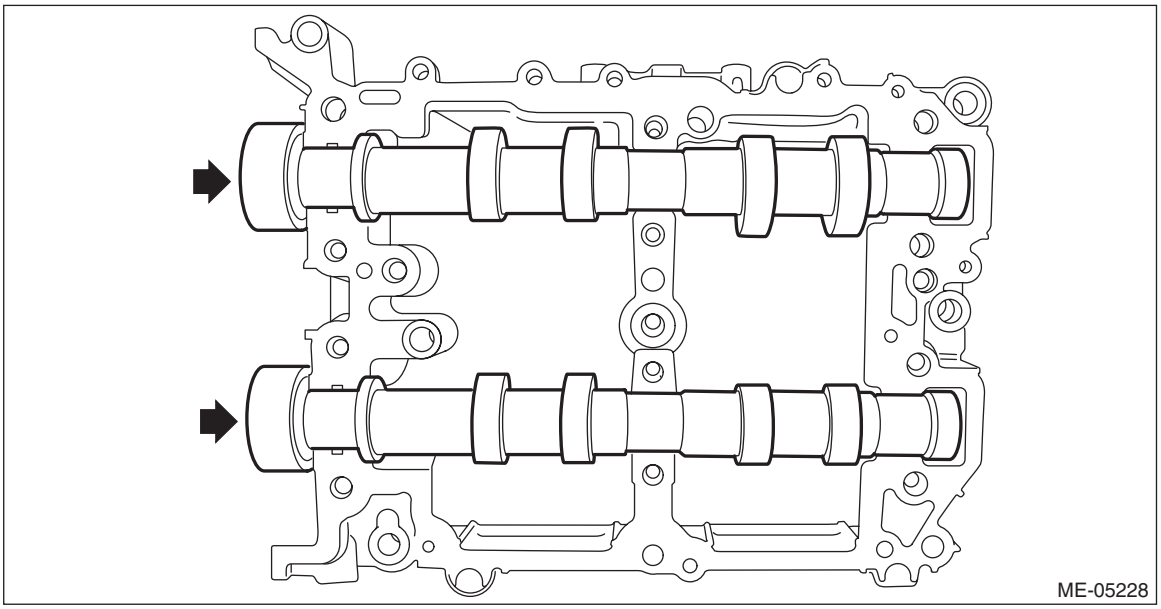
2. CAM CARRIER LH

1) Loosen the bolts (front camshaft cap LH, intake center camshaft cap LH, intake rear camshaft cap LH, exhaust center camshaft cap LH and exhaust rear camshaft cap LH) equally, a little at a time in numerical sequence as shown in the figure, and remove each camshaft cap.

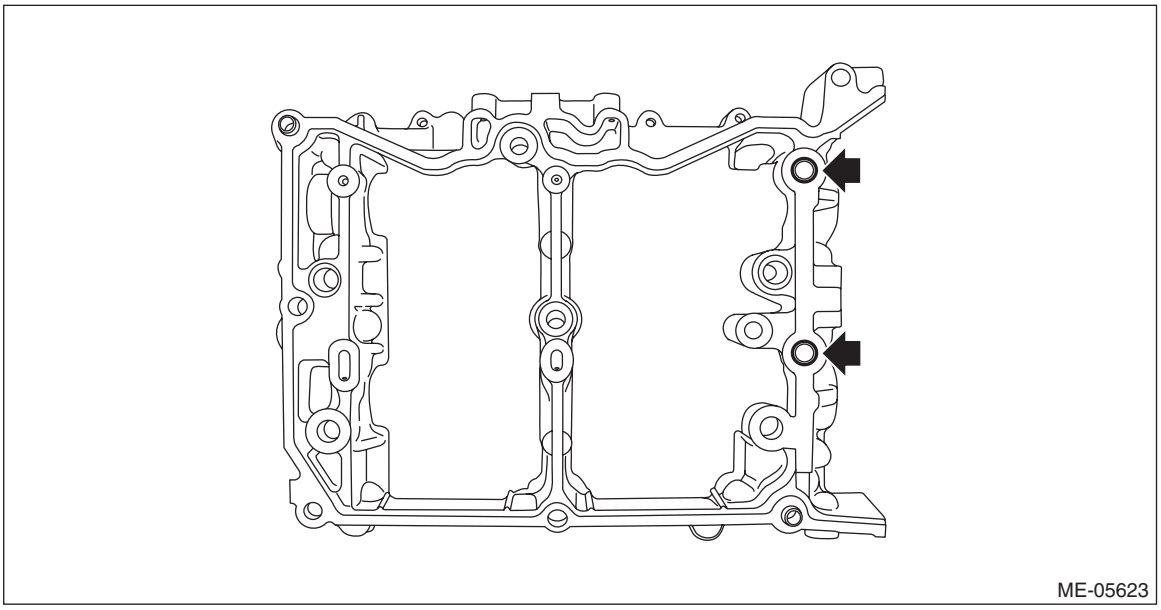
NOTE:
Arrange camshaft caps in order so that they can be installed in their original positions.



2) Remove the intake camshaft LH and the exhaust camshaft LH from cam carrier LH.



3) Remove the filter from cam carrier LH.



4) Remove the liquid gasket from cam carrier LH and front camshaft cap LH, intake rear camshaft cap LH and exhaust rear camshaft cap LH.

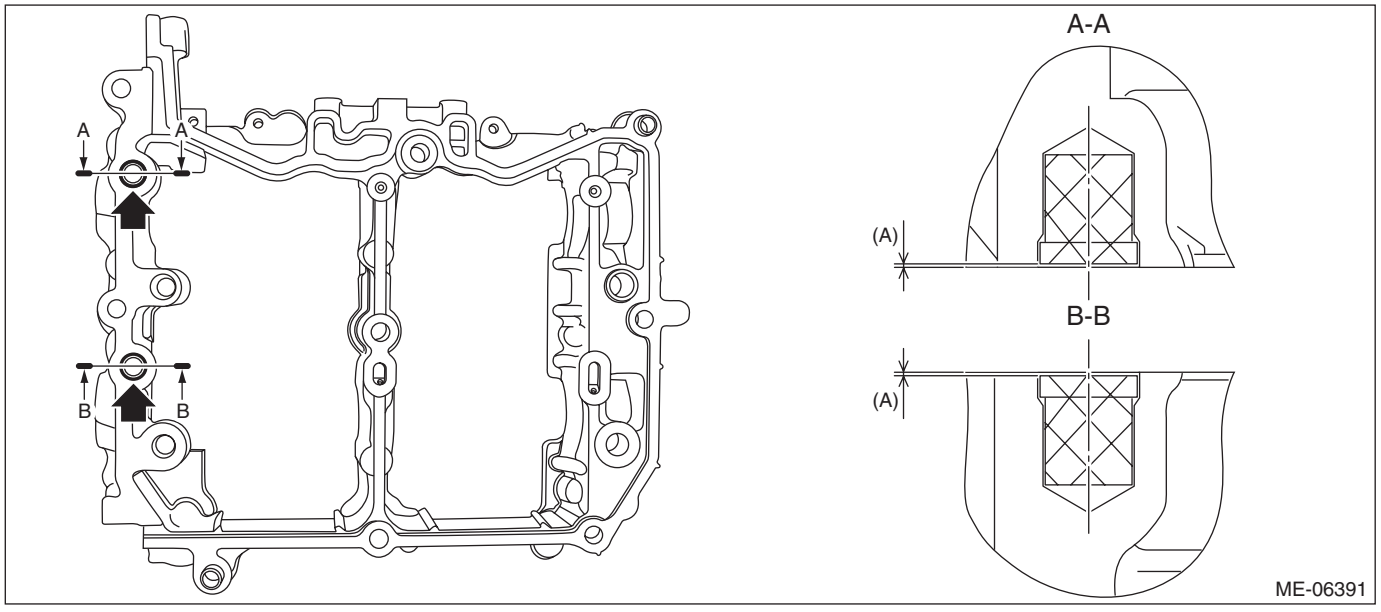
D: ASSEMBLY

1. CAM CARRIER RH

1) Install the filter to the cam carrier RH.

NOTE:
Use a new filter.

Filter insert position:
Cam carrier RH end face $0^{+0}_{-0.5}$ mm ($^{+0}_{-0.0197}$ in) position



(A) 0 — 0.5 mm (0 — 0.0197 in)

2) Set the intake camshaft RH and the exhaust camshaft RH to the cam carrier RH.

NOTE:
Apply engine oil to the journals of cam carrier RH before setting the intake camshaft RH and exhaust camshaft RH.

3) Install the front camshaft cap RH, intake center camshaft cap RH, intake rear camshaft cap RH, exhaust center camshaft cap RH and exhaust rear camshaft cap RH.

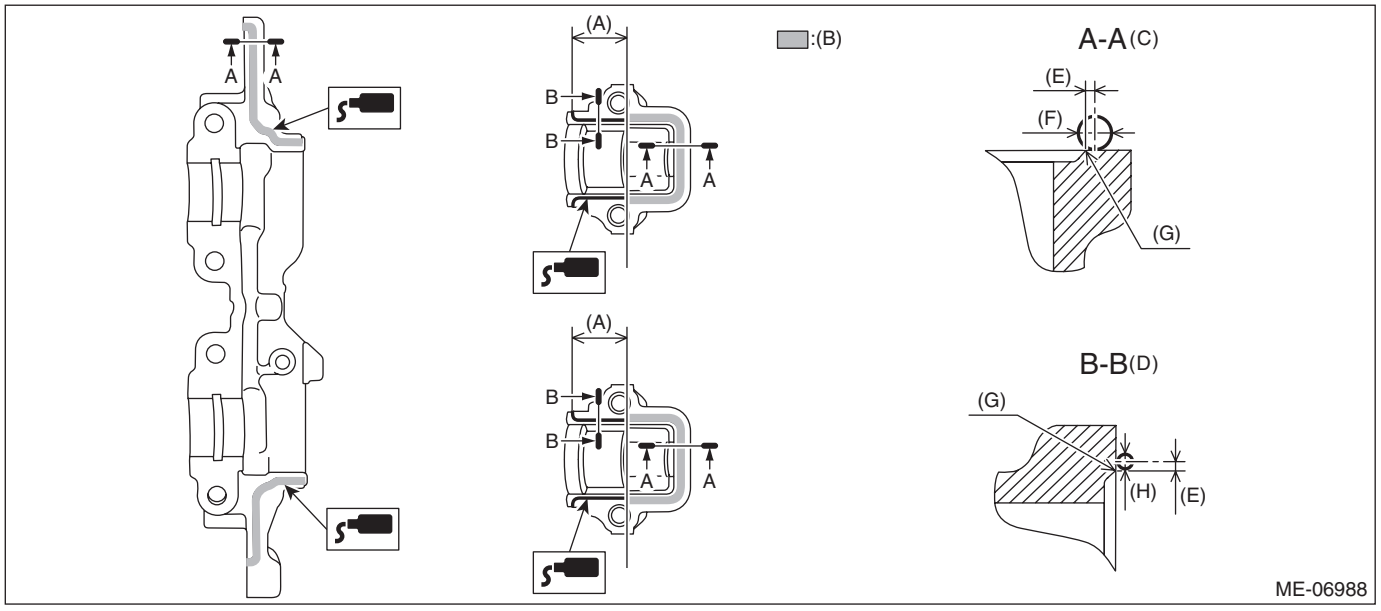
(1) Apply liquid gasket to the mating surface of front camshaft cap RH, intake rear camshaft cap RH and exhaust rear camshaft cap RH as shown in the figure.

CAUTION:
• Do not apply liquid gasket excessively. Applying excessively may cause excess gasket to flow toward camshaft journal, resulting in engine seizure.
• Do not apply liquid gasket excessively to the intake center camshaft cap RH and exhaust center camshaft cap RH.

NOTE:
• Before applying liquid gasket, degrease the old liquid gasket seal surface of the front camshaft cap RH, intake rear camshaft cap RH, exhaust rear camshaft cap RH, and cam carrier RH.
• Install within 5 min. after applying liquid gasket.

Liquid gasket:
THREE BOND 1217G (Part No. 0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:
Mating surfaces other than range A
2±0.5 mm (0.0787±0.0197 in)
Mating surfaces of range A
3.5±0.5 mm (0.1378±0.0197 in)

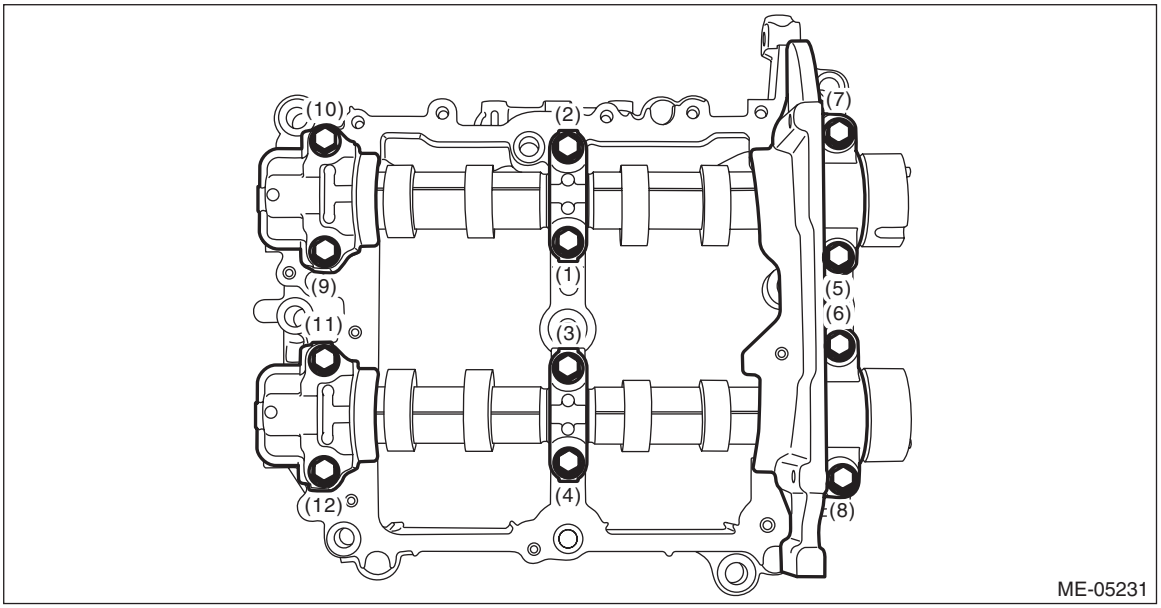


(A)	28.5 mm (1.122 in)	(D)	Liquid gasket applying position of mating surfaces other than range A	(G)	Chamfer edge
(B)	Range A	(E)	1 mm (0.0394 in) or less	(H)	ϕ2±0.5 mm (0.0787±0.0197 in)
(C)	Liquid gasket applying position of mating surfaces of range A	(F)	ϕ3.5±0.5 mm (0.1378±0.0197 in)		

(2) Apply engine oil to the journals of each camshaft cap before setting the camshaft cap.

(3) Tighten the bolts which secure front camshaft cap RH, intake center camshaft cap RH, intake rear camshaft cap RH, exhaust center camshaft cap RH and exhaust rear camshaft cap RH in numerical order as shown in the figure.

Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)

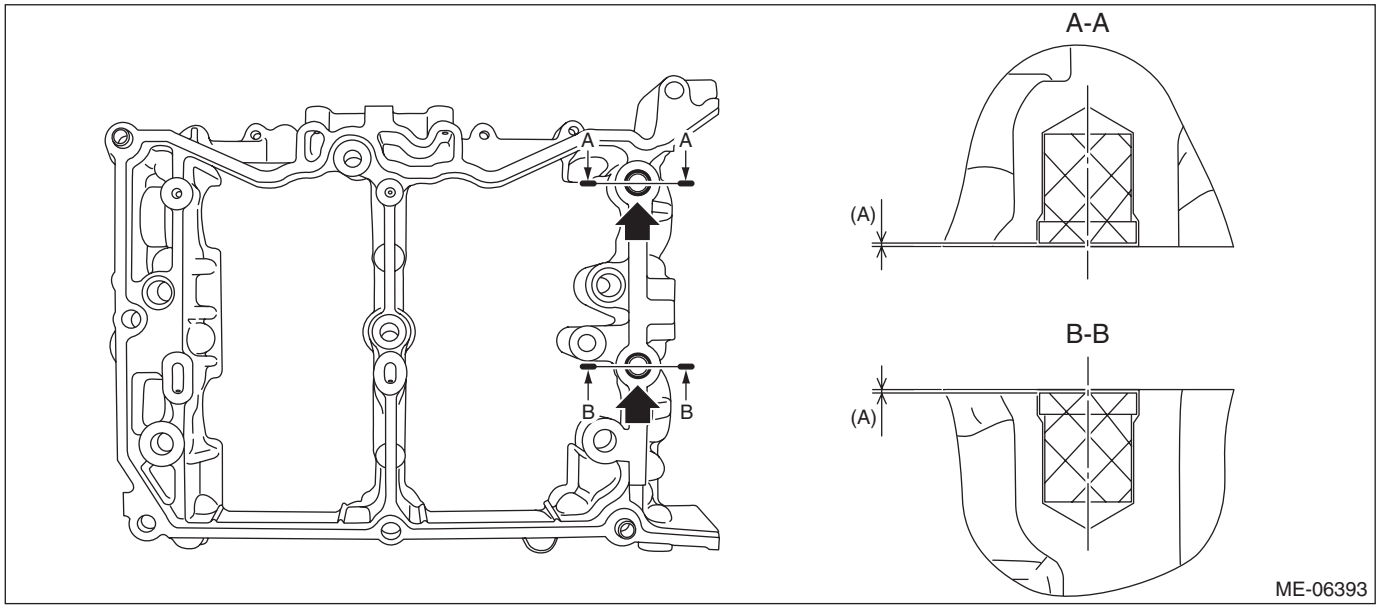


2. CAM CARRIER LH

1) Install the filter to the cam carrier LH.

NOTE:
Use a new filter.

Filter insert position:
Cam carrier LH end face $0^{+0}_{-0.5}$ mm ($^{+0}_{-0.0197}$ in) position



(A) 0 — 0.5 mm (0 — 0.0197 in)

2) Set the intake camshaft LH and the exhaust camshaft LH to the cam carrier LH.

NOTE:
Apply engine oil to the journals of cam carrier LH before setting the intake camshaft LH and exhaust camshaft LH.

3) Install the front camshaft cap LH, intake center camshaft cap LH, intake rear camshaft cap LH, exhaust center camshaft cap LH and exhaust rear camshaft cap LH.

(1) Apply liquid gasket to the mating surface of front camshaft cap LH, intake rear camshaft cap LH and exhaust rear camshaft cap LH as shown in the figure.

CAUTION:

• Do not apply liquid gasket excessively. Applying excessively may cause excess gasket to flow toward camshaft journal, resulting in engine seizure.

• Do not apply liquid gasket excessively to the intake center camshaft cap LH and exhaust center camshaft cap LH.

NOTE:

• Before applying liquid gasket, degrease the old liquid gasket seal surface of the front camshaft cap LH, intake rear camshaft cap LH, exhaust rear camshaft cap LH, and cam carrier LH.

• Install within 5 min. after applying liquid gasket.

Liquid gasket:

THREE BOND 1217G (Part No. 0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

Mating surfaces other than ranges A, B and C

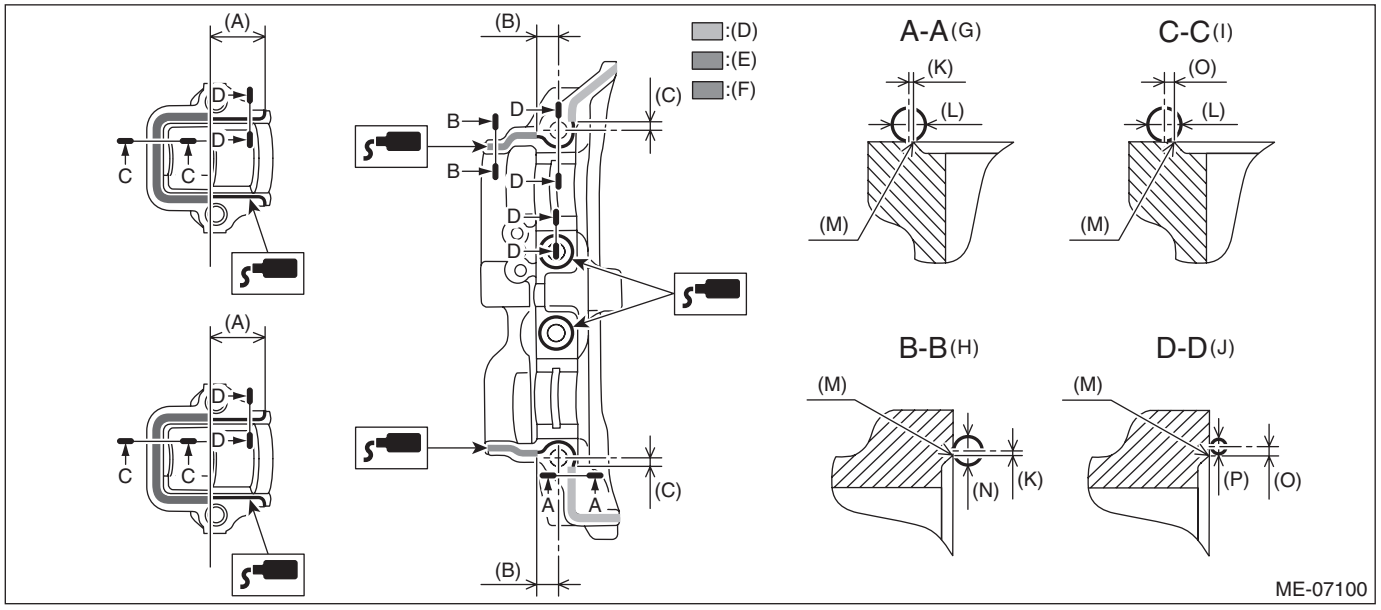
2±0.5 mm (0.0787±0.0197 in)

Mating surfaces of ranges A and C

3.5±0.5 mm (0.1378±0.0197 in)

Mating surfaces of range B

$3^{+0.5}_{-0}$ mm ($0.1181^{+0.0197}_{-0}$ in)

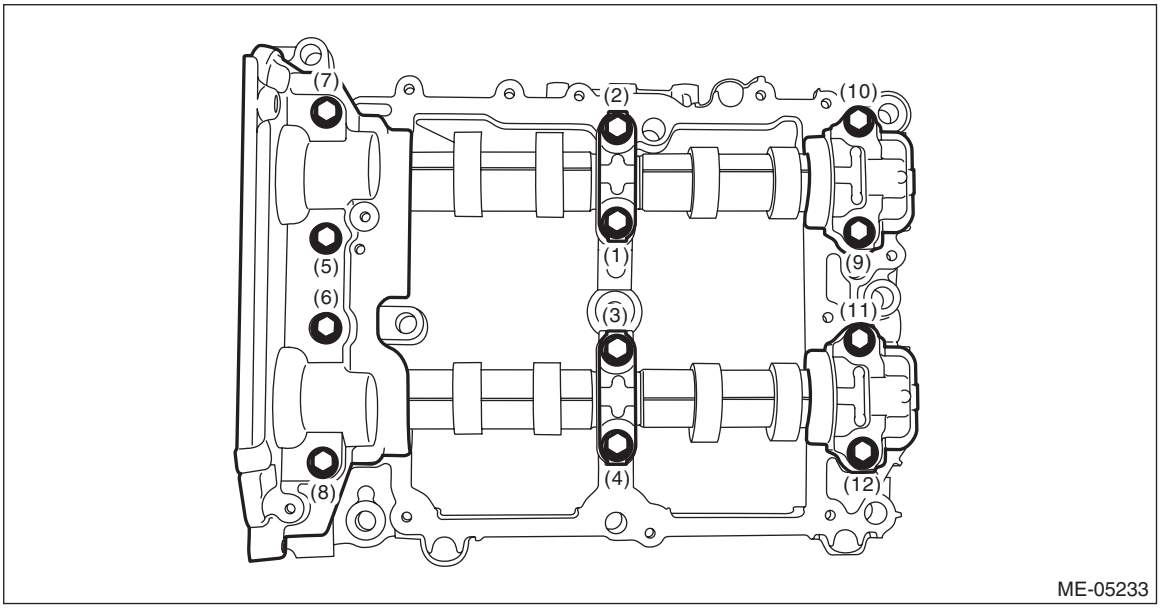


(A)	28.5 mm (1.122 in)	(G)	Liquid gasket applying position of mating surfaces of range A	(M)	Chamfer edge
(B)	11.6 mm (0.4567 in)	(H)	Liquid gasket applying position of mating surfaces of range B	(N)	$\phi 3^{+0.5}_{-0}$ mm ($^{+0.0197}_{-0}$ in)
(C)	5.1 mm (0.2008 in)	(I)	Liquid gasket applying position of mating surfaces of range C	(O)	1 mm (0.0394 in) or less
(D)	Range A	(J)	Liquid gasket applying position of mating surfaces other than range A, range B and range C	(P)	ϕ2±0.5 mm (0.0787±0.0197 in)
(E)	Range B	(K)	0.5 mm (0.0197 in)		
(F)	Range C	(L)	ϕ3.5±0.5 mm (0.1378±0.0197 in)		

(2) Apply engine oil to the journals of each camshaft cap before setting the camshaft cap.

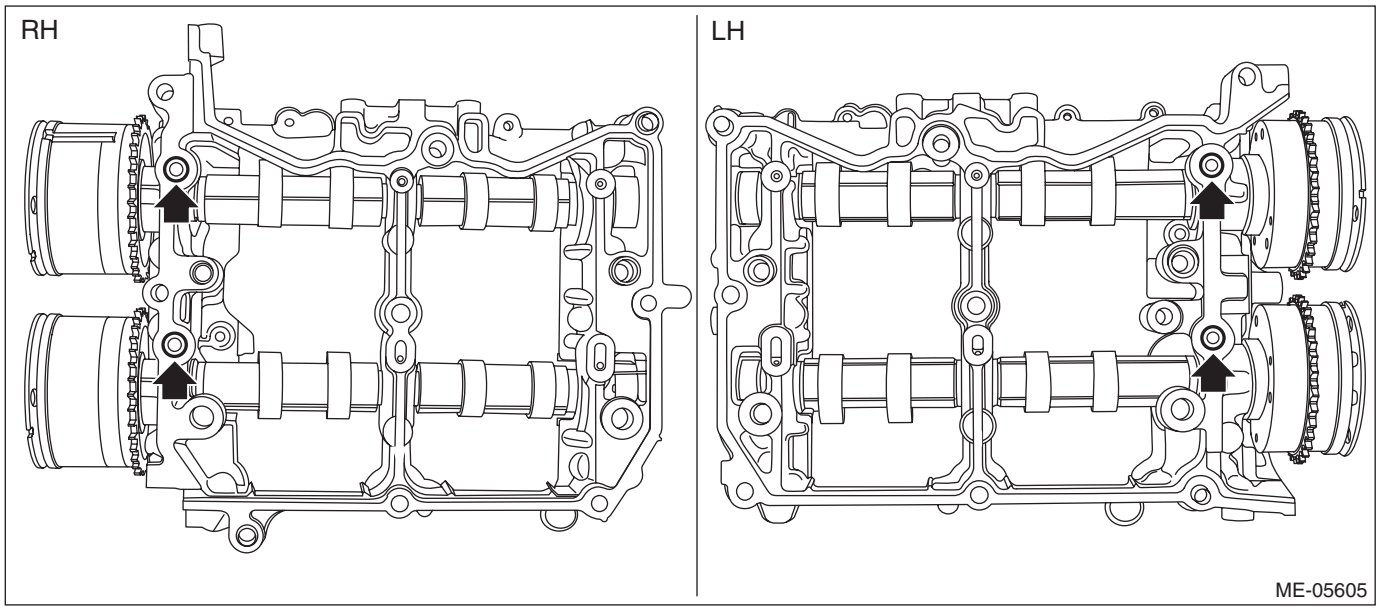
(3) Tighten the bolts which secure front camshaft cap LH, intake center camshaft cap LH, intake rear camshaft cap LH, exhaust center camshaft cap LH and exhaust rear camshaft cap LH in numerical order as shown in the figure.

Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)



E: INSPECTION

1) Visually check the cam carrier filter, and if clogging is found, replace with a new part.

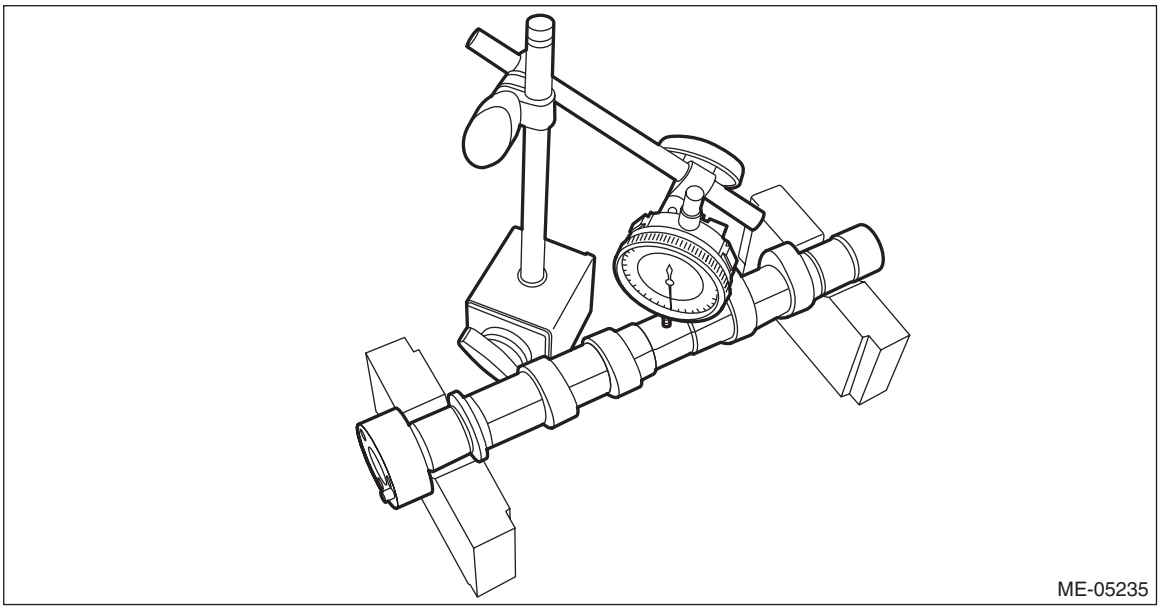


2) Check the camshaft journals for damage and wear. Replace the camshaft if faulty.
3) Check the cam face condition of camshaft, and remove the minor faults by grinding with oil stone. Replace the camshaft if uneven wear is found.

4) Using a dial gauge, check the camshaft bend. If it exceeds the limit, replace the camshaft.

NOTE:
Measurement should be performed at a temperature of 20°C (68°F).

Camshaft bend:
Limit
0.020 mm (0.00079 in)

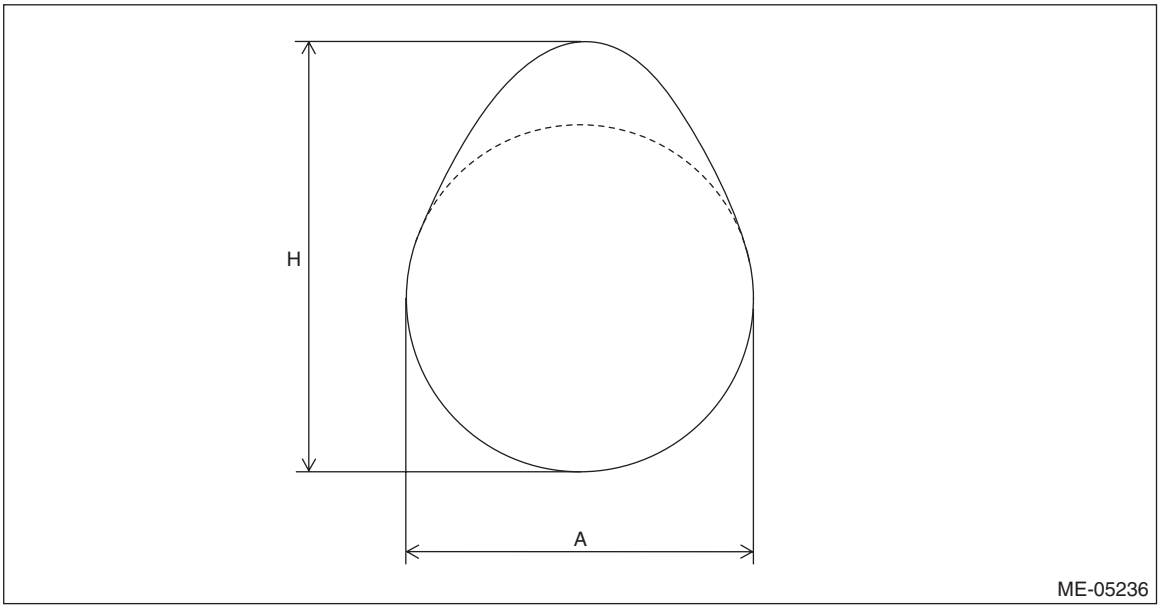


5) Check the cam lobe height “H” and cam base circle diameter “A” of camshaft as shown in the figure, using micrometer. If it is not within the standard, replace the camshaft.

NOTE:
Measurement should be performed at a temperature of 20°C (68°F).

Camshaft cam lobe overall height H:
Intake
Standard
40.34 — 40.44 mm (1.588 — 1.592 in)
Exhaust
Standard
39.66 — 39.76 mm (1.561 — 1.565 in)

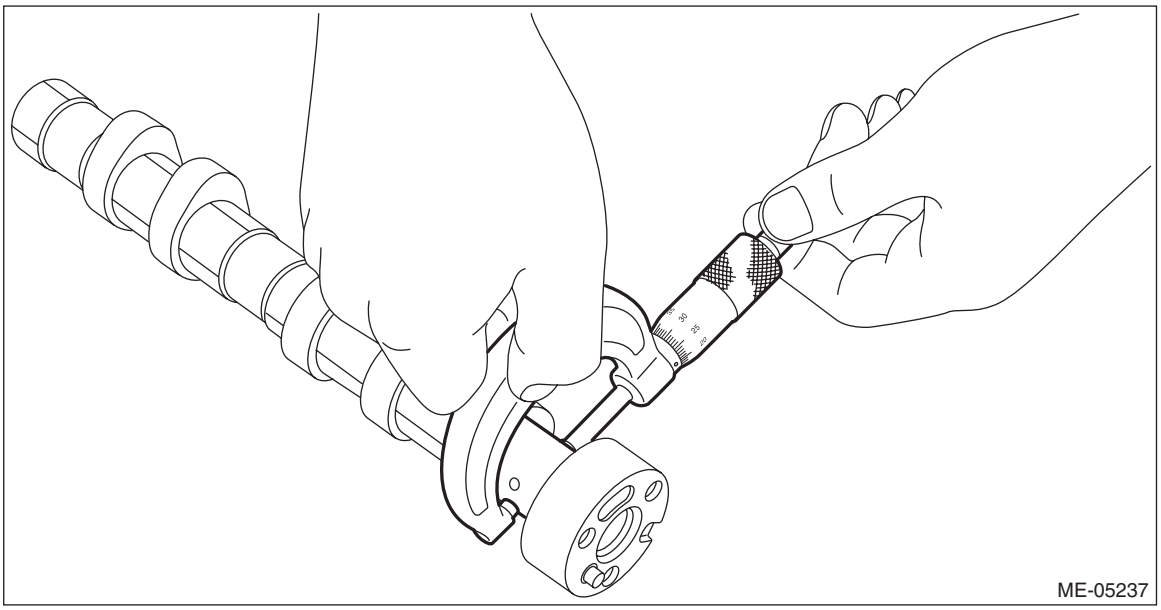
Camshaft cam base circle diameter A:
Standard
34.0 mm (1.339 in)



6) Check the camshaft journal outer diameter using micrometer. If it is not within the standard, replace the camshaft.

NOTE:
- Measurement should be performed at a temperature of 20°C (68°F).
- Measure outer diameter of each journal at several points, and read the value of most worn location.

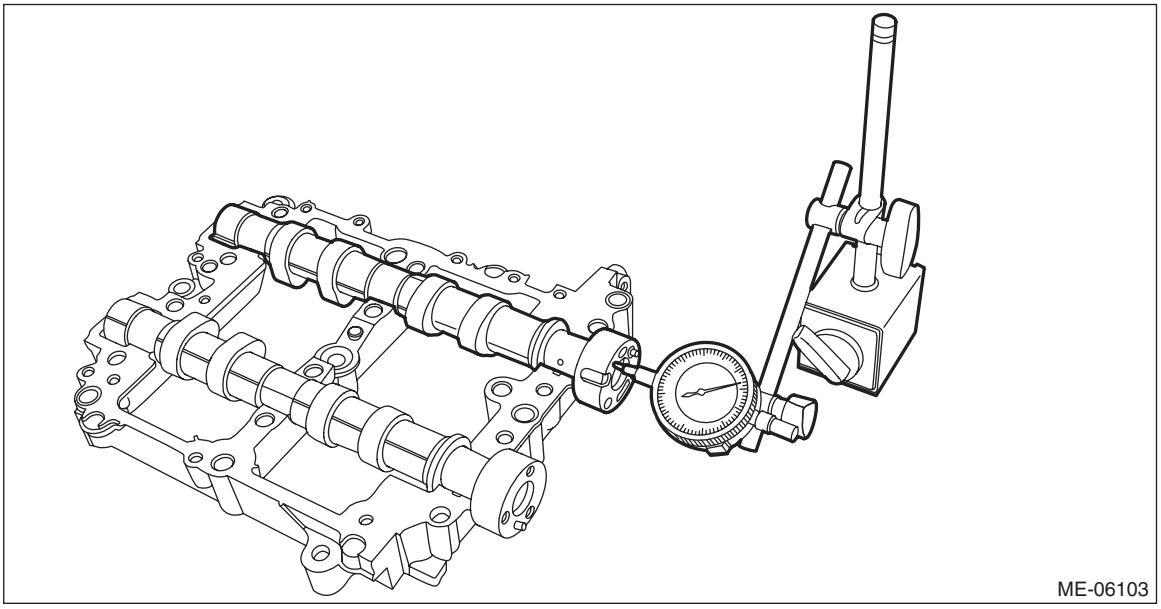
Camshaft journal outer diameter:
Standard
25.946 — 25.963 mm (1.0215 — 1.0222 in)



7) Using a dial gauge, check the thrust clearance of the camshaft. If it is not within the standard or if uneven wear is found, replace each camshaft cap and cam carrier as a set. If necessary replace the camshaft.

NOTE:
- Measurement should be performed at a temperature of 20°C (68°F).
- Set the dial gauge at end surface of camshaft.

Camshaft thrust clearance:
Standard
0.068 — 0.116 mm (0.0027 — 0.0047 in)

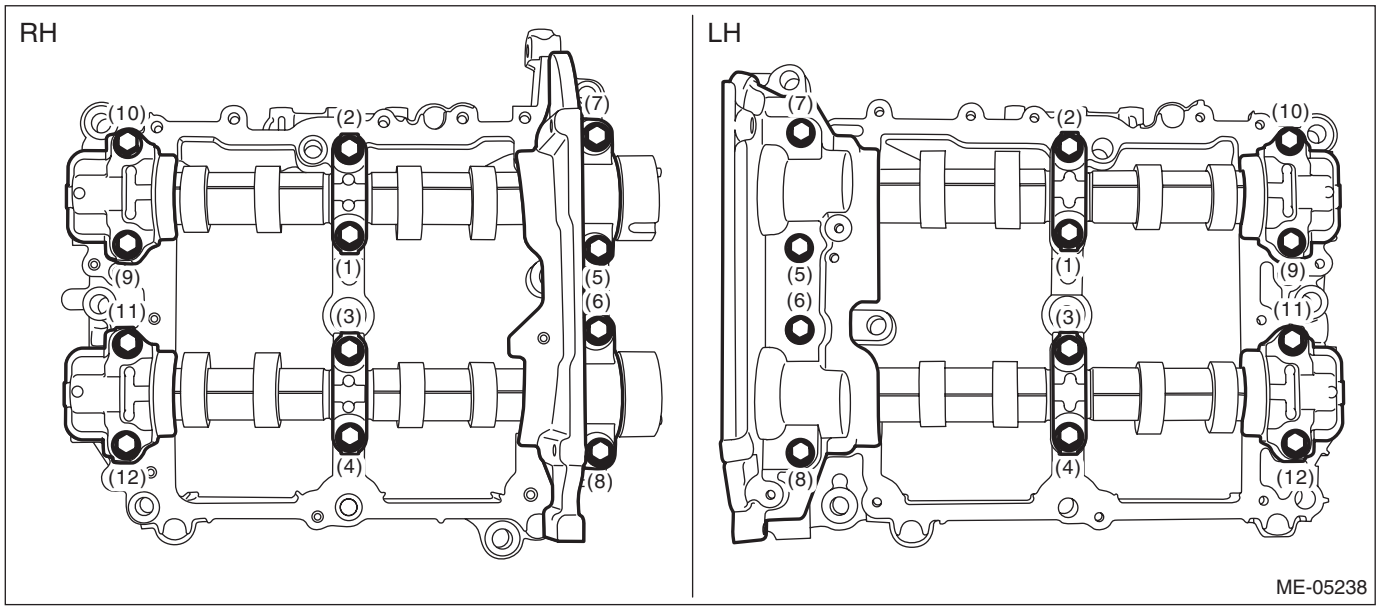


8) Check the oil clearance on the camshaft using a plastigauge.

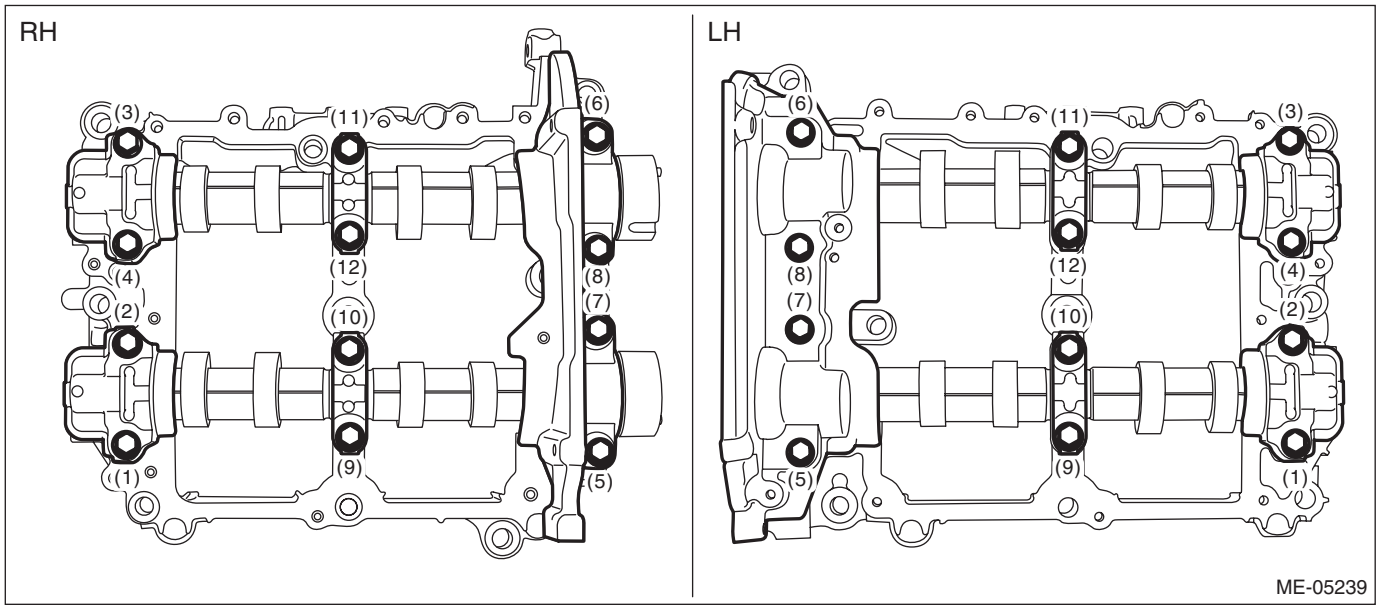
NOTE:
Measurement should be performed at a temperature of 20°C (68°F).

(1) Remove the liquid gasket from cam carrier and front camshaft cap, intake rear camshaft cap and exhaust rear camshaft cap.
(2) Clean each camshaft cap and cam carrier journals.
(3) Set the camshaft to the cam carrier.
(4) Place a plastigauge across the camshaft journals of each camshaft and set the camshaft caps.
(5) Tighten the bolts which secure front camshaft cap, intake center camshaft cap, intake rear camshaft cap, exhaust center camshaft cap and exhaust rear camshaft cap in numerical order as shown in the figure.

Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)

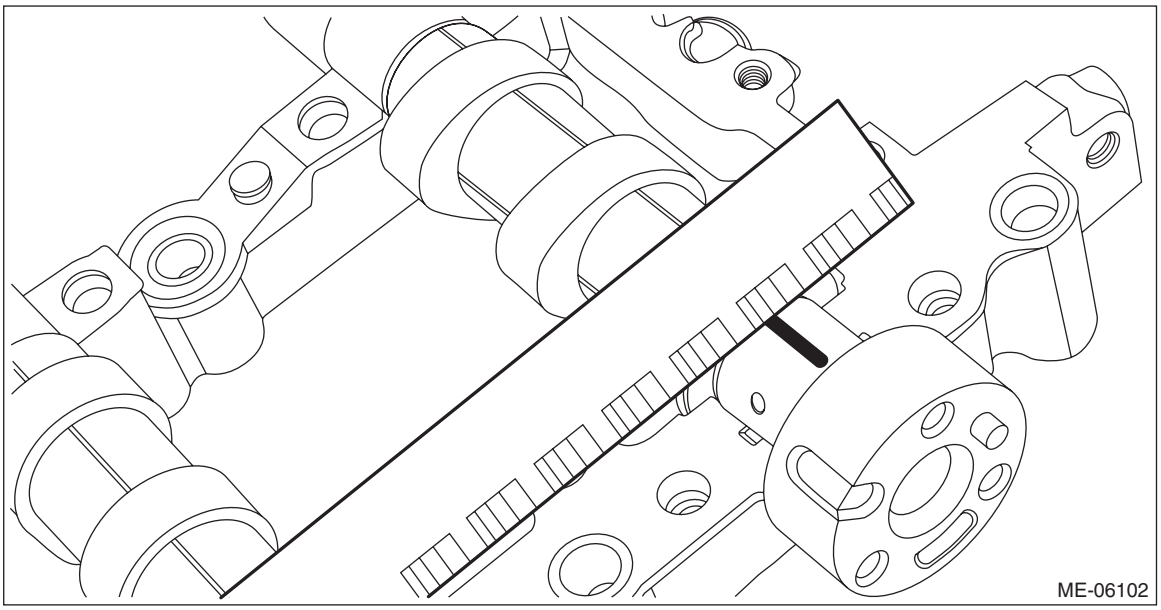


(6) Loosen the bolts (front camshaft cap, intake center camshaft cap, intake rear camshaft cap, exhaust center camshaft cap and exhaust rear camshaft cap) equally, a little at a time in numerical sequence as shown in the figure, and remove each camshaft cap.



(7) Determine camshaft oil clearance by matching the widest point of plastigauge on each journal against scale printed on a package of plastigauge. If it is not within the standard, replace each camshaft cap and cam carrier as a set. If necessary replace the camshaft.

Camshaft oil clearance:
Standard
0.037 — 0.072 mm (0.0015 — 0.0028 in)



(8) Completely remove the plastigauge.

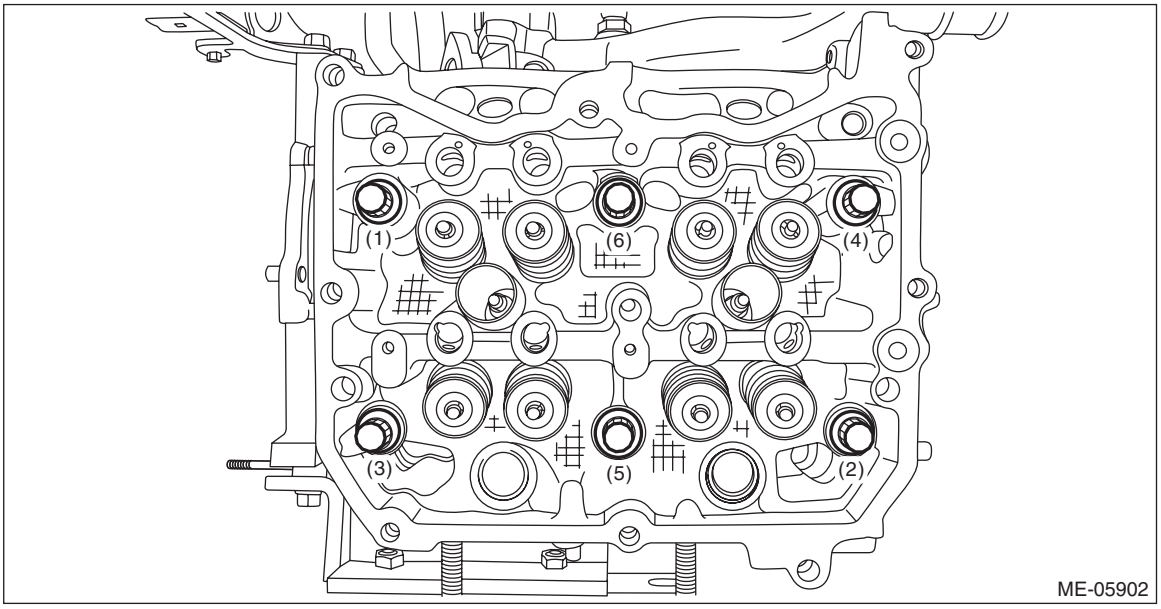
21.Cylinder Head

A: REMOVAL

1. CYLINDER HEAD RH

1) Remove the engine from the vehicle. <Ref. to ME(H4DO(w/o HEV))-55, REMOVAL, Engine Assembly.>
2) Remove the intake manifold. <Ref. to FU(H4DO(w/o HEV))-19, REMOVAL, Intake Manifold.> <Ref. to FU(H4DO(HEV))-19, REMOVAL, Intake Manifold.>
3) Remove the engine wiring harness. <Ref. to FU(H4DO(w/o HEV))-43, REMOVAL, Engine Wiring Harness.> <Ref. to FU(H4DO(HEV))-34, REMOVAL, Engine Wiring Harness.>
4) Remove the tumble generator valve assembly RH. <Ref. to FU(H4DO(w/o HEV))-85, REMOVAL, Tumble Generator Valve Assembly.> <Ref. to FU(H4DO(HEV))-73, REMOVAL, Tumble Generator Valve Assembly.>
5) Remove the chain cover. <Ref. to ME(H4DO(w/o HEV))-149, REMOVAL, Chain Cover.>
6) Remove the rocker cover RH. <Ref. to ME(H4DO(w/o HEV))-202, ROCKER COVER RH, REMOVAL, Rocker Cover.>
7) Remove the cam carrier RH. <Ref. to ME(H4DO(w/o HEV))-220, CAM CARRIER RH, REMOVAL, Cam Carrier.>
8) Remove the EGR cooler. <Ref. to EC(H4DO(w/o HEV))-32, REMOVAL, EGR Cooler.> <Ref. to EC(H4DO(HEV))-31, REMOVAL, EGR Cooler.>
9) Loosen the bolts holding the cylinder head RH equally, a little at a time in numerical sequence as shown in the figure, and while leaving the cylinder head bolts (1) and (4) engaged by three or four threads, remove the other cylinder head bolts.

NOTE:
Leaving the cylinder head bolts (1) and (4) engaged by three or four threads prevents the cylinder head RH from falling.



10) While tapping the cylinder head RH with a plastic hammer, separate it from cylinder block RH.
11) Remove the bolts (1) and (4) to remove cylinder head RH.
12) Remove the cylinder head gasket RH.

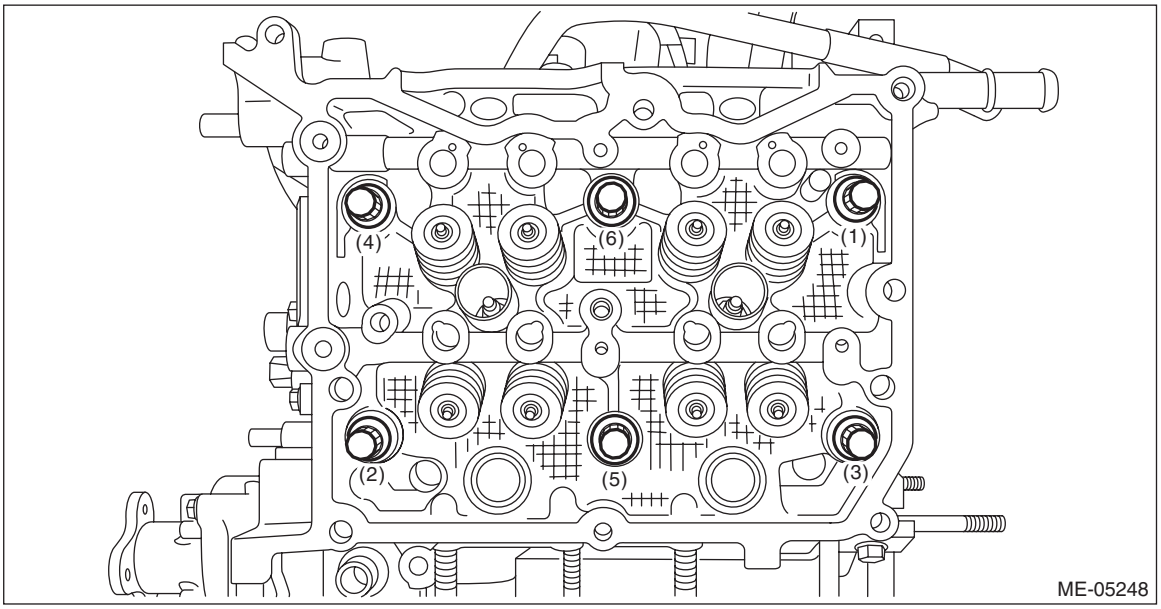
CAUTION:
Be careful not to scratch the mating surface of cylinder head and cylinder block.
13) Remove the liquid gasket from cylinder head RH and cam carrier RH.

2. CYLINDER HEAD LH

1) Remove the engine from the vehicle. <Ref. to ME(H4DO(w/o HEV))-55, REMOVAL, Engine Assembly.>
2) Remove the intake manifold. <Ref. to FU(H4DO(w/o HEV))-19, REMOVAL, Intake Manifold.> <Ref. to FU(H4DO(HEV))-19, REMOVAL, Intake Manifold.>

3) Remove the engine wiring harness. <Ref. to FU(H4DO(w/o HEV))-43, REMOVAL, Engine Wiring Harness.> <Ref. to FU(H4DO(HEV))-34, REMOVAL, Engine Wiring Harness.>
4) Remove the tumble generator valve assembly LH. <Ref. to FU(H4DO(w/o HEV))-85, REMOVAL, Tumble Generator Valve Assembly.> <Ref. to FU(H4DO(HEV))-73, REMOVAL, Tumble Generator Valve Assembly.>
5) Remove the chain cover. <Ref. to ME(H4DO(w/o HEV))-149, REMOVAL, Chain Cover.>
6) Remove the rocker cover LH. <Ref. to ME(H4DO(w/o HEV))-206, ROCKER COVER LH, REMOVAL, Rocker Cover.>
7) Remove the cam carrier LH. <Ref. to ME(H4DO(w/o HEV))-225, CAM CARRIER LH, REMOVAL, Cam Carrier.>
8) Remove the A/C compressor. <Ref. to AC-53, REMOVAL, Compressor.>
9) Loosen the bolts holding the cylinder head LH equally, a little at a time in numerical sequence as shown in the figure, and while leaving the cylinder head bolts (1) and (4) engaged by three or four threads, remove the other cylinder head bolts.

NOTE:
Leaving the cylinder head bolts (1) and (4) engaged by three or four threads prevents the cylinder head LH from falling.



10) While tapping the cylinder head LH with a plastic hammer, separate it from cylinder block LH.
11) Remove the cylinder head bolts (1) and (4) to remove cylinder head LH.
12) Remove the cylinder head gasket LH.

CAUTION:
Be careful not to scratch the mating surface of cylinder head and cylinder block.
13) Remove the liquid gasket from cylinder head LH and cam carrier LH.

B: INSTALLATION

1. CYLINDER HEAD RH

1) Clean the bolt holes in the cylinder block RH.

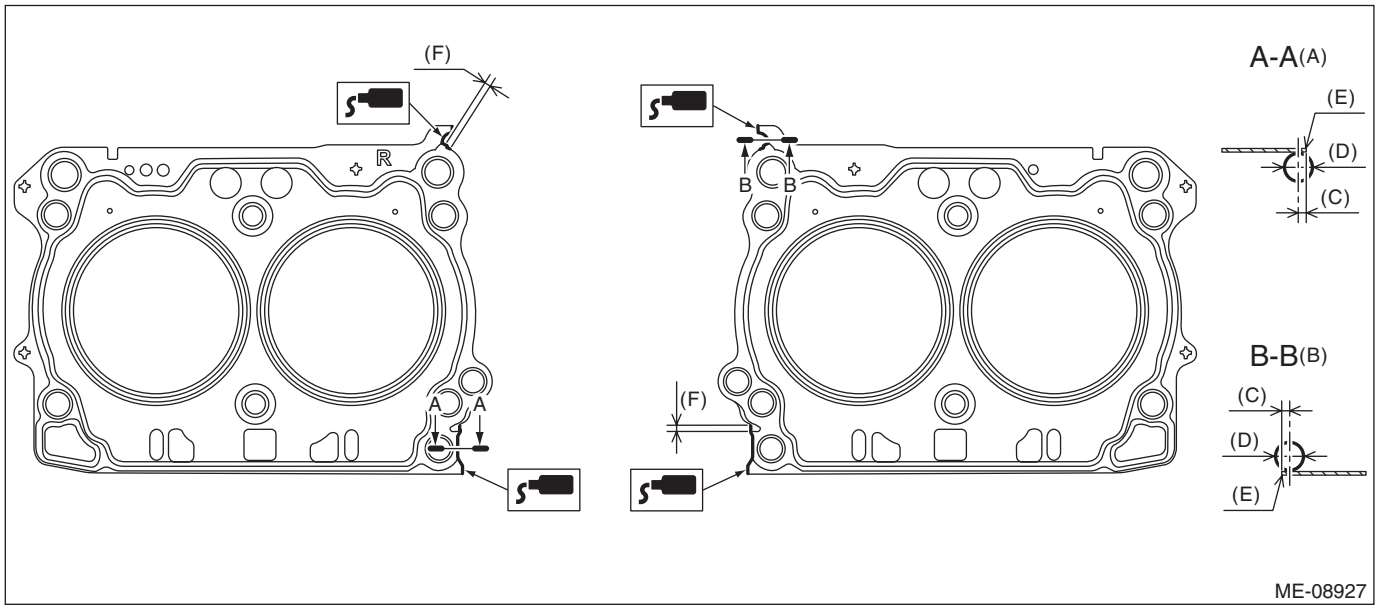
CAUTION:
To avoid erroneous tightening of the bolts, clean out the bolt holes sufficiently by blowing with compressed air to eliminate engine coolant etc.

2) Apply liquid gasket to both sides of the cylinder head gasket RH as shown in the figure.

NOTE:
- Use a new cylinder head gasket RH.
- Before applying liquid gasket, degrease the mating surface of cylinder blocks RH and cylinder head RH.
- Install within 5 min. after applying liquid gasket.

Liquid gasket:
THREE BOND 1217G (Part No. 0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:
3±1 mm (0.1181±0.0394 in)



(A)	Liquid gasket applying position to the cylinder head side	(C)	1 mm (0.0394 in) or less	(E)	Cylinder head gasket edge
(B)	Liquid gasket applying position to the cylinder block side	(D)	ϕ3±1 mm (0.1181±0.0394 in)	(F)	Overlap of bead end and liquid gasket: 3 — 10 mm (0.1181 — 0.3937 in)

3) Attach the cylinder head gasket RH.

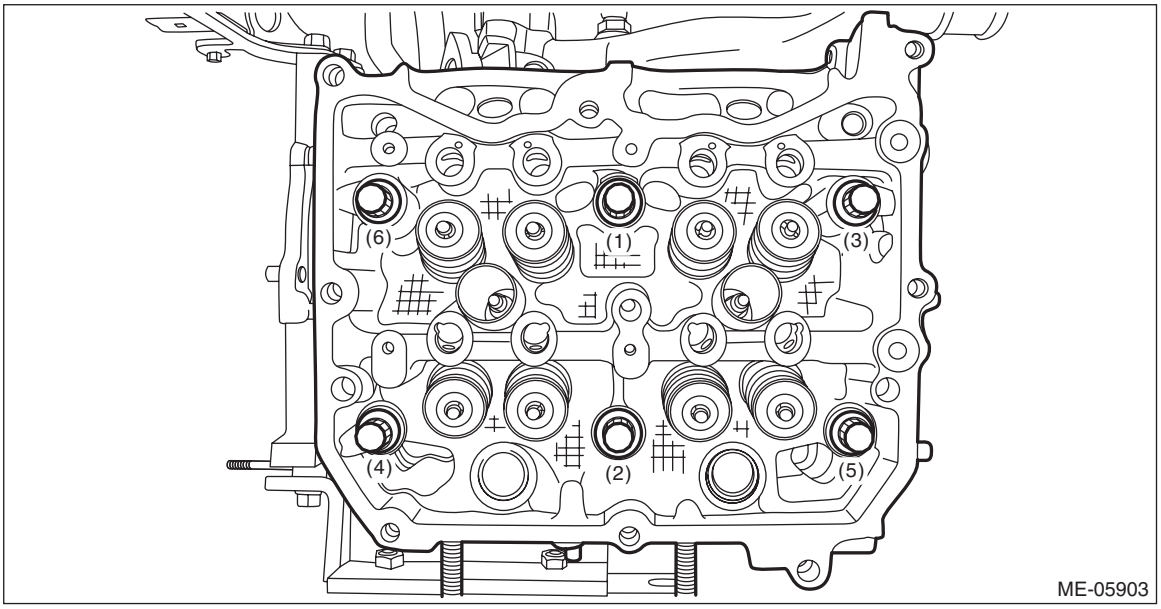
NOTE:
Check that liquid gasket RH is squeezed out from the cylinder head gasket.

4) Install the cylinder head RH to the cylinder block RH.

CAUTION:
Be careful not to scratch the mating surface of cylinder head RH and cylinder block RH.

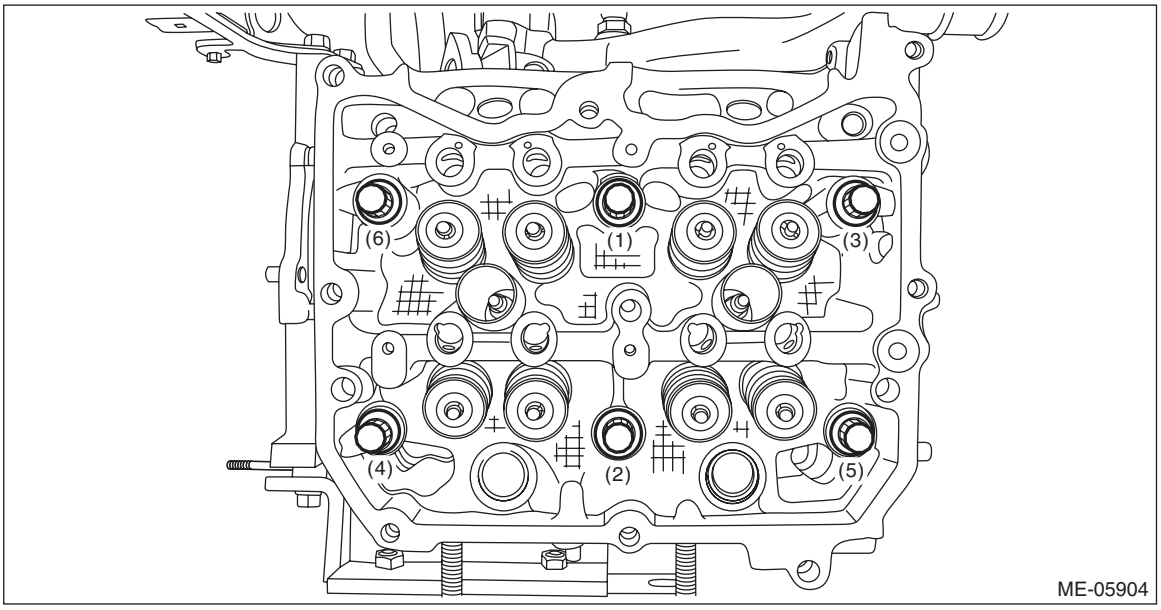
(1) Clean the cylinder head bolt threads and apply sufficient engine oil to the washer and cylinder head bolts threads.

(2) Mount the cylinder head RH onto the cylinder block RH, and tighten all bolts with a torque of 29 N·m (3.0 kgf-m, 21.4 ft-lb) in numerical order as shown in the figure.

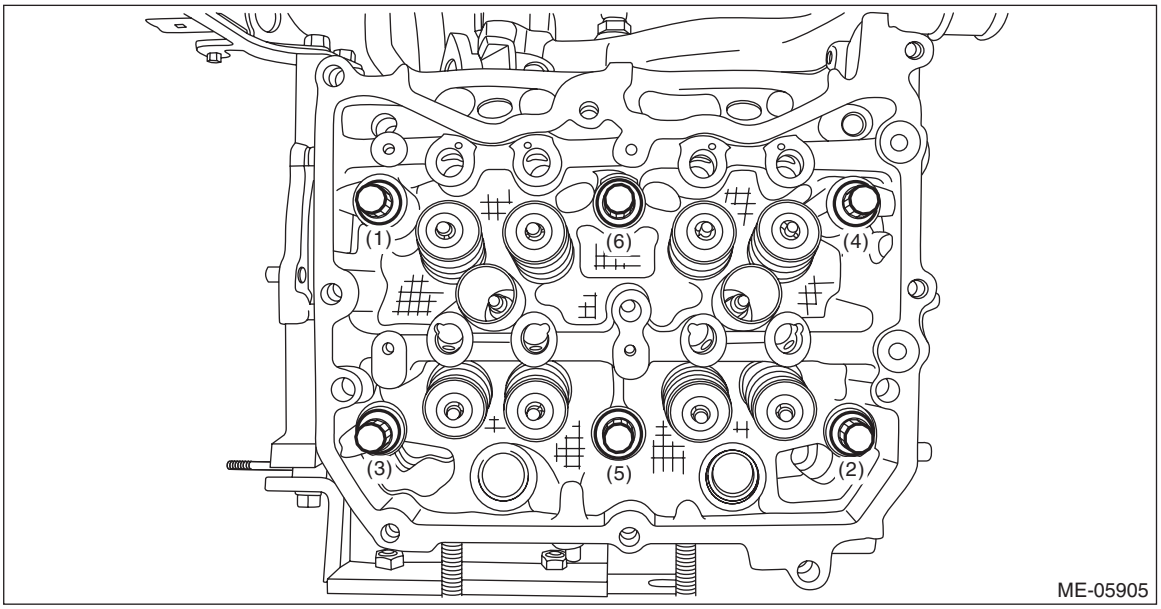


(3) Tighten all cylinder head bolts further with a torque of 100 N·m (10.2 kgf-m, 73.8 ft-lb) in numerical order as shown in the figure.

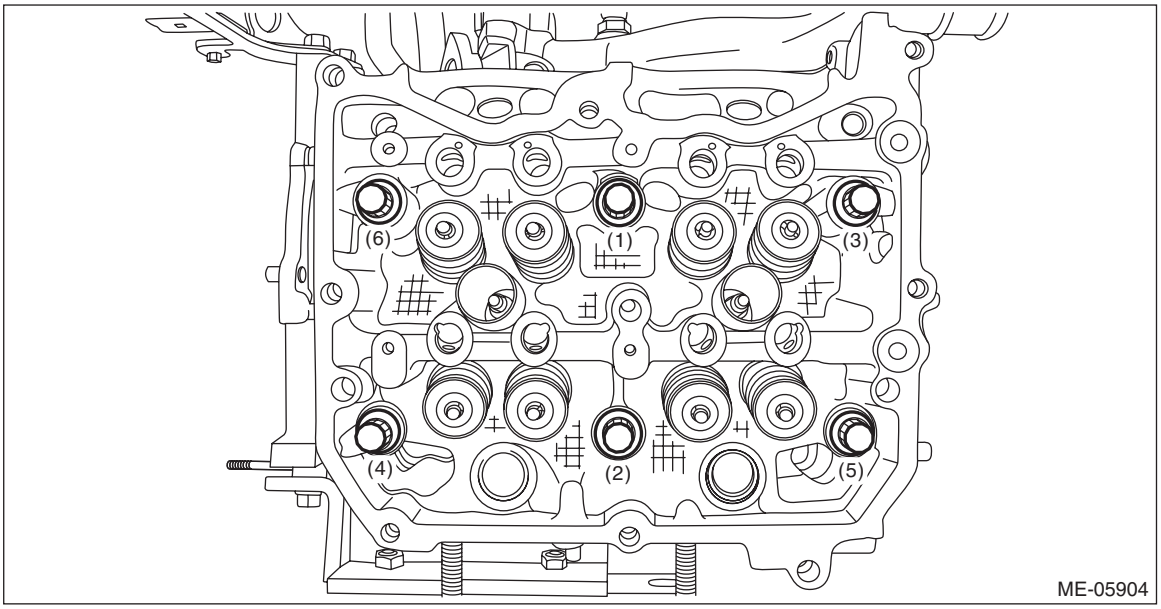
CAUTION:
If the bolt makes stick-slip sound during tightening, repeat the procedure from step 1). In that case, the cylinder head gasket RH can be reused. But it is necessary to remove liquid gasket completely from cylinder block RH, cylinder head RH and cylinder head gasket RH and re-apply to them.



(4) Loosen all cylinder head bolts 180° in numerical order as shown in the figure, and then loosen all cylinder head bolts 180° further in numerical order as shown in the figure.



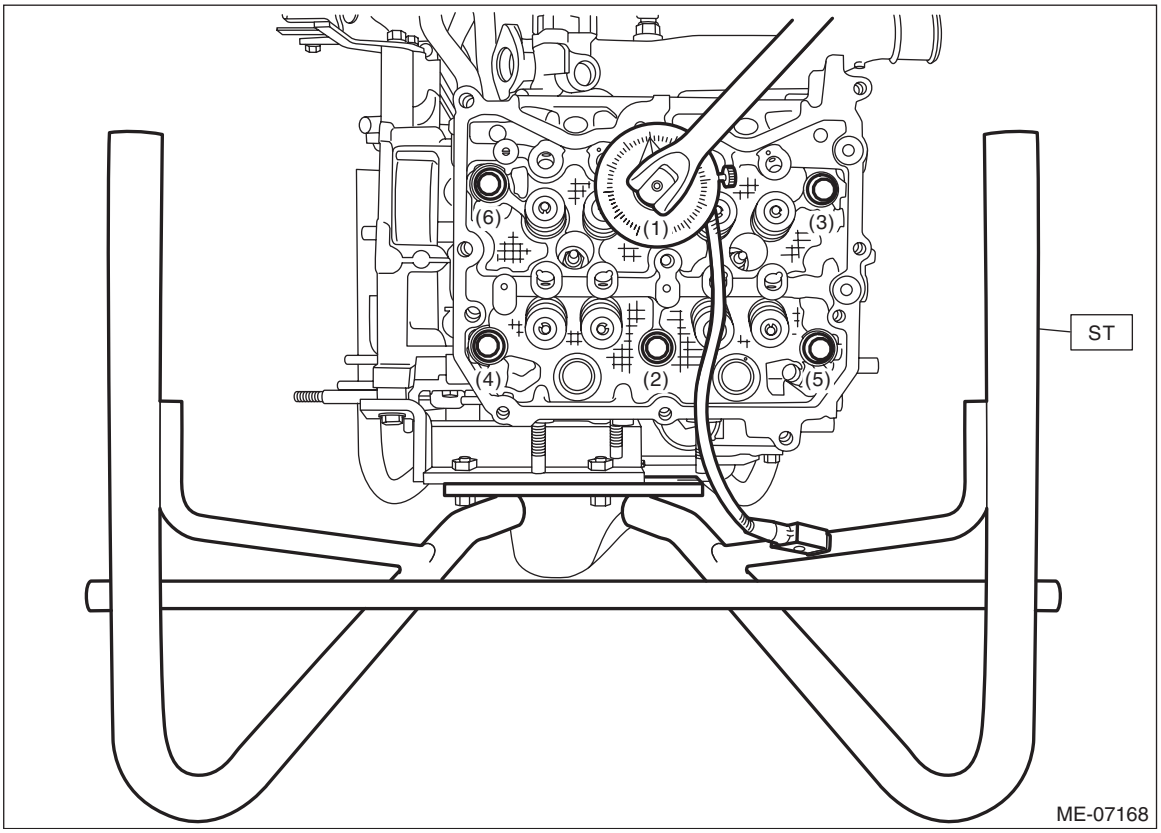
(5) Tighten all cylinder head bolts with a torque of 42 N·m (4.3 kgf-m, 31.0 ft-lb) in numerical order as shown in the figure.



(6) Using angle gauge, tighten all cylinder head bolts with specified angle in numerical order as shown in the figure.

ST 499817100 ENGINE STAND

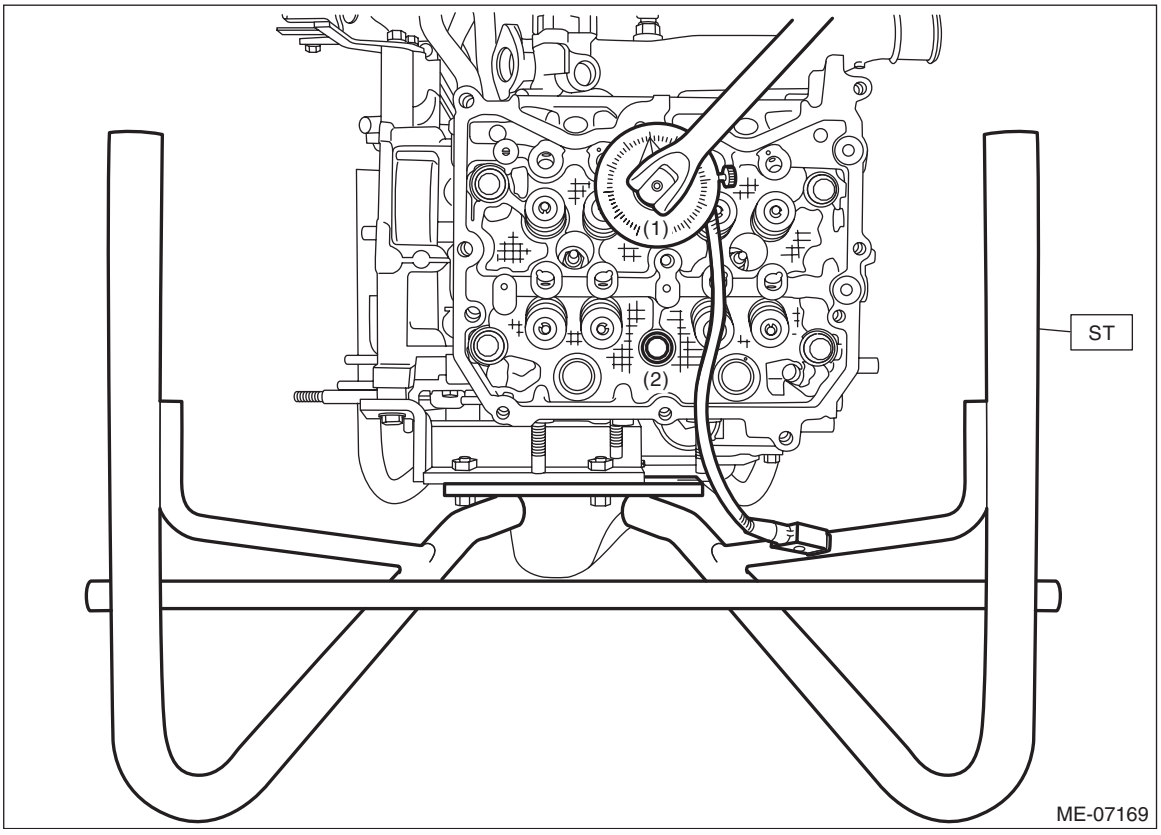
Tightening angle:
80°±2°



(7) Using angle gauge, tighten the cylinder head bolts (2 places) with specified angle in numerical order as shown in the figure.

ST 499817100 ENGINE STAND

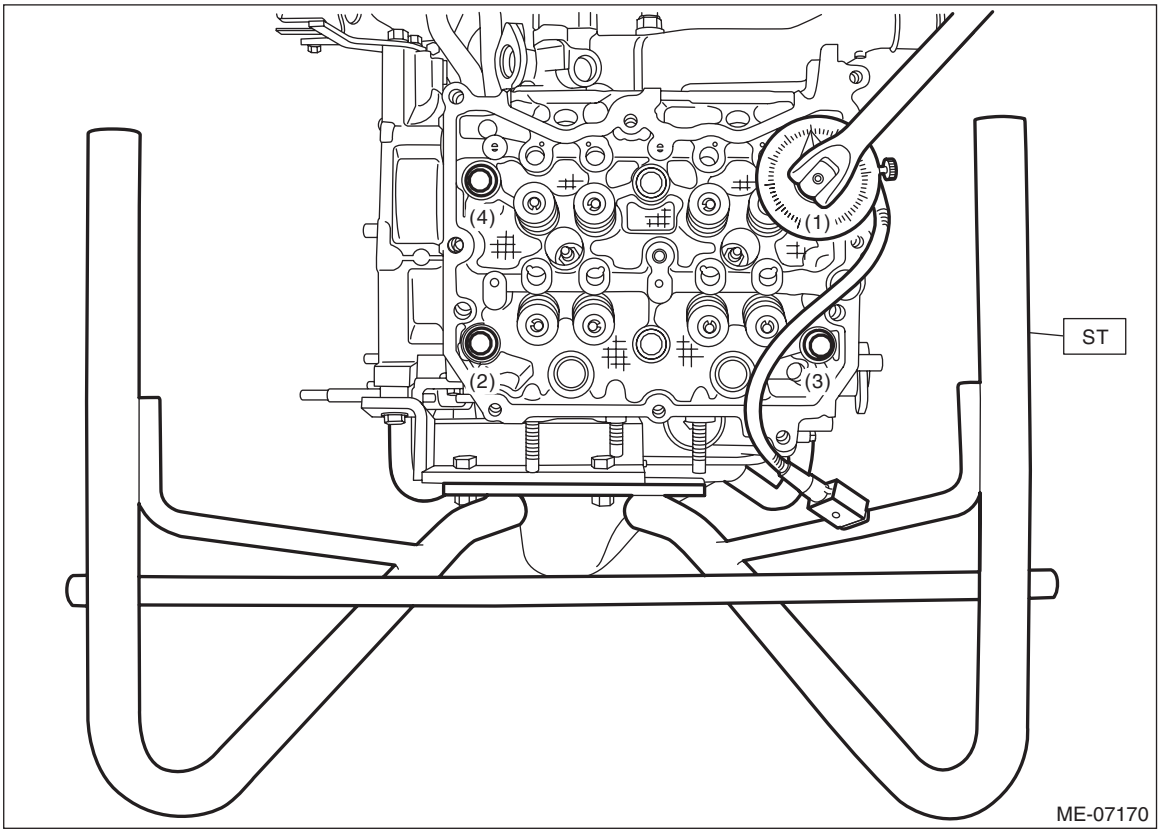
Tightening angle:
75°±2°



(8) Using angle gauge, tighten the cylinder head bolts (4 places) with specified angle in numerical order as shown in the figure.

NOTE:
After tightening, if the liquid gasket is squeezed out onto the seal surface of the chain cover, completely remove any squeezed-out liquid gasket.
ST 499817100 ENGINE STAND

Tightening angle:
30°±2°



5) Install the EGR cooler. <Ref. to EC(H4DO(w/o HEV))-36, INSTALLATION, EGR Cooler.> <Ref. to EC(H4DO(HEV))-33, INSTALLATION, EGR Cooler.>
6) Install the cam carrier RH. <Ref. to ME(H4DO(w/o HEV))-230, CAM CARRIER RH, INSTALLATION, Cam Carrier.>
7) Install the rocker cover RH. <Ref. to ME(H4DO(w/o HEV))-210, ROCKER COVER RH, INSTALLATION, Rocker Cover.>
8) Install the chain cover. <Ref. to ME(H4DO(w/o HEV))-156, INSTALLATION, Chain Cover.>
9) Install the tumble generator valve assembly RH. <Ref. to FU(H4DO(w/o HEV))-86, INSTALLATION, Tumble Generator Valve Assembly.> <Ref. to FU(H4DO(HEV))-74, INSTALLATION, Tumble Generator Valve Assembly.>
10) Install the engine wiring harness. <Ref. to FU(H4DO(w/o HEV))-47, INSTALLATION, Engine Wiring Harness.> <Ref. to FU(H4DO(HEV))-38, INSTALLATION, Engine Wiring Harness.>
11) Install the intake manifold. <Ref. to FU(H4DO(w/o HEV))-29, INSTALLATION, Intake Manifold.> <Ref. to FU(H4DO(HEV))-25, INSTALLATION, Intake Manifold.>
12) Install the engine to the vehicle. <Ref. to ME(H4DO(w/o HEV))-88, INSTALLATION, Engine Assembly.>

2. CYLINDER HEAD LH

1) Clean the bolt holes in the cylinder block LH.

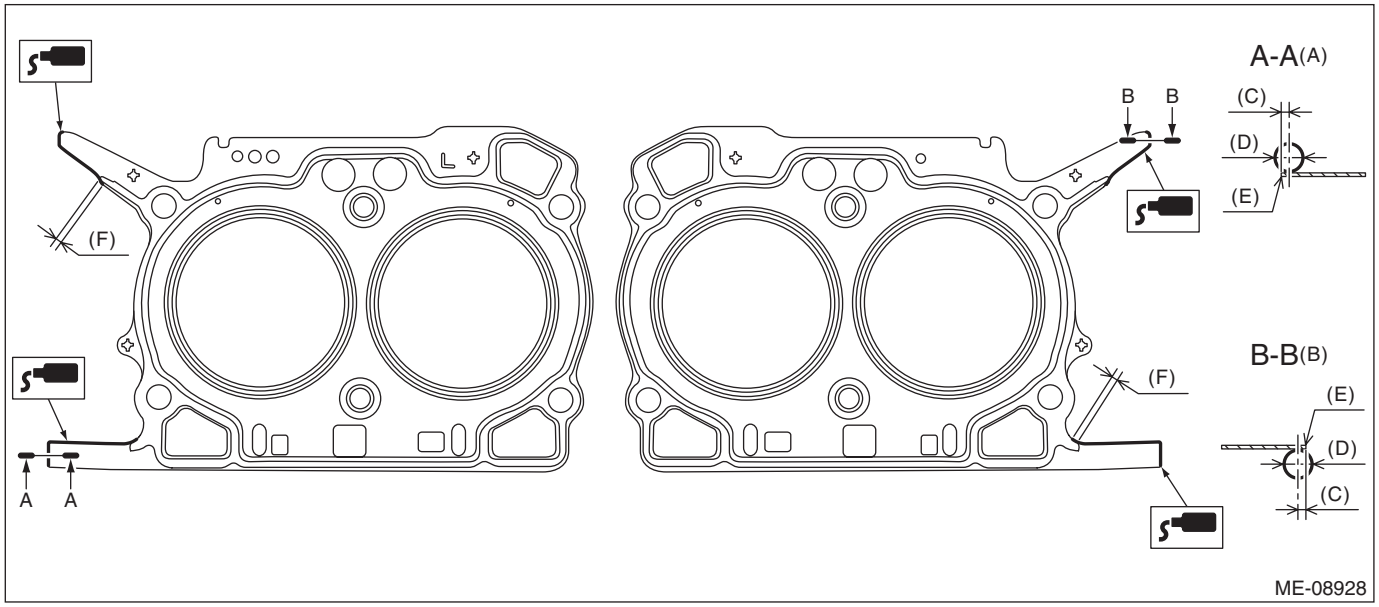
CAUTION:
To avoid erroneous tightening of the bolts, clean out the bolt holes sufficiently by blowing with compressed air to eliminate engine coolant etc.

2) Apply liquid gasket to both sides of the cylinder head gasket LH as shown in the figure.

NOTE:
- Use a new cylinder head gasket LH.
- Before applying liquid gasket, degrease the mating surface of cylinder blocks LH and cylinder head LH.
- Install within 5 min. after applying liquid gasket.

Liquid gasket:
THREE BOND 1217G (Part No. 0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:
3±1 mm (0.1181±0.0394 in)



(A)	Liquid gasket applying position to the cylinder head side	(C)	1 mm (0.0394 in) or less	(E)	Cylinder head gasket edge
(B)	Liquid gasket applying position to the cylinder block side	(D)	ϕ3±1 mm (0.1181±0.0394 in)	(F)	Overlap of bead end and liquid gasket: 3 — 10 mm (0.1181 — 0.3937 in)

3) Attach the cylinder head gasket LH.

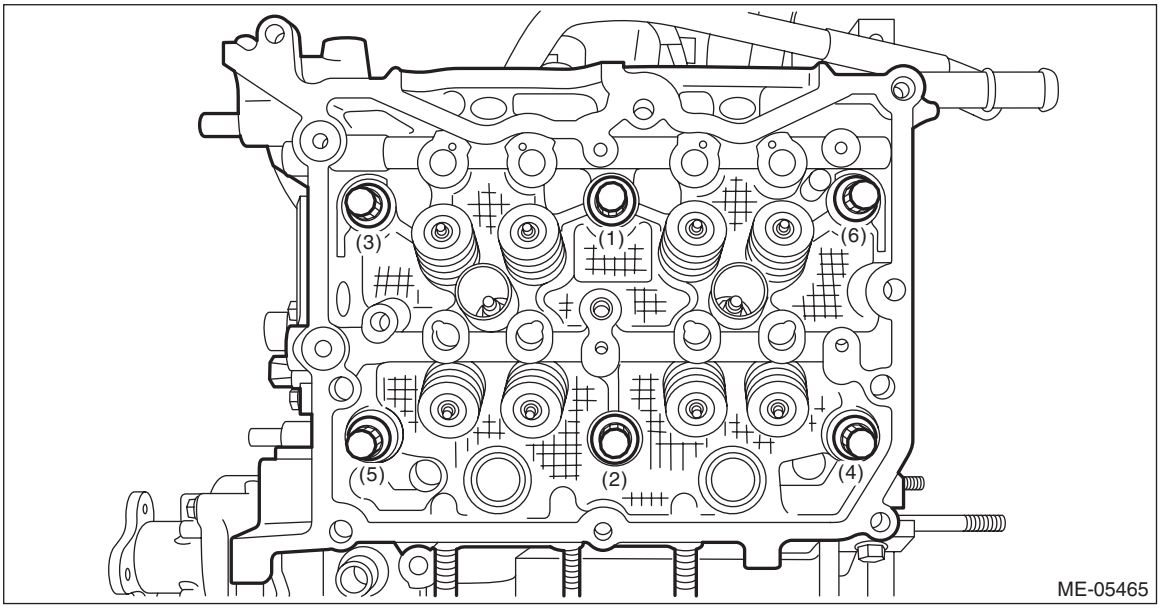
NOTE:
Check that liquid gasket is squeezed out from the cylinder head gasket LH.

4) Install the cylinder head LH to the cylinder block LH.

CAUTION:
Be careful not to scratch the mating surface of cylinder head LH and cylinder block LH.

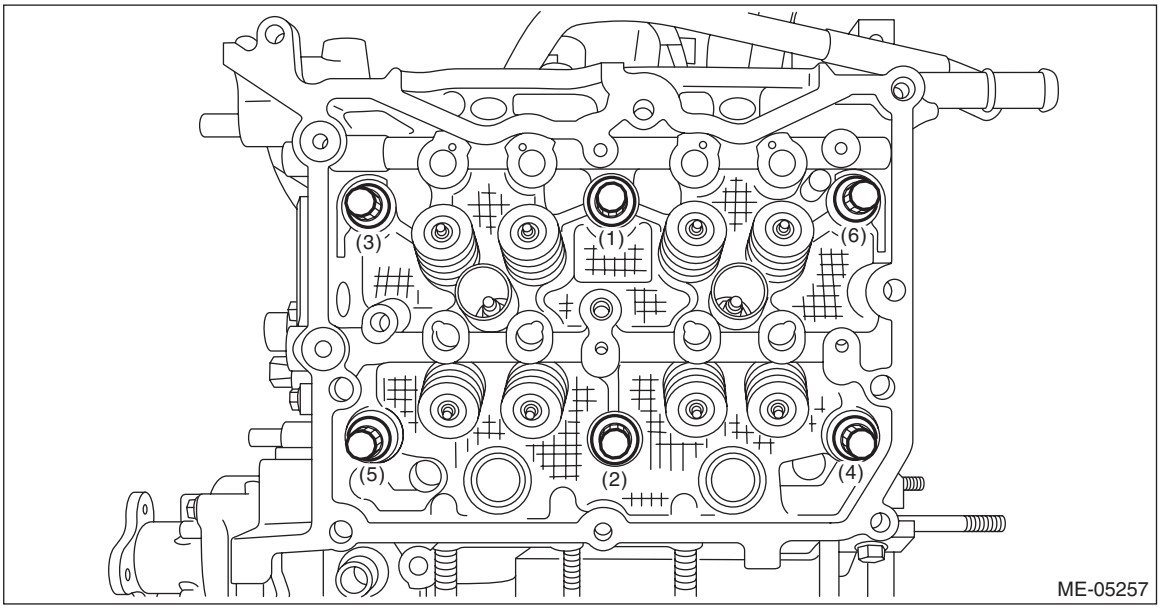
(1) Clean the cylinder head bolt threads and apply sufficient engine oil to the washer and cylinder head bolts threads.

(2) Mount the cylinder head LH onto the cylinder block LH, then tighten all bolts with a torque of 29 N·m (3.0 kgf-m, 21.4 ft-lb) in numerical order as shown in the figure.

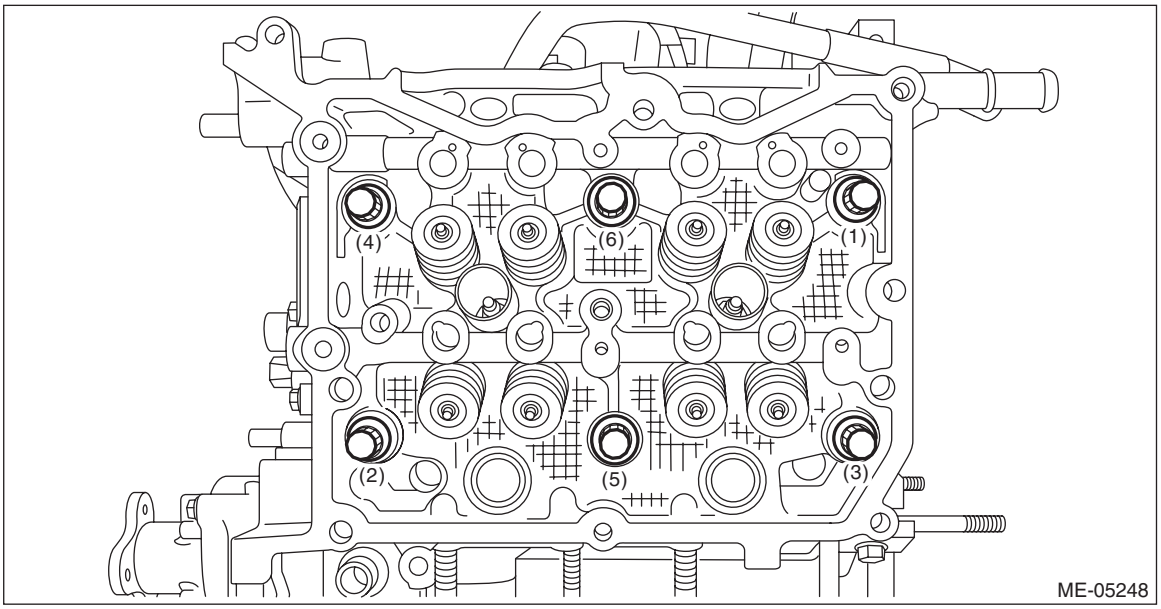


(3) Tighten all cylinder head bolts further with a torque of 100 N·m (10.2 kgf-m, 73.8 ft-lb) in numerical order as shown in the figure.

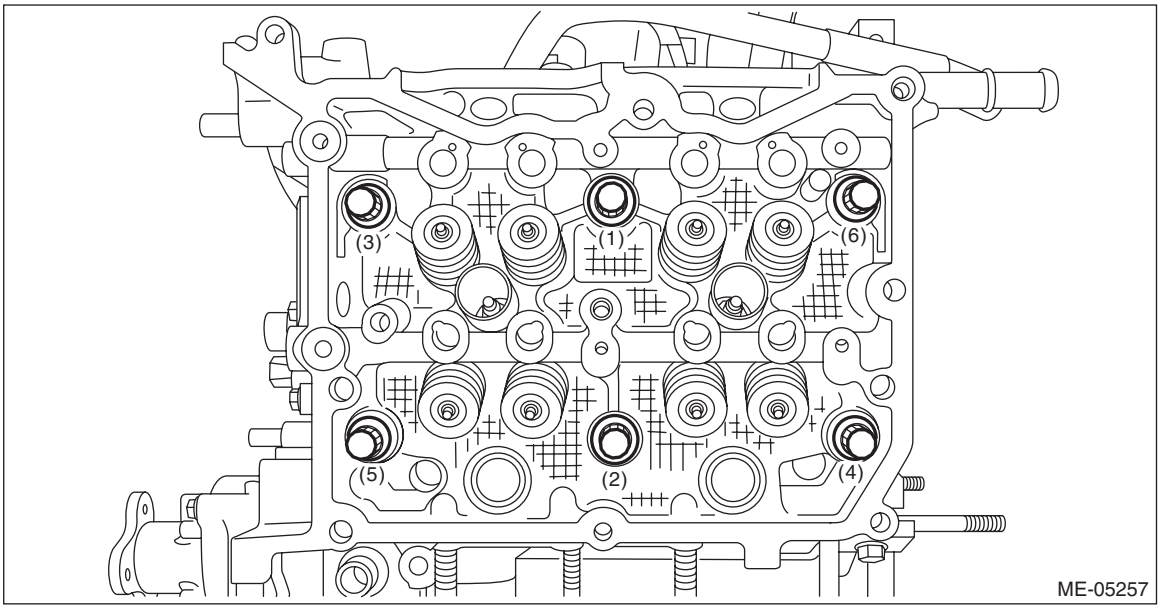
CAUTION:
If the bolt makes stick-slip sound during tightening, repeat the procedure from step 1). In that case, the cylinder head gasket LH can be reused. But it is necessary to remove liquid gasket completely from cylinder block LH, cylinder head LH and cylinder head gasket LH and re-apply to them.



(4) Loosen all cylinder head bolts 180° in numerical order as shown in the figure, and then loosen all cylinder head bolts 180° further in numerical order as shown in the figure.



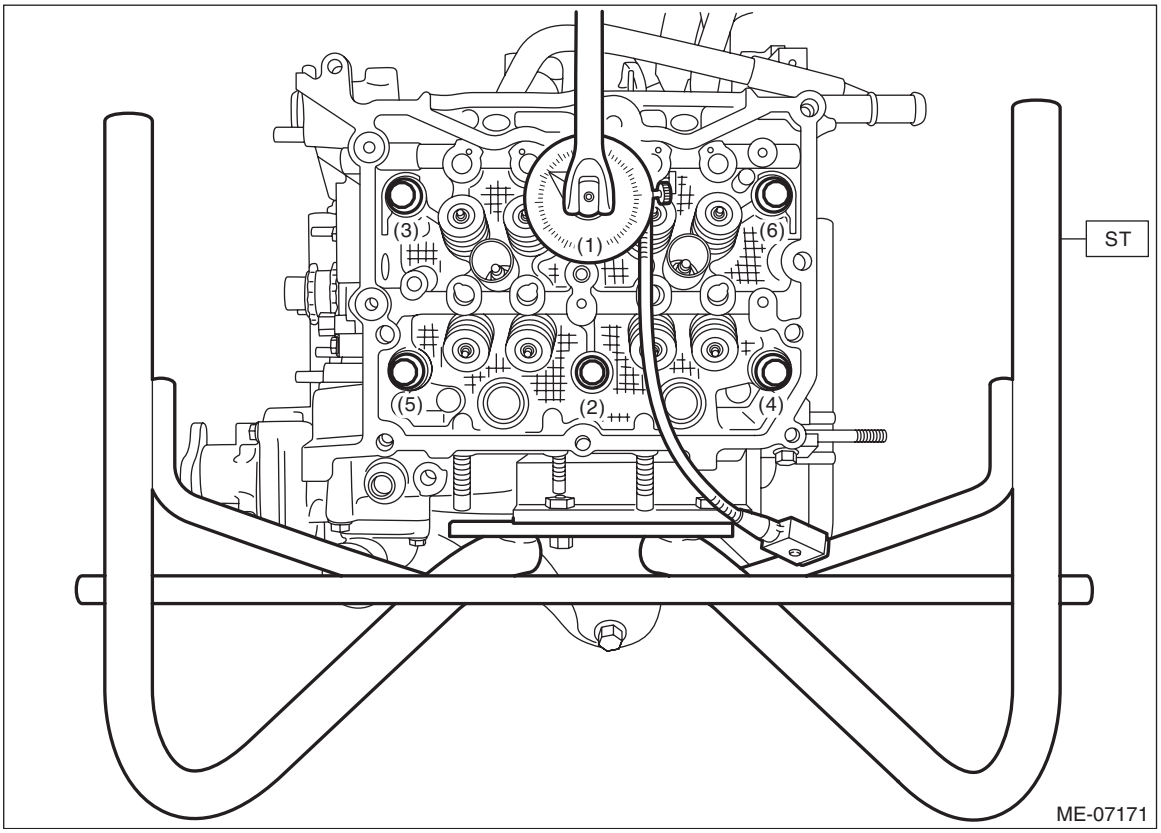
(5) Tighten all cylinder head bolts with a torque of 42 N·m (4.3 kgf-m, 31.0 ft-lb) in numerical order as shown in the figure.



(6) Using angle gauge, tighten all cylinder head bolts with specified angle in numerical order as shown in the figure.

ST 499817100 ENGINE STAND

Tightening angle:
80°±2°

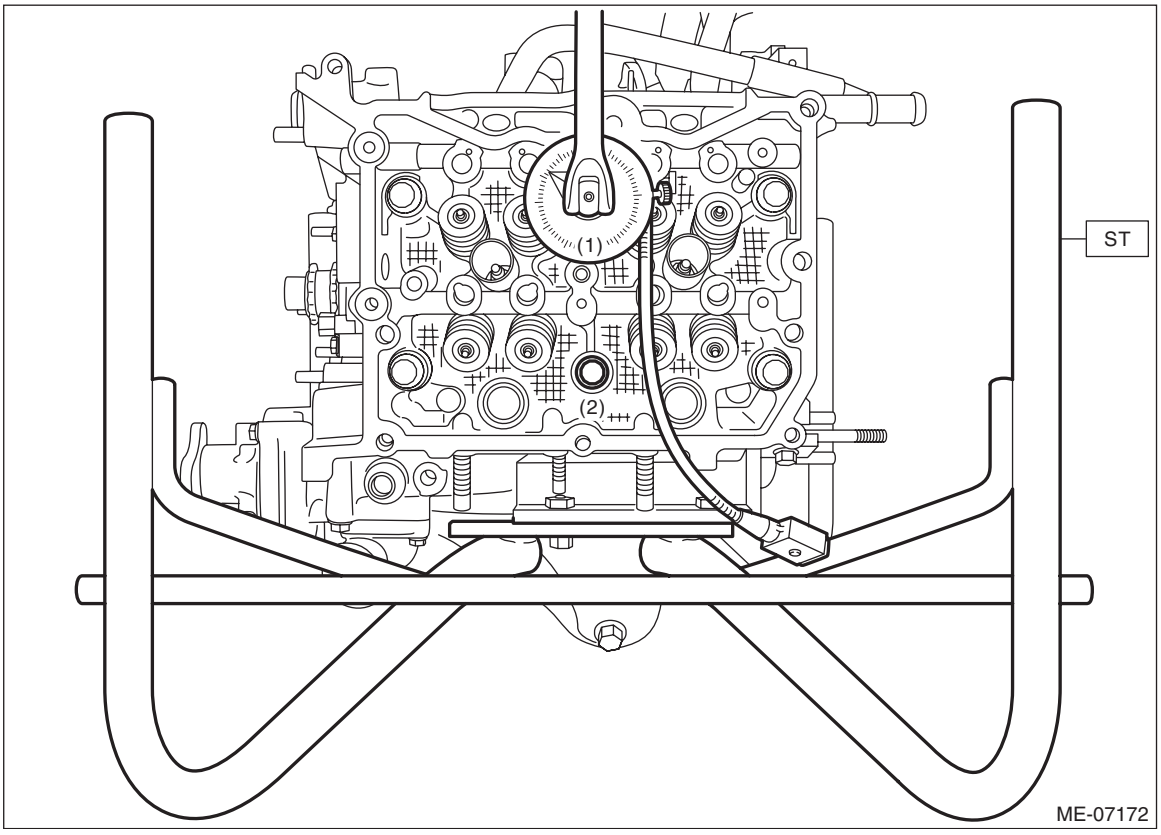


(7) Using angle gauge, tighten the cylinder head bolts (2 places) with specified angle in numerical order as shown in the figure.

ST 499817100 ENGINE STAND

Tightening angle:

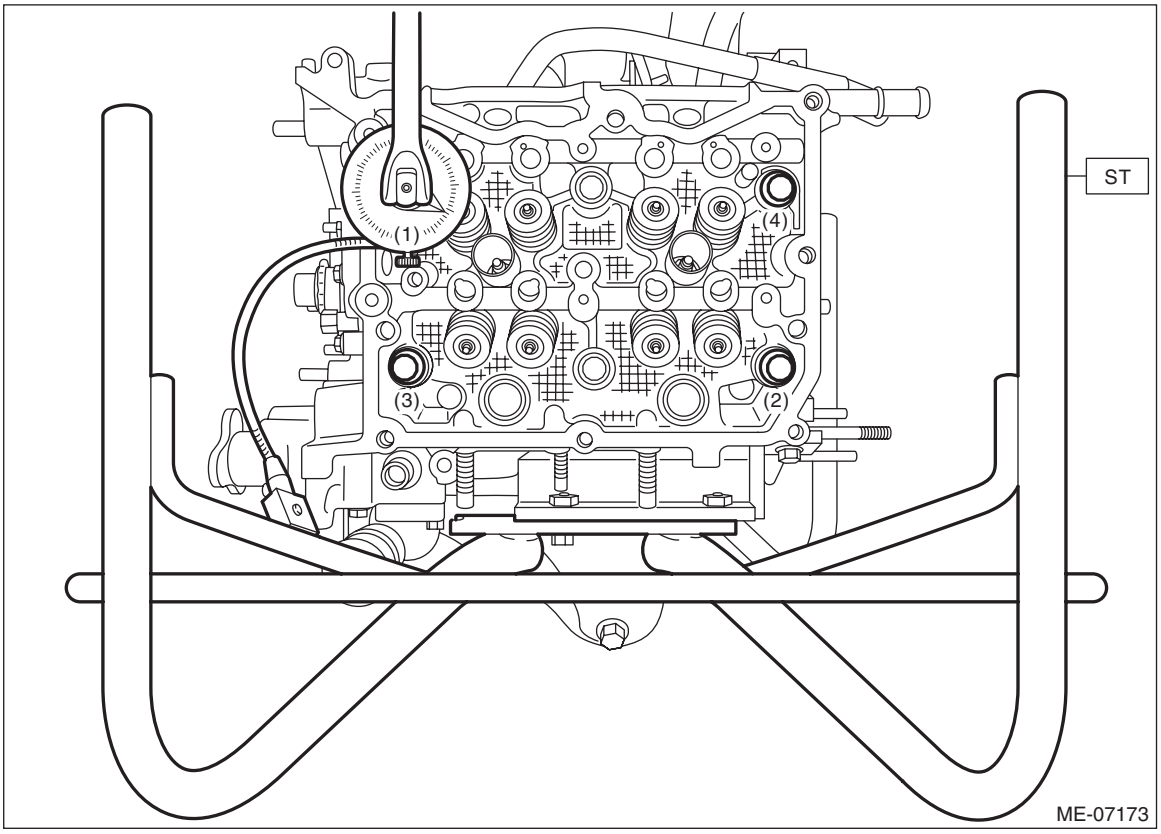
75°±2°



(8) Using angle gauge, tighten the cylinder head bolts (4 places) with specified angle in numerical order as shown in the figure.

NOTE:
After tightening, if the liquid gasket is squeezed out onto the seal surface of the chain cover, completely remove any squeezed-out liquid gasket.
ST 499817100 ENGINE STAND

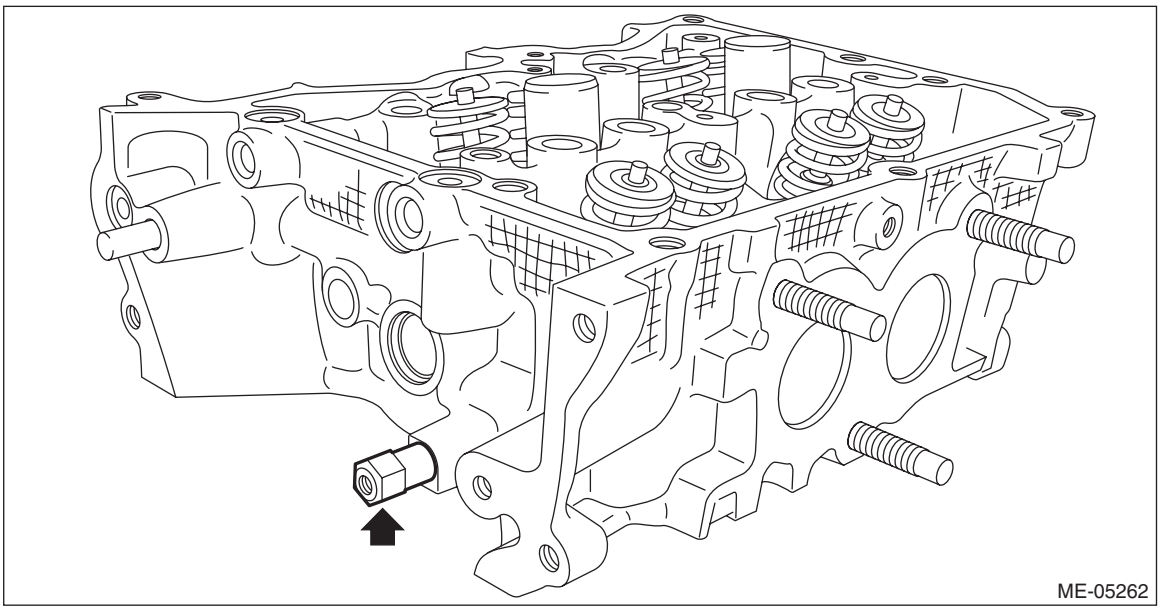
Tightening angle:
30°±2°



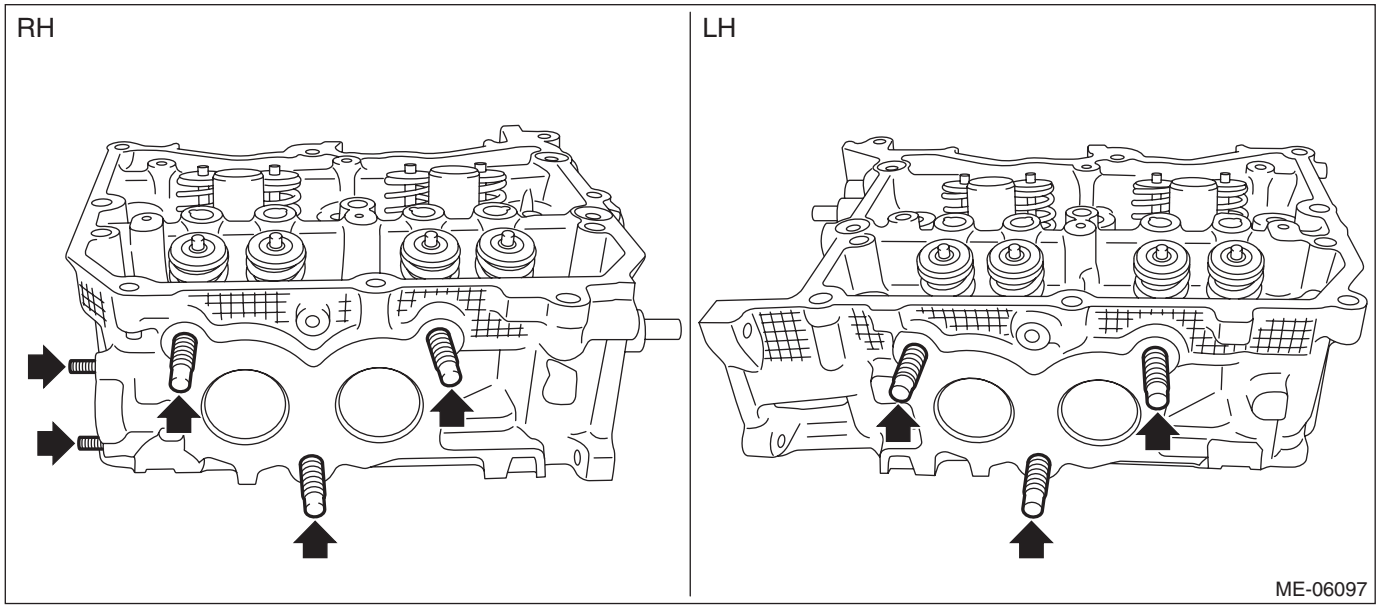
5) Install the A/C compressor. <Ref. to AC-56, INSTALLATION, Compressor.>
6) Install the cam carrier LH. <Ref. to ME(H4DO(w/o HEV))-240, CAM CARRIER LH, INSTALLATION, Cam Carrier.>
7) Install the rocker cover LH. <Ref. to ME(H4DO(w/o HEV))-214, ROCKER COVER LH, INSTALLATION, Rocker Cover.>
8) Install the chain cover. <Ref. to ME(H4DO(w/o HEV))-156, INSTALLATION, Chain Cover.>
9) Install the tumble generator valve assembly LH. <Ref. to FU(H4DO(w/o HEV))-86, INSTALLATION, Tumble Generator Valve Assembly.> <Ref. to FU(H4DO(HEV))-74, INSTALLATION, Tumble Generator Valve Assembly.>
10) Install the engine wiring harness. <Ref. to FU(H4DO(w/o HEV))-47, INSTALLATION, Engine Wiring Harness.> <Ref. to FU(H4DO(HEV))-38, INSTALLATION, Engine Wiring Harness.>
11) Install the intake manifold. <Ref. to FU(H4DO(w/o HEV))-29, INSTALLATION, Intake Manifold.> <Ref. to FU(H4DO(HEV))-25, INSTALLATION, Intake Manifold.>
12) Install the engine to the vehicle. <Ref. to ME(H4DO(w/o HEV))-88, INSTALLATION, Engine Assembly.>

C: DISASSEMBLY

1) Remove the chain cover securing bolt from the cylinder head LH.



2) Remove the stud bolts from the cylinder head.



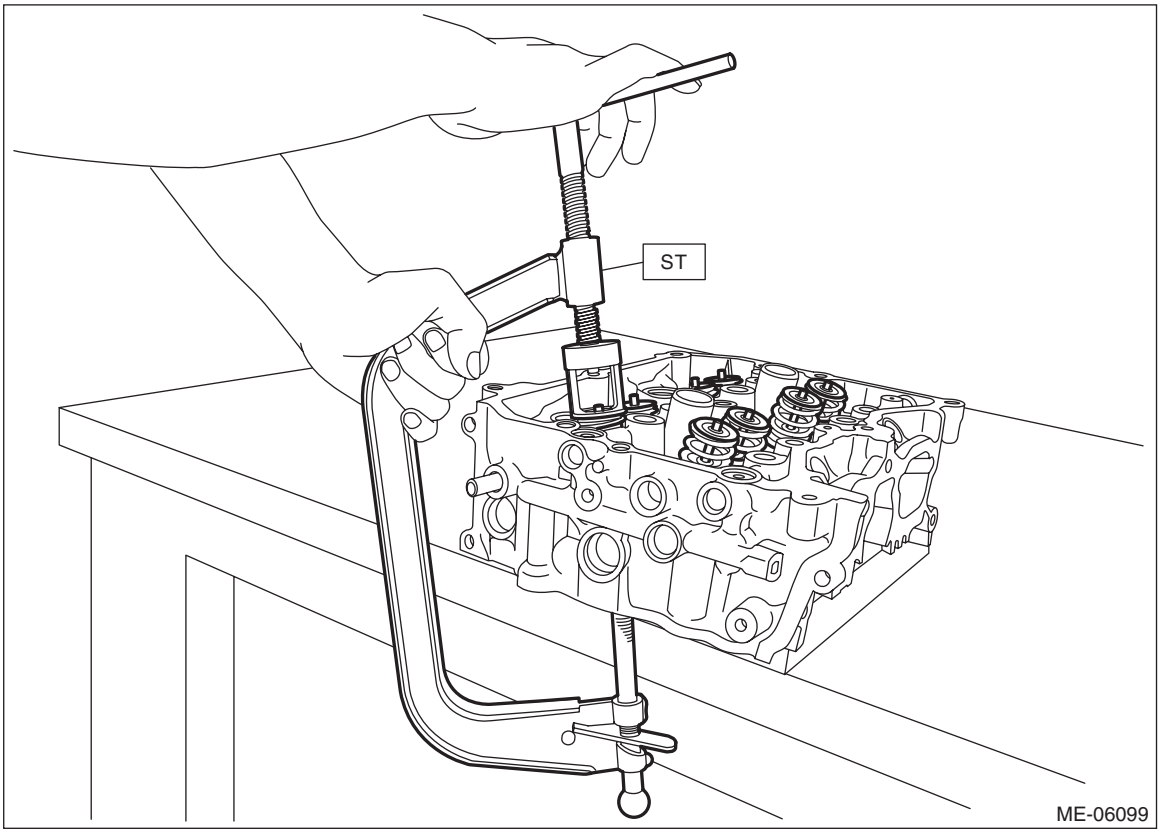
3) Remove the valve collet, valve, valve spring retainer, valve spring and valve spring seat from the cylinder head RH.

CAUTION:
During work, place a waste cloth, etc. to avoid scratching the mating surface of the cylinder head RH.

NOTE:
- Mark each part to prevent confusion.
- Keep all the removed parts in order for re-installing in their original positions.

(1) Compress the valve spring and remove the valve collet using ST.

ST 0920287002000 REMOVER AND REPLACER



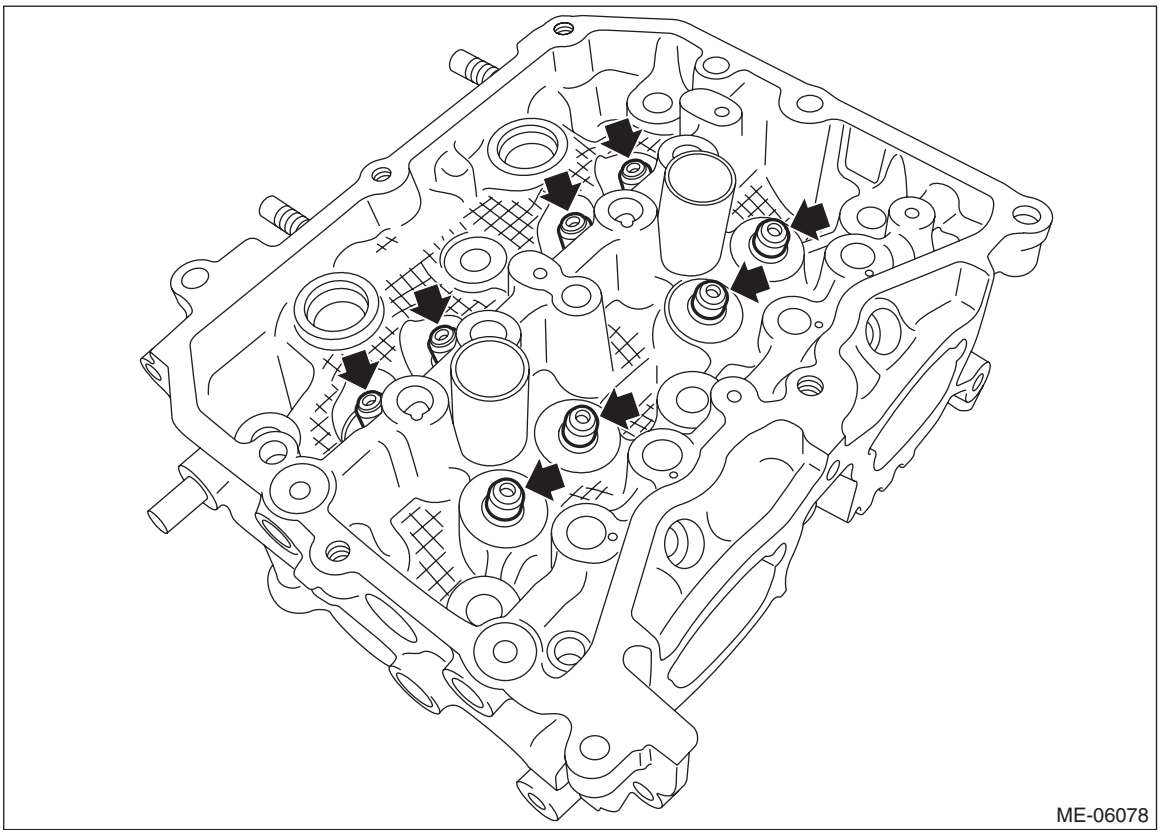
(2) Remove valve, valve spring retainer, valve spring and valve spring seat.

4) Remove the valve collet, valve, valve spring retainer, valve spring and valve spring seat from the cylinder head LH.

5) Remove the valve oil seals from valve guides of cylinder head RH.

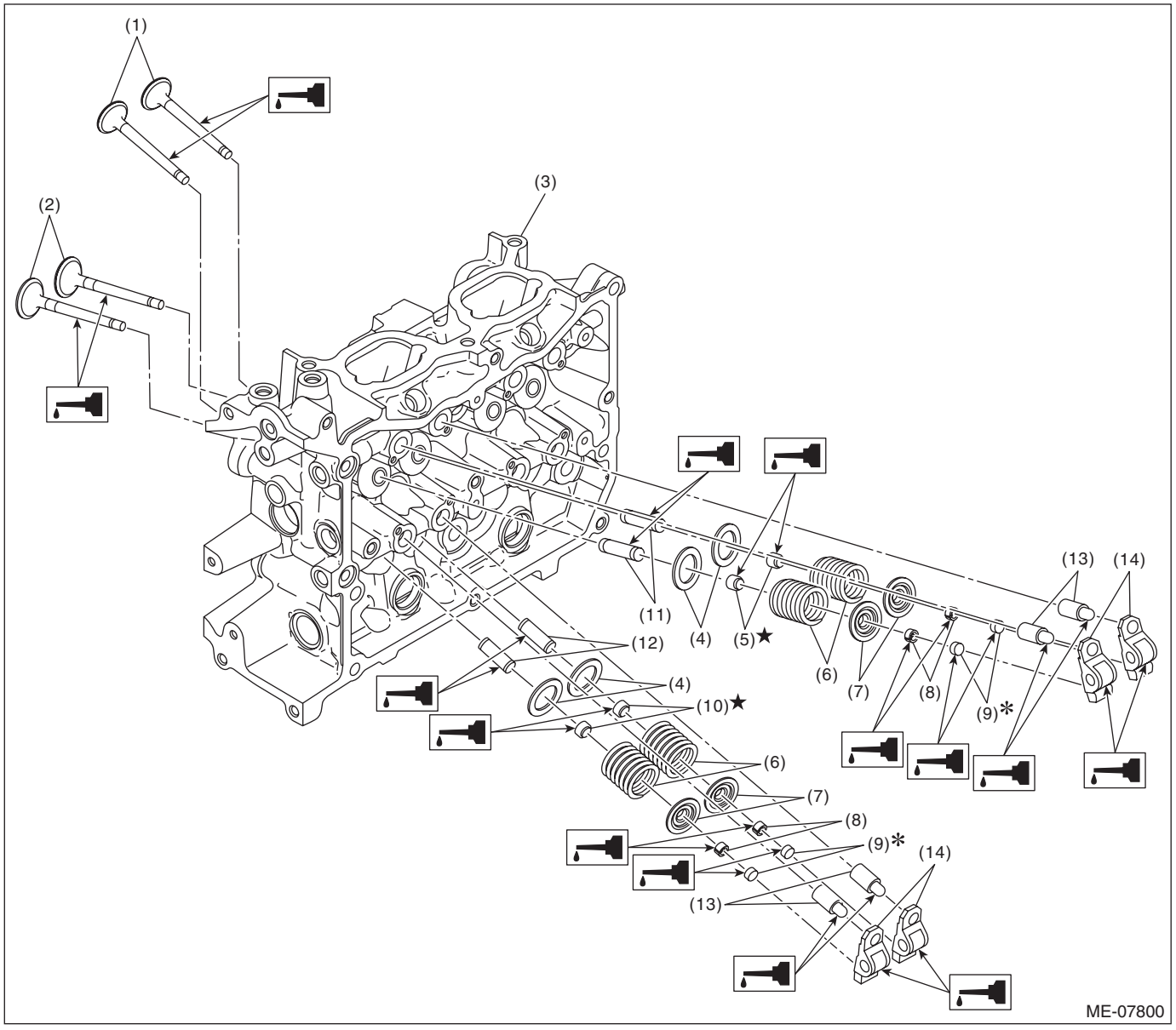
CAUTION:
• During work, place a waste cloth, etc. to avoid scratching the mating surface of the cylinder head RH.
• Use special care not to damage the cylinder head RH and guide during work.

NOTE:
For removal of valve guide, refer to INSPECTION. <Ref. to ME(H4DO(w/o HEV))-285, VALVE & VALVE GUIDE, INSPECTION, Cylinder Head.>



6) For cylinder head LH, remove the valve oil seal in the same manner.

D: ASSEMBLY



(1) Exhaust valve
(2) Intake valve
(3) Cylinder head
(4) Valve spring seat
(5) Intake valve oil seal
(6) Valve spring
(7) Valve spring retainer
(8) Valve collet
(9) Valve shim
(10) Exhaust valve oil seal
(11) Intake valve guide
(12) Exhaust valve guide
(13) Roller rocker arm pivot
(14) Roller rocker arm

1) Using the ST, install the valve oil seals to valve guides of cylinder head RH.

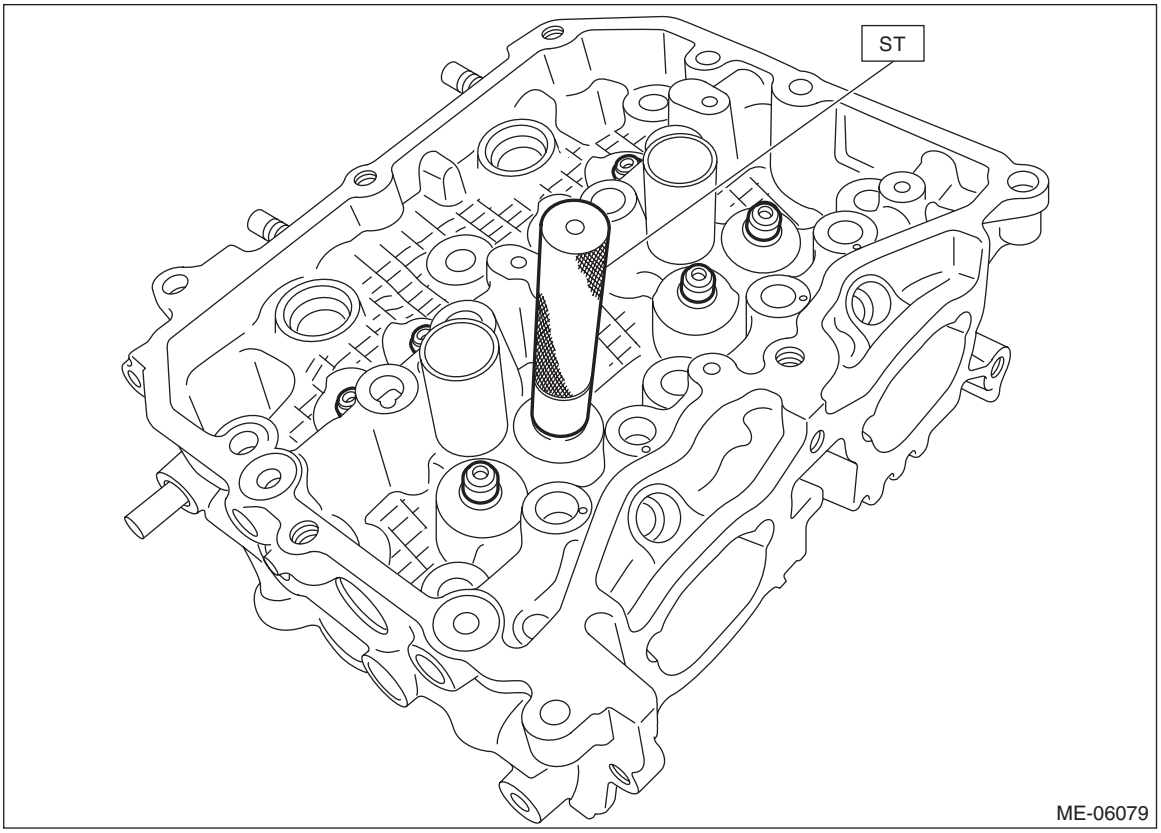
CAUTION:
• During work, place a waste cloth, etc. to avoid scratching the mating surface of the cylinder head RH.
• Use special care not to damage the cylinder head RH and guide during work.
• When installing the valve oil seal, press the ST with hands to install it and never drive the ST with a plastic hammer, otherwise the valve oil seal can be damaged.

NOTE:
- Use a new valve oil seal.
- Apply engine oil to valve oil seal before installing.
- The intake valve oil seals and exhaust valve oil seals are distinguished by their colors.

Identification colors:
Intake [Gray]
Exhaust [Green]

- For installation of valve guide, refer to INSPECTION. <Ref. to ME(H4DO(w/o HEV))-285, VALVE & VALVE GUIDE, INSPECTION, Cylinder Head.>

ST 18261AA010 VALVE OIL SEAL GUIDE



2) For cylinder head LH, install the valve oil seal in the same manner.
3) Install the valve spring seat, valve spring, valve spring retainer, valve and valve collet to the cylinder head RH.

CAUTION:
During work, place a waste cloth, etc. to avoid scratching the mating surface of the cylinder head RH.

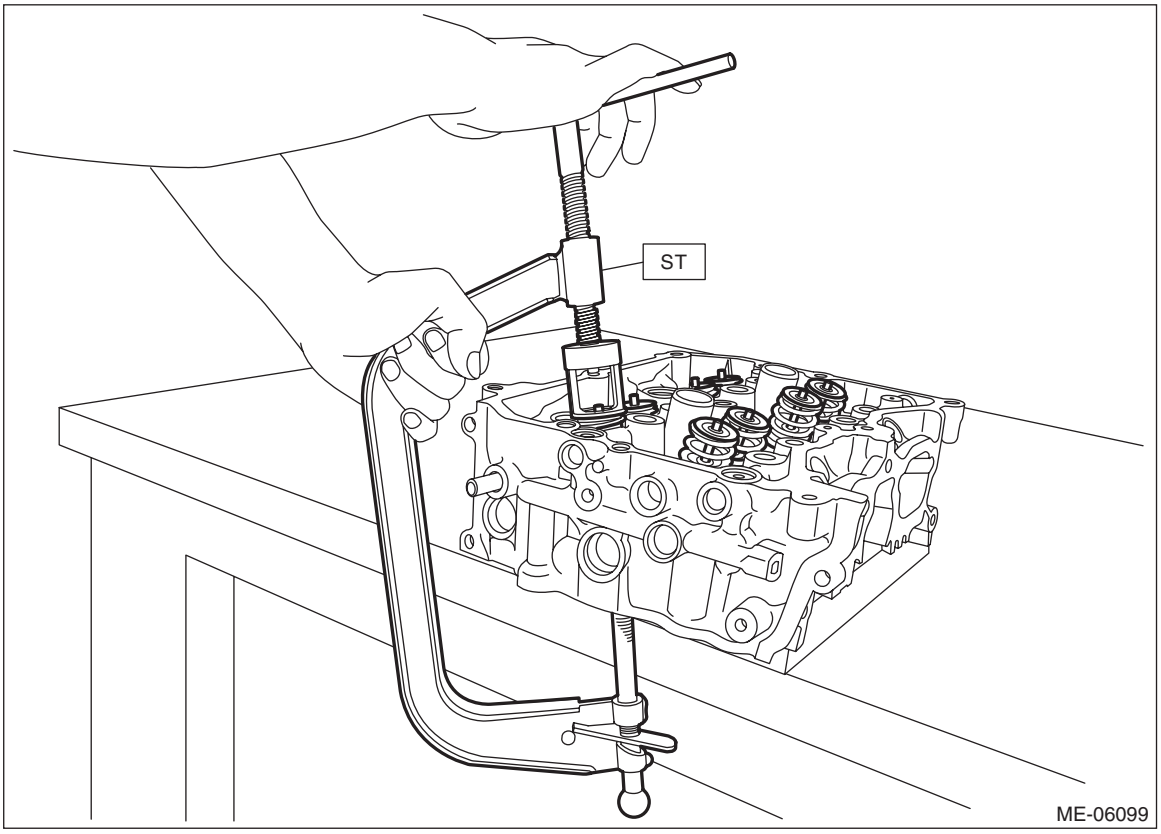
(1) Set the valve spring seat, valve spring and valve spring retainer onto the cylinder head RH.

NOTE:
Be sure to install the valve spring with its close-coiled end facing the cylinder head side.

(2) Coat the valve stem of each valve with engine oil and insert the valve into valve guide.

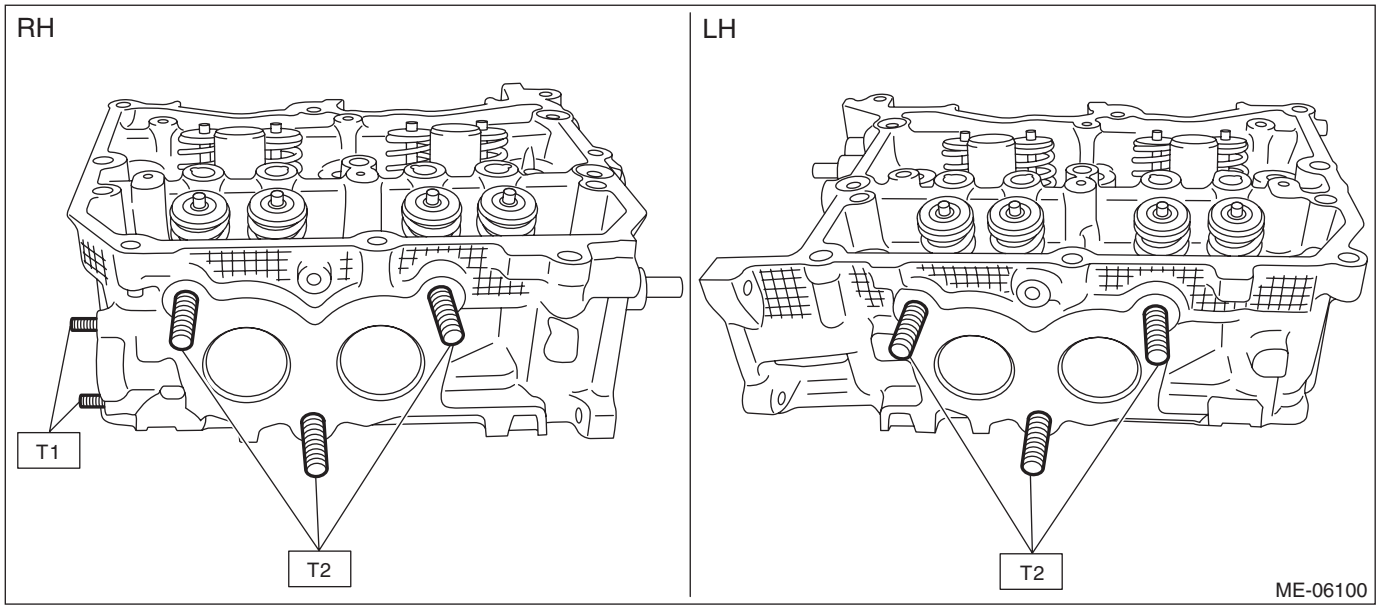
NOTE:
When inserting the valve into valve guide, use special care not to damage the oil seal lip.

(3) Compress the valve spring and install the valve collet using ST.
ST 0920287002000 REMOVER AND REPLACER



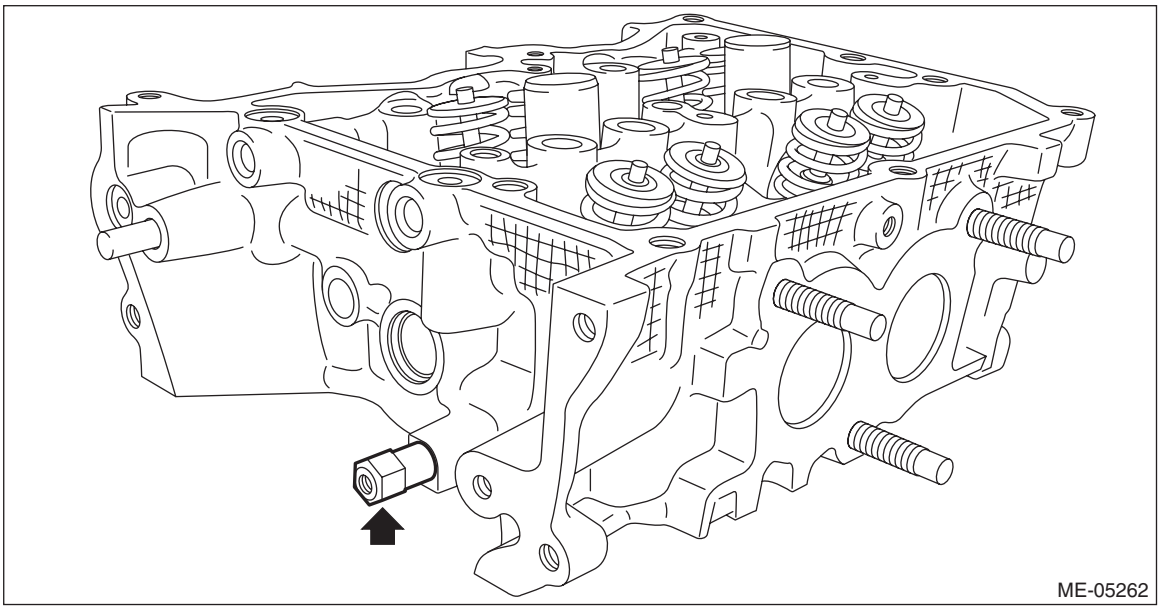
4) Install the valve spring seat, valve spring, valve spring retainer, valve and valve collet to the cylinder head LH.
5) Lightly tap the valve spring retainer with a plastic hammer, and make sure that the valve collet is securely attached.
6) Install the stud bolts onto cylinder heads.

Tightening torque:
T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
T2: 18 N·m (1.8 kgf-m, 13.3 ft-lb)



7) Install the chain cover securing bolt to the cylinder head LH.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



E: INSPECTION

1. CYLINDER HEAD

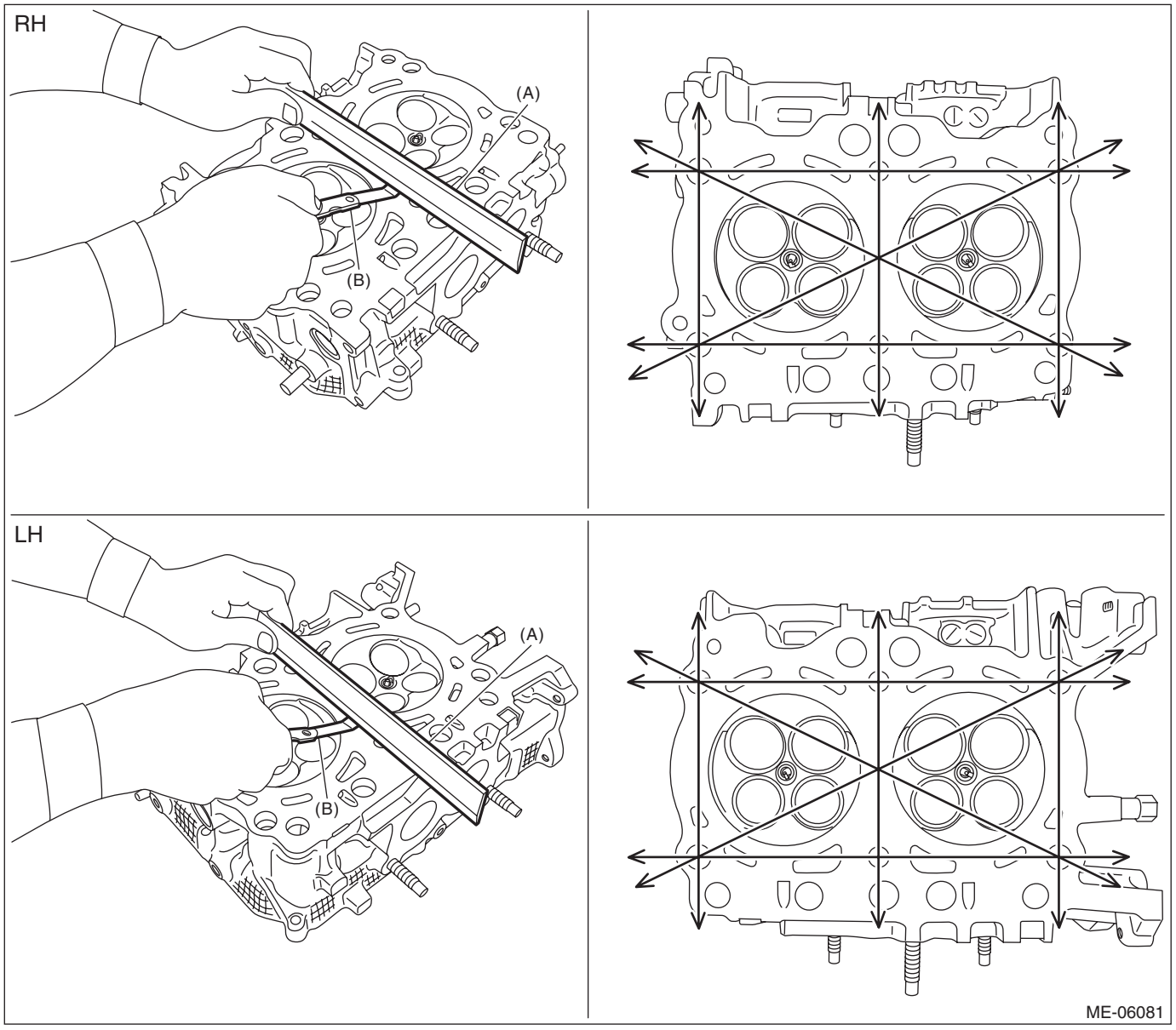
1) Visually inspect to make sure that there are no cracks, scratches or other damage.
2) Use liquid penetrant tester on the important sections to check for fissures.
3) Check that there are no marks of gas leaking or water leaking on gasket attachment surface.
4) Check the warping of the cylinder head mating surface that mates with cylinder block at the locations shown in the figure using a straight edge (A) and thickness gauge (B). If it exceeds the limit, correct the surface by grinding it with a surface grinder or replace the cylinder head.

NOTE:
- Measurement should be performed at a temperature of 20°C (68°F).
- If there is warpage on the cylinder head mating surface, the cylinder head bolt tightening torque and angle tightening may be improper. When installing the cylinder head, make sure that tightening torque and angle tightening work is performed precisely according to the operation procedures.
- When the cylinder head is replaced, lap each valve. Refer to “VALVE SEAT” for lapping. <Ref. to ME(H4DO(w/o HEV))-295, VALVE SEAT, INSPECTION, Cylinder Head.>

Cylinder head warpage:
Limit
0.020 mm (0.0008 in)

Cylinder head grinding limit:
To 98.4 mm (3.874 in)

Cylinder head height:
Standard
98.5 mm (3.878 in)



2. VALVE & VALVE GUIDE

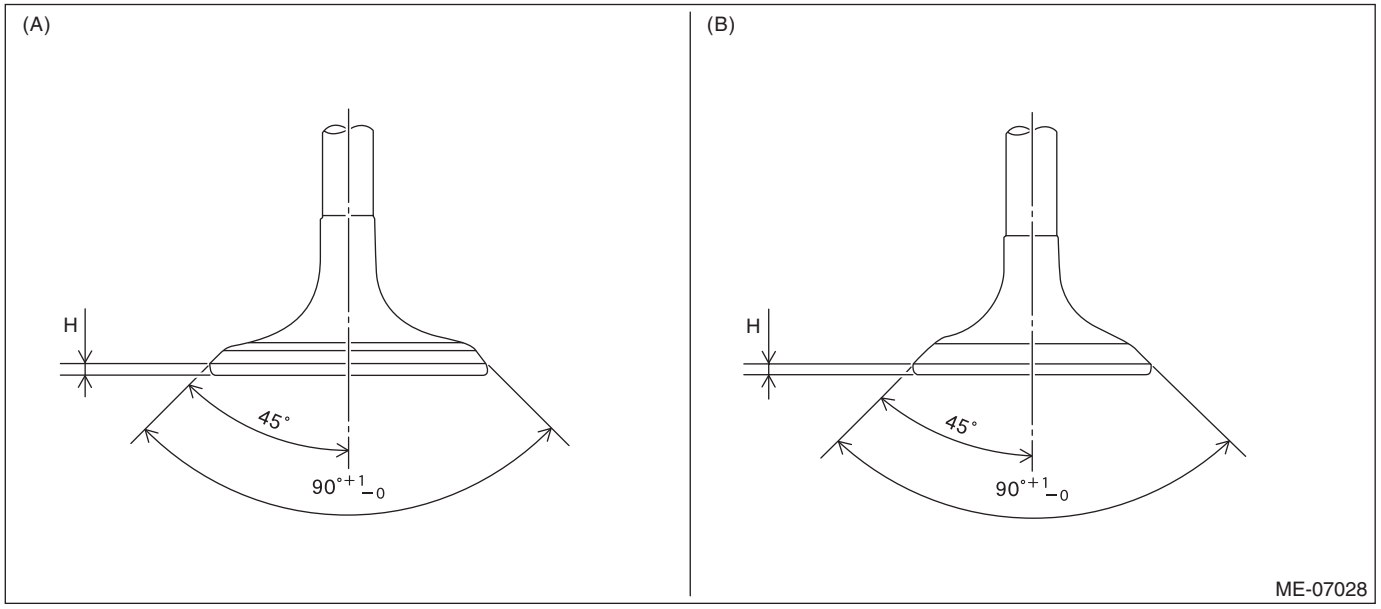
1) Check the valve flange and stem for damage, wear or deformation.
2) Measure the thickness “H” of valve head edge as shown in the figure using a caliper gauge. If it is not within the standard, replace the valve.

NOTE:
- It is possible to differentiate between the intake valve and the exhaust valve by their overall length.

Valve overall length:
Intake
104.95 mm (4.132 in)
Exhaust
96.5 mm (3.799 in)

- When the valve is replaced, lap the valve. Refer to “VALVE SEAT” for lapping. <Ref. to ME(H4DO(w/o HEV))-295, VALVE SEAT, INSPECTION, Cylinder Head.>

Valve head edge thickness H:
Intake (A)
Standard
0.8 — 1.2 mm (0.031 — 0.047 in)
Exhaust (B)
Standard
1.0 — 1.4 mm (0.039 — 0.055 in)



3) Check the clearance between valve and valve guide. Check the clearance between valve and valve guide by measuring the outer diameter of valve stem and the inner diameter of valve guide respectively.

(1) Measure the outer diameter of valve stem with a micrometer. If it is not within the standard, replace the valve.

NOTE:
- Measurement should be performed at a temperature of 20°C (68°F).
- Measure the outer diameter of the valve stem at the six locations as shown in the figure, and read the value of most worn location.
- When the valve is replaced, lap the valve. Refer to “VALVE SEAT” for lapping. <Ref. to ME(H4DO(w/o HEV))-295, VALVE SEAT, INSPECTION, Cylinder Head.>

Valve stem outer diameter:

Intake

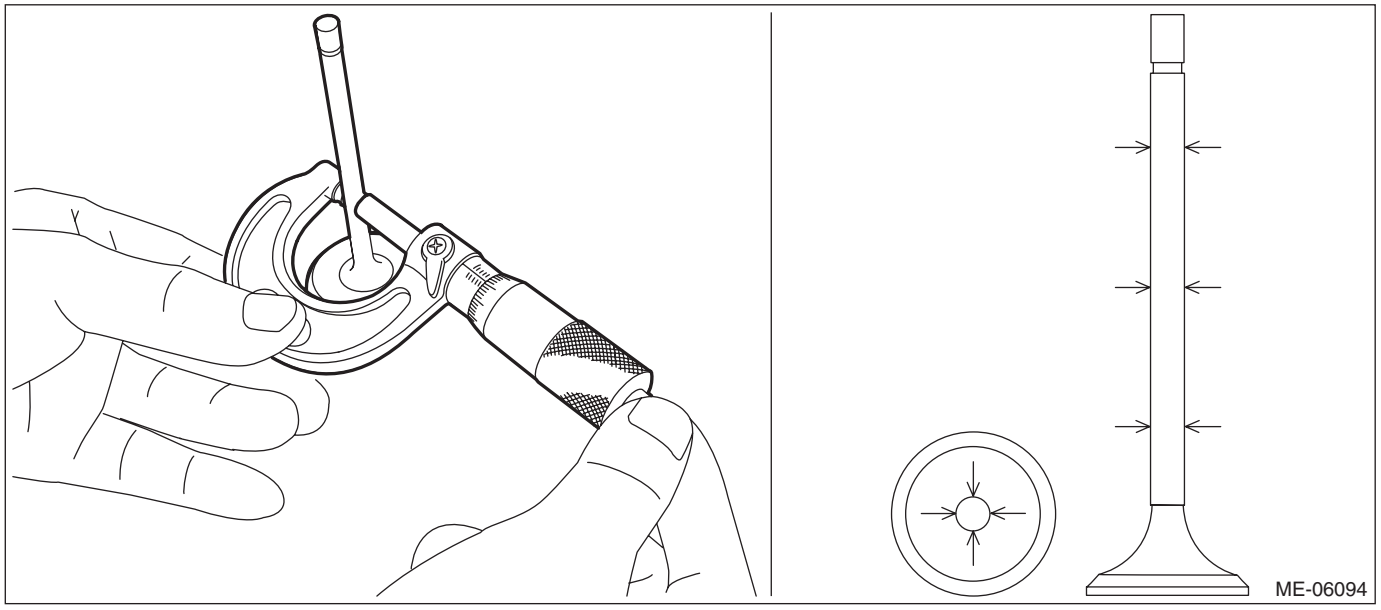
Standard

5.455 — 5.470 mm (0.2148 — 0.2154 in)

Exhaust

Standard

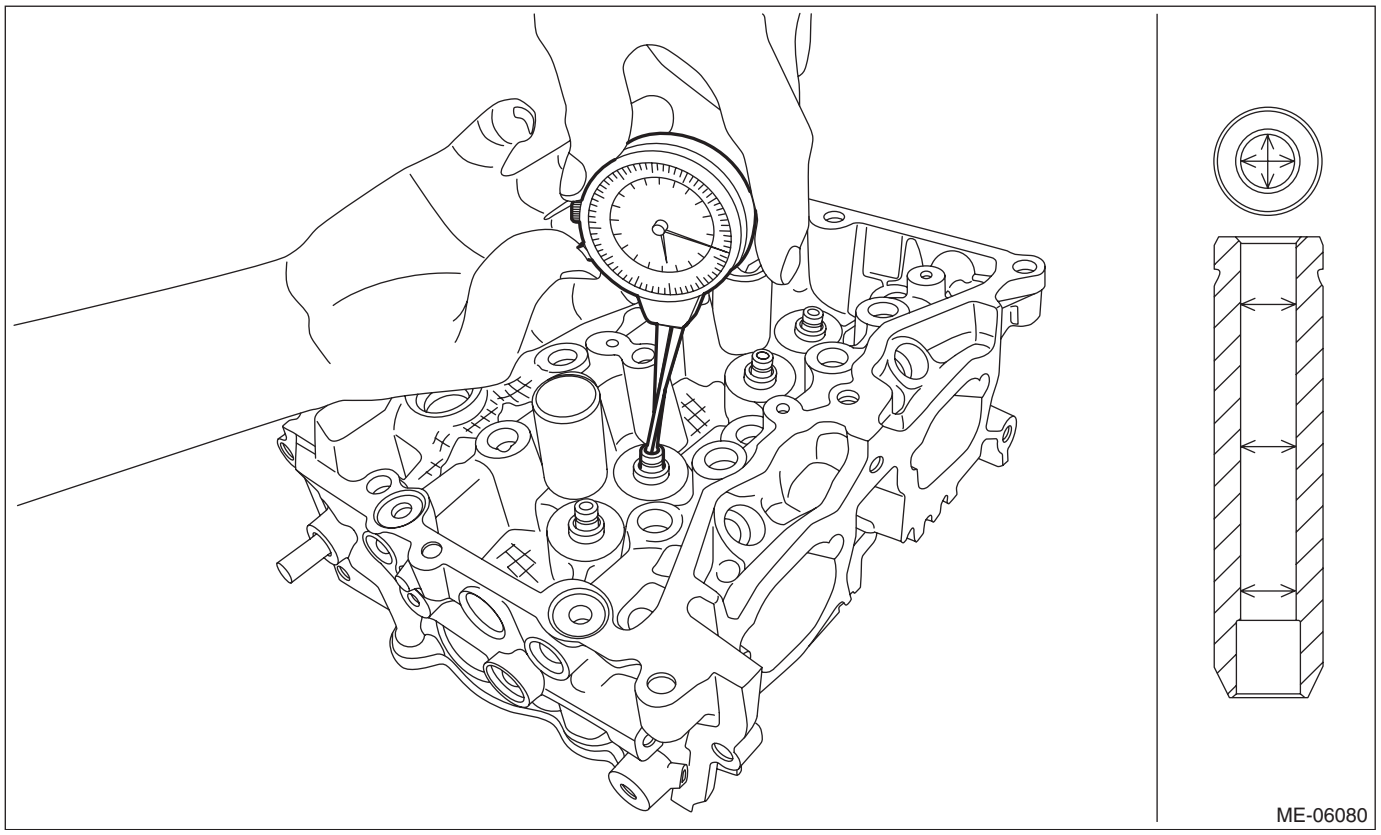
5.445 — 5.460 mm (0.2144 — 0.2150 in)



(2) Using a caliper gauge, measure the inner diameter of valve guide. If it is not within the standard, replace the valve guide. For replacement procedure, refer to step 4).

NOTE:
- Measurement should be performed at a temperature of 20°C (68°F).
- Measure the inner diameter of the valve guide at the six locations as shown in the figure, and read the value of most worn location.

Valve guide inner diameter:
Standard
5.500 — 5.512 mm (0.2165 — 0.2170 in)



(3) Calculate the clearance between valve and valve guide.

Clearance between valve and valve guide:
Intake
Standard
0.030 — 0.057 mm (0.0012 — 0.0022 in)
Exhaust
Standard
0.040 — 0.067 mm (0.0016 — 0.0026 in)

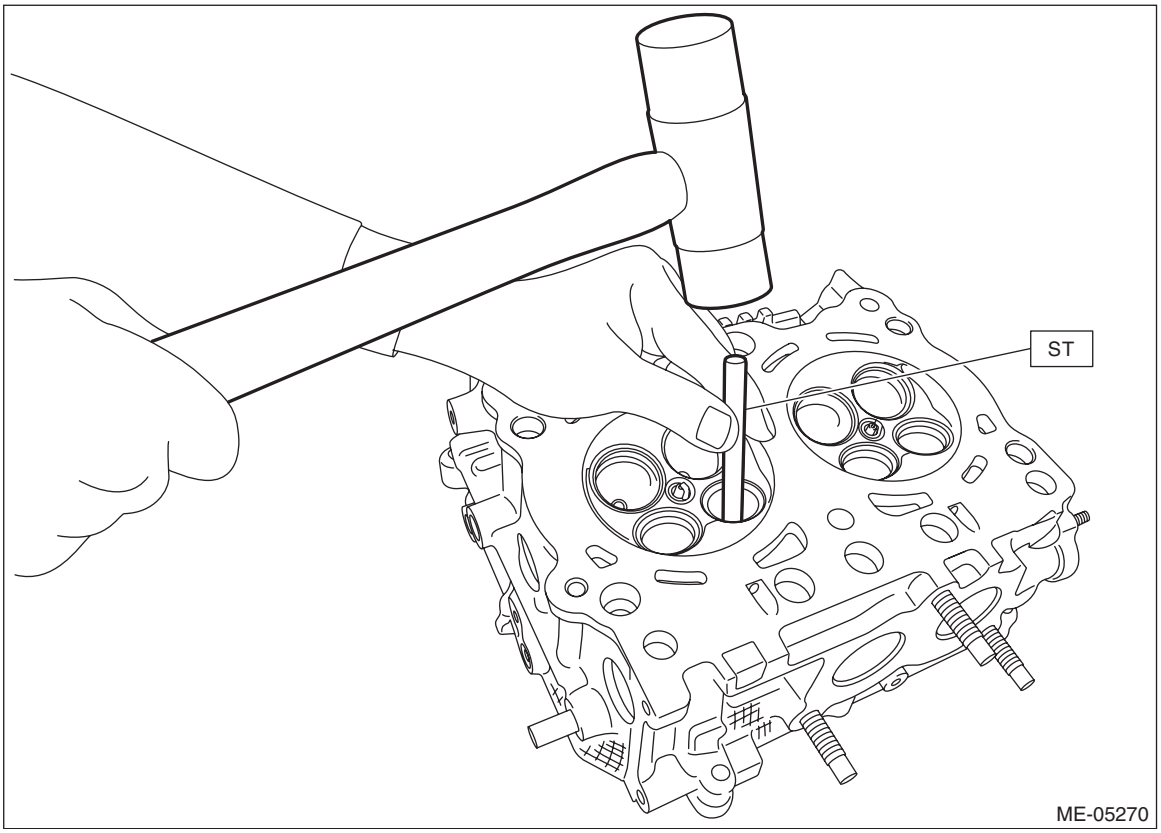
4) If the clearance between valve and valve guide exceeds the standard, replace the valve or valve guide, whichever shows the greater amount of wear or damage. For replacement procedure of valve guide, refer to the following.

NOTE:
When the valve is replaced, lap the valve. Refer to “VALVE SEAT” for lapping. <Ref. to ME(H4DO(w/o HEV))-295, VALVE SEAT, INSPECTION, Cylinder Head.>

(1) Insert ST into the valve guide with the combustion chamber upward and remove the valve guide using plastic hammer.

CAUTION:
- **Place a wood board wrapped with a waste cloth to stabilize the cylinder head before work.**
- **Use special care not to damage the cylinder head during work.**
- **Always strike the ST vertically with a plastic hammer. Otherwise, the ST can be damaged.**

ST 499765700 VALVE GUIDE REMOVER AND INSTALLER

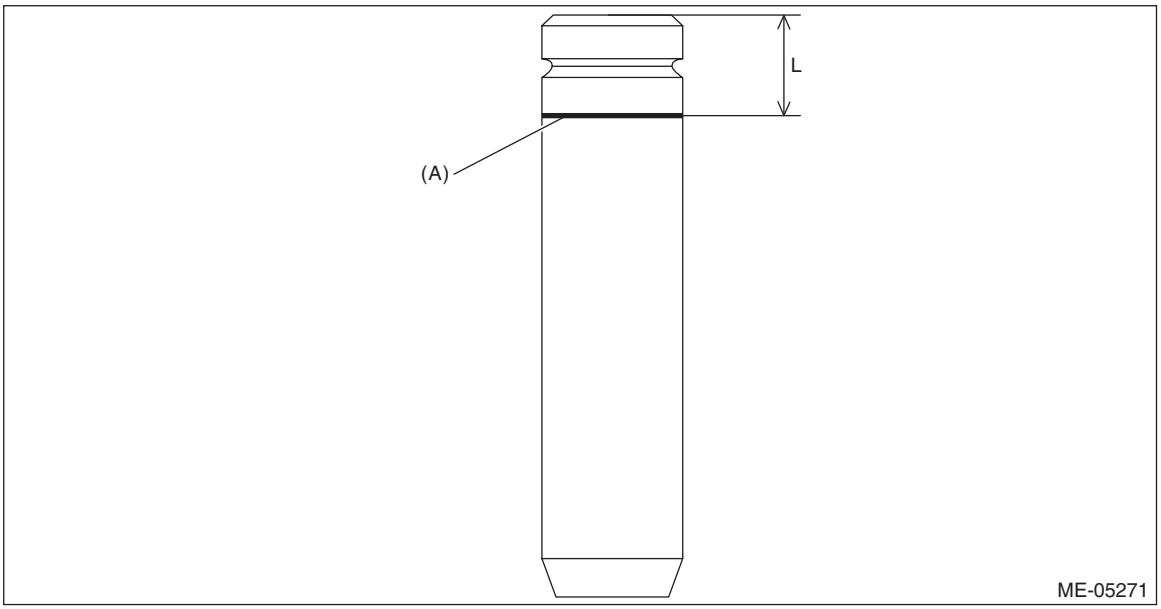


(2) Before installing the valve guide, make sure that neither scratches nor damages exist on the inner surface of valve guide installation holes of cylinder head.

(3) Draw a reference line (A) for insert on the valve guide using a marker as shown in the figure.

NOTE:
- Use a new valve guide.
- A reference line for insert is used as a guide when tapping-in the valve guide.

Valve guide inserting reference line position L:
15 mm (0.5906 in)

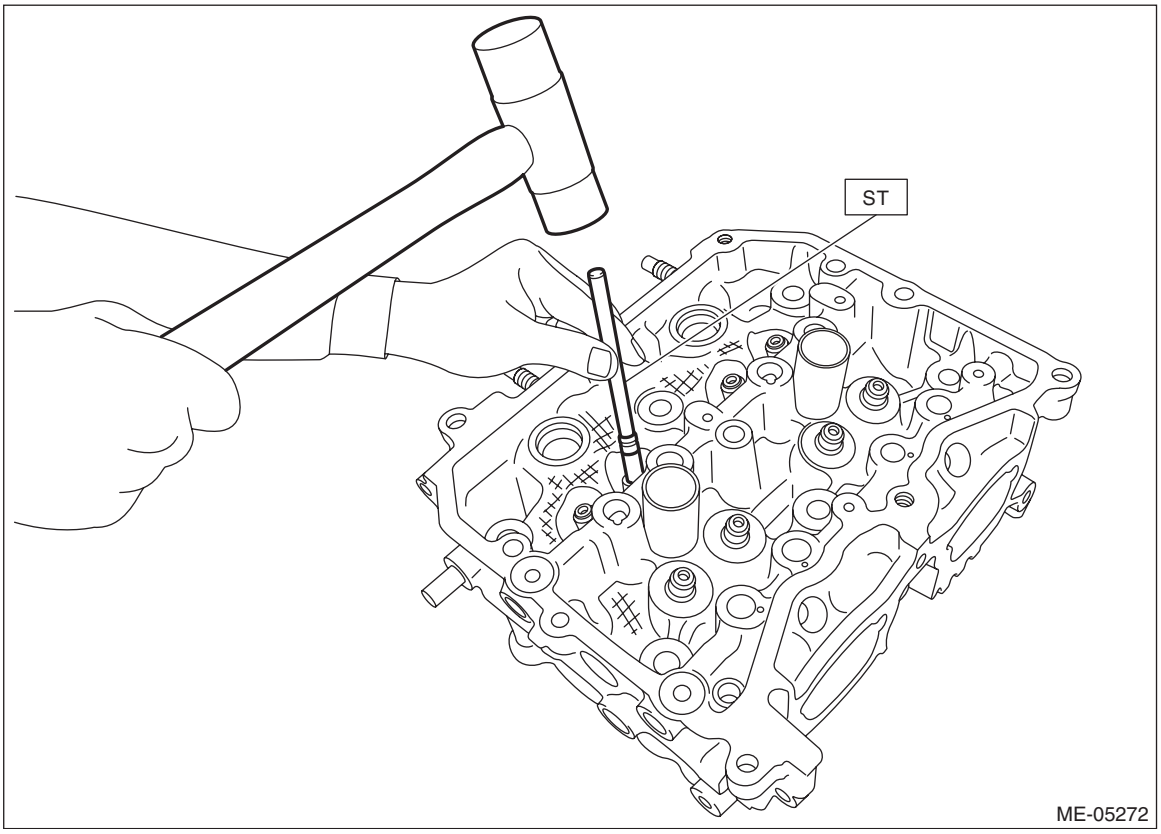


(4) Apply a enough coat of engine oil to the valve guide, and set the valve guide on the cylinder head with the combustion chamber downward.

(5) Insert the ST into the valve guide, and tap-in the valve guide to the reference line (A) for insert using plastic hammer.

CAUTION:
- **During work, place a waste cloth, etc. to avoid scratching the mating surface of the cylinder head.**
- **Use special care not to damage the cylinder head during work.**
- **Always strike the ST vertically with a plastic hammer. Otherwise, the ST can be damaged.**

ST 499765700 VALVE GUIDE REMOVER AND INSTALLER

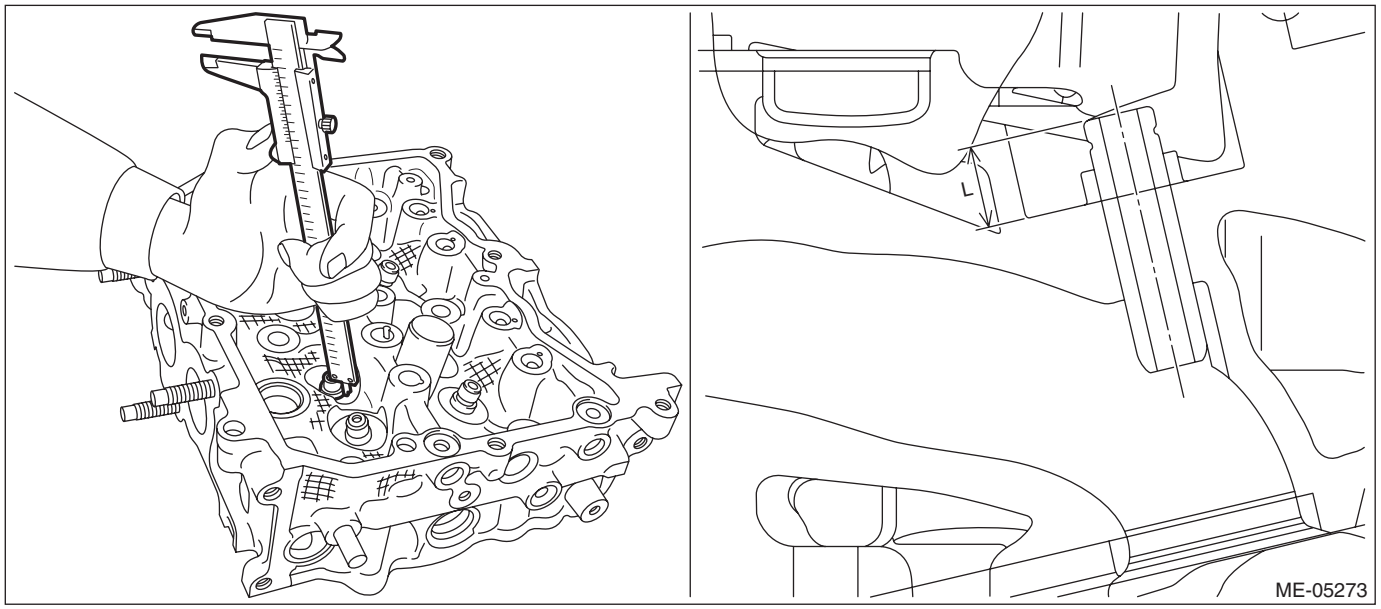


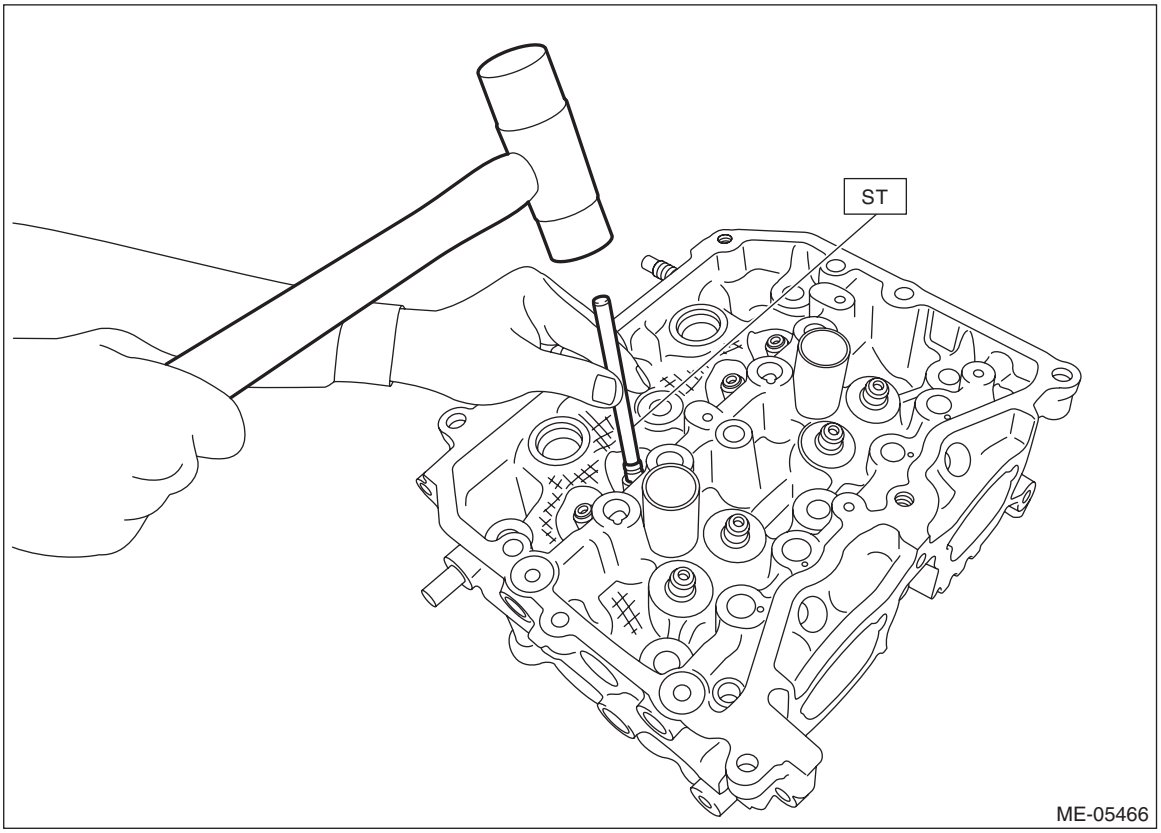
(6) Measure the valve guide protrusion amount “L” as shown in the figure using a caliper gauge. Insert the ST into the valve guide again, and tap-in the valve guide so that it is positioned within standard by referring to the measured value using plastic hammer.

CAUTION:
- **During work, place a waste cloth, etc. to avoid scratching the mating surface of the cylinder head.**
- **Use special care not to damage the cylinder head during work.**
- **Always strike the ST vertically with a plastic hammer. Otherwise, the ST can be damaged.**

NOTE:
Be careful not to tap-in excessively by repeating the steps of Tapping-in → Measurement → Tapping-in → Measurement … when installing the valve guide.
ST 499765700 VALVE GUIDE REMOVER AND INSTALLER

Valve guide protrusion amount L:
Standard
11.4 — 11.8 mm (0.449 — 0.465 in)



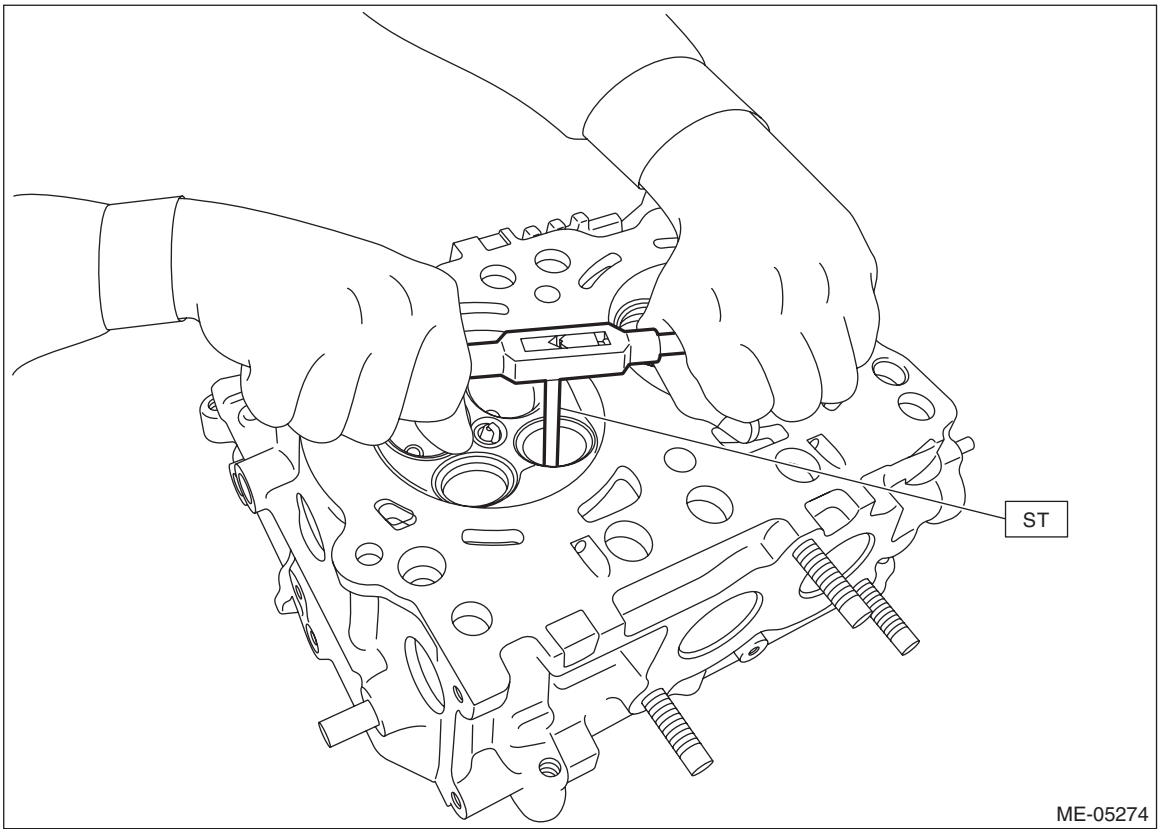


(7) Ream the inside of valve guide with the combustion chamber upward using the ST. Put the ST in valve guide, and rotate the ST slowly clockwise while pushing it lightly. Bring the ST back while rotating it clockwise.

CAUTION:
- **Place a wood board wrapped with a waste cloth to stabilize the cylinder head before work.**
- **Use special care not to damage the cylinder head during work.**

NOTE:
- Apply engine oil to the ST.
- If the inner surface of valve guide is damaged, the edge of ST should be slightly ground with oil stone.
- If the inner surface of valve guide becomes lustrous and the ST does not chip, use a new ST or remedy the ST.

ST 499765900 VALVE GUIDE REAMER



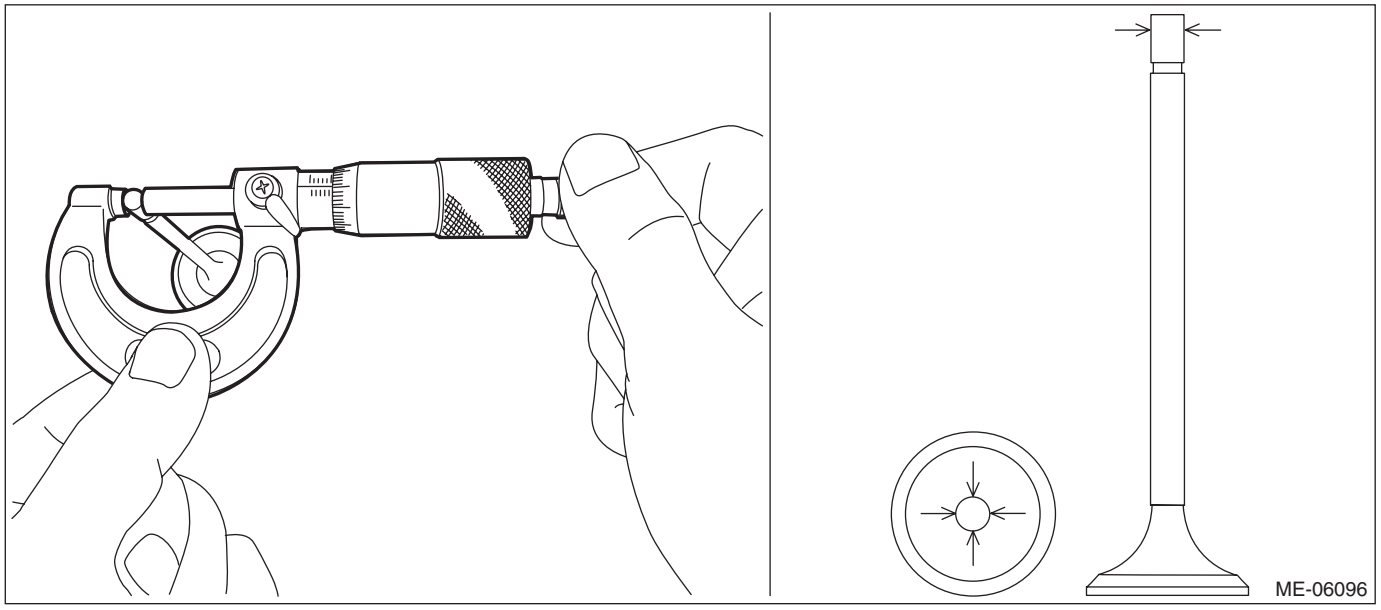
(8) After reaming, clean the valve guide to remove chips.
(9) Check the seating width between valve and valve seat. <Ref. to ME(H4DO(w/o HEV))-295, VALVE SEAT, INSPECTION, Cylinder Head.>

3. VALVE & VALVE SHIM

1) Visually check the valve shim for damage.
2) Check the clearance between valve and valve shim. Check the clearance between valve and valve shim by measuring the outer diameter of valve stem end and the inner diameter of valve shim respectively.
   (1) Measure the outer diameter of valve stem end with a micrometer. If it is not within the standard, replace the valve.

NOTE:
- Measurement should be performed at a temperature of 20°C (68°F).
- Measure the outer diameter of the valve stem end at the two locations as shown in the figure, and read the value of most worn location.
- When the valve is replaced, lap the valve. Refer to “VALVE SEAT” for lapping. <Ref. to ME(H4DO(w/o HEV))-295, VALVE SEAT, INSPECTION, Cylinder Head.>

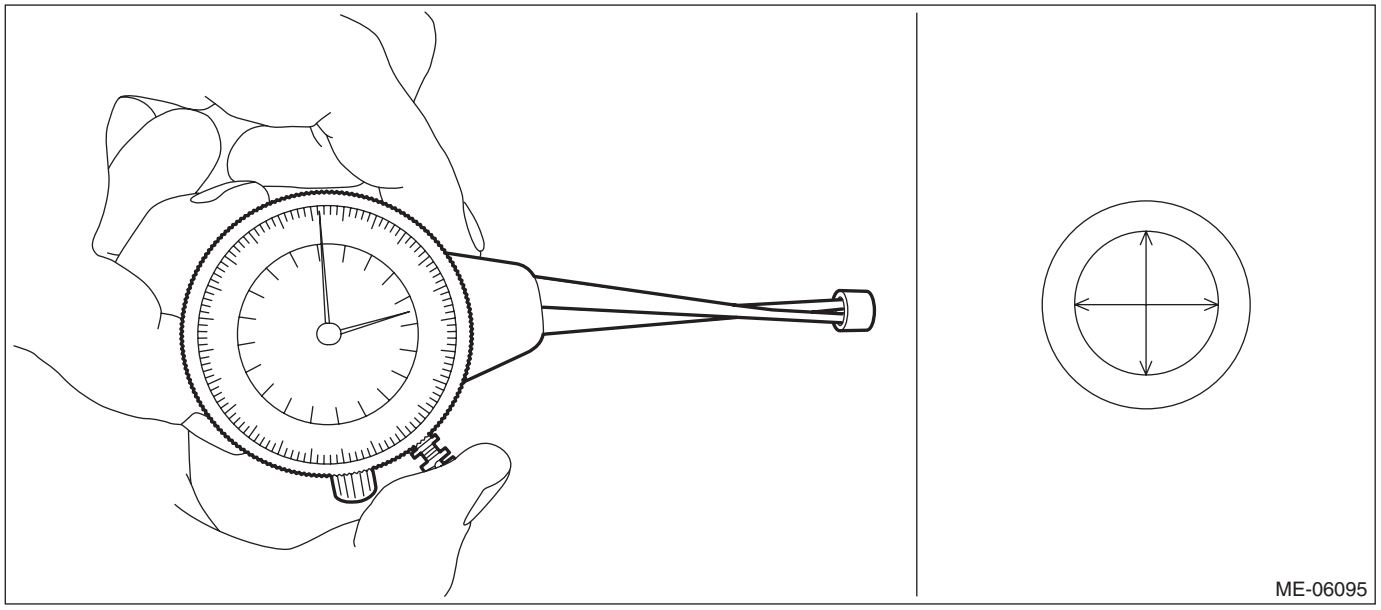
Valve stem end outer diameter:
Intake
Standard
5.455 — 5.470 mm (0.2148 — 0.2154 in)
Exhaust
Standard
5.445 — 5.460 mm (0.2144 — 0.2150 in)



(2) Using a caliper gauge, measure the inner diameter of valve shim. If it is not within the standard, replace the valve shim.

NOTE:
• Measurement should be performed at a temperature of 20°C (68°F).
• Measure the inner diameter of the valve shim at the two locations as shown in the figure, and read the value of most worn location.
• If the valve shim has to be replaced, check the cam clearance and replace with the suitable valve shim. <Ref. to ME(H4DO(w/o HEV))-51, WHEN TIMING CHAIN ASSEMBLY IS REMOVED, INSPECTION, Cam Clearance.>

Valve shim inner diameter:
Standard
5.500 — 5.560 mm (0.2165 — 0.2189 in)



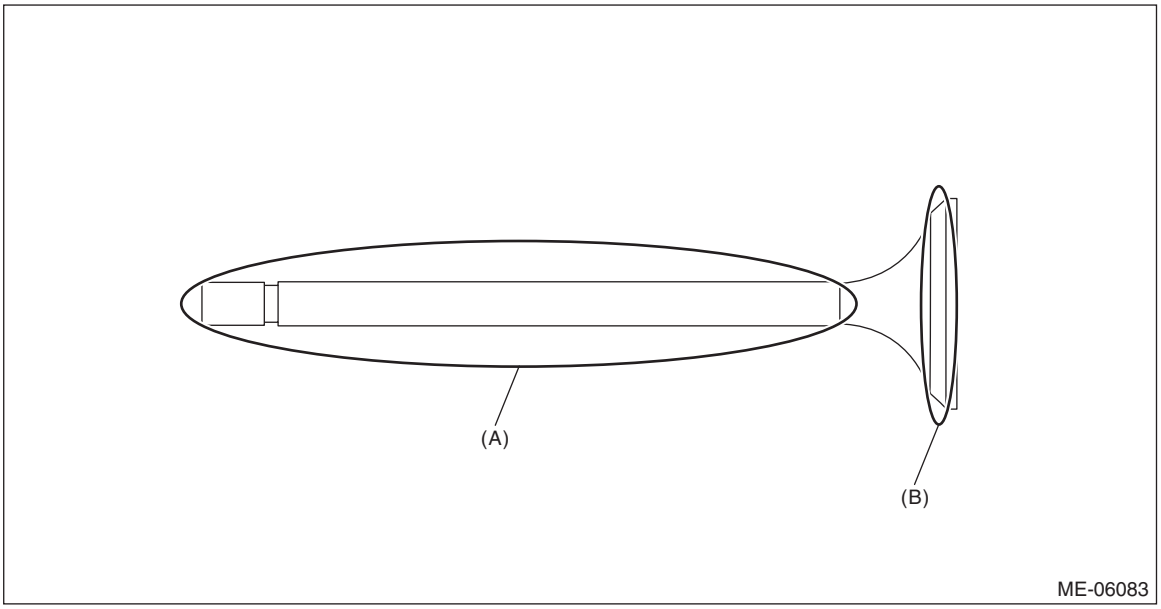
(3) Calculate the clearance between valve and valve shim. If the clearance exceeds the standard, replace the valve or valve shim, whichever shows the greater amount of wear or damage.

NOTE:
• When the valve is replaced, lap the valve. Refer to “VALVE SEAT” for lapping. <Ref. to ME(H4DO(w/o HEV))-295, VALVE SEAT, INSPECTION, Cylinder Head.>
• If the valve shim has to be replaced, check the cam clearance and replace with the suitable valve shim. <Ref. to ME(H4DO(w/o HEV))-51, WHEN TIMING CHAIN ASSEMBLY IS REMOVED, INSPECTION, Cam Clearance.>

Clearance between valve and valve shim:
Intake
Standard
0.030 — 0.105 mm (0.0012 — 0.0041 in)
Exhaust
Standard
0.040 — 0.115 mm (0.0016 — 0.0045 in)

4. VALVE SEAT

1) Check the valve seat for damage and deformation.
2) Check the seating width and seating position between valve and valve seat for the intake valve seat and exhaust valve seat.
   (1) Clean the valve and valve seat.
   (2) Coat the stem (A) of the valve lightly with engine oil and apply red dye evenly on the valve face (B).

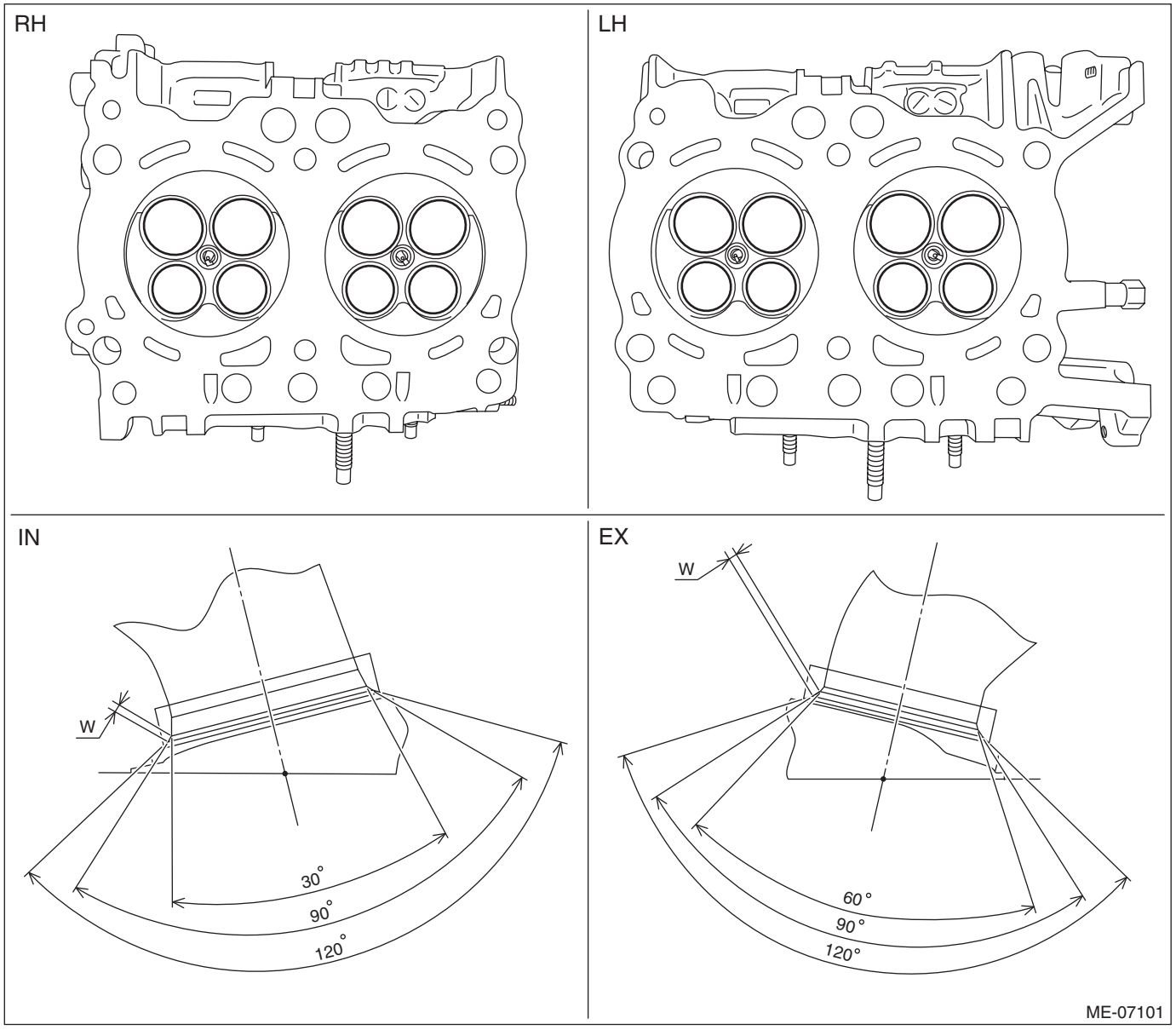


   (3) Using the valve lapper, slowly insert the valve with red dye applied into the valve guide. Lightly press the valve against the valve seat without turning the valve, and then slowly pull out the valve.

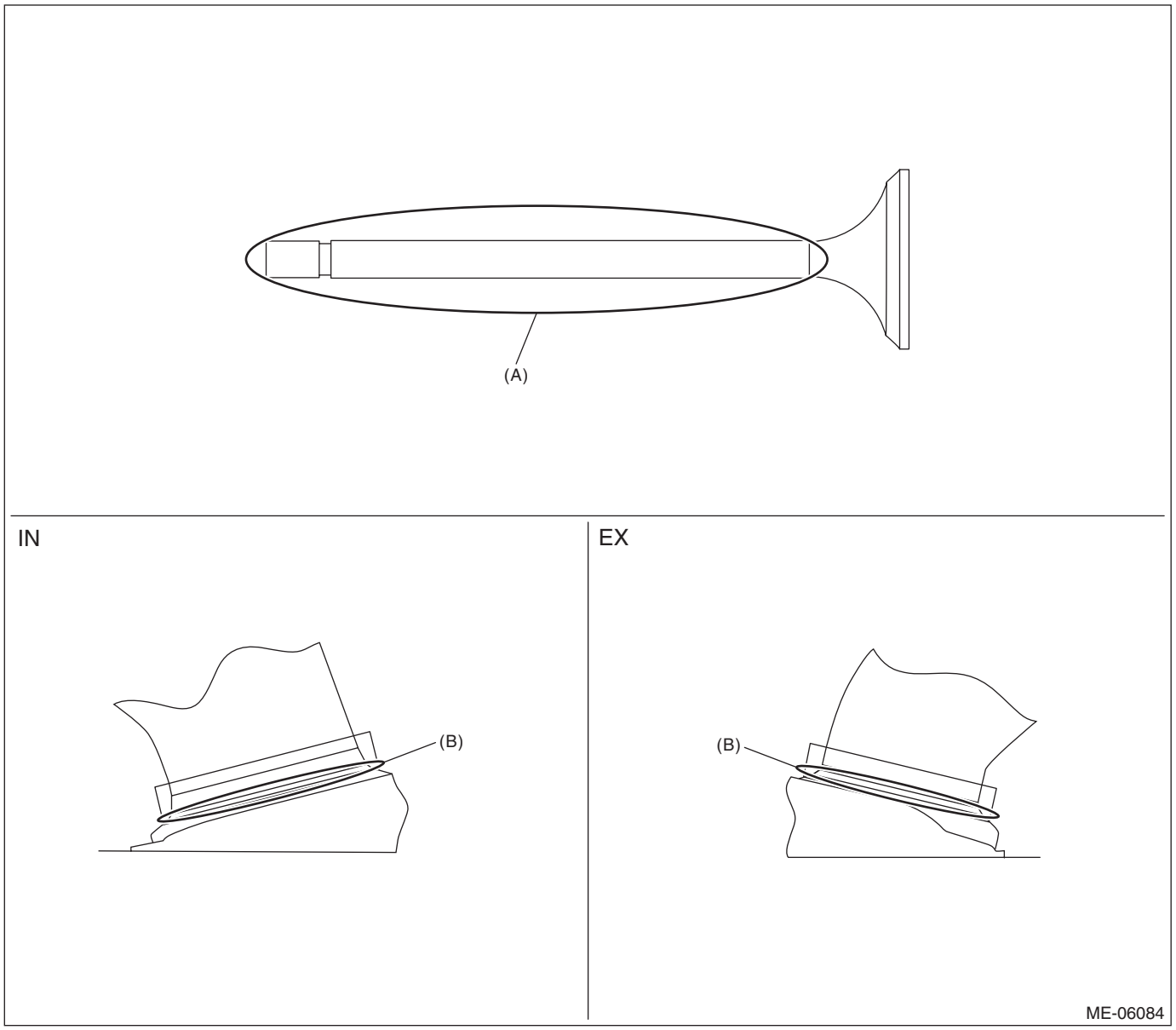
(4) Check the seating width “W” of valve seat as shown in the figure, using a caliper gauge. Check the seating width “W” between valve and valve seat by measuring the width of red dye on the seating surface of valve seat. If the seating width “W” between valve and valve seat is out of the standard, correct the seating surface of valve seat using the valve seat cutter. For correcting procedures of the valve seat seating surface, refer to step 3).

NOTE:
• When the red dye does not appear seamlessly on the valve seat seating surface, lap the valve. For lapping procedure, refer to step 4).
• When the red dye does not appear seamlessly on the valve seat seating surface even after lapping the valve, correct the valve seat seating surface using the valve seat cutter. For correcting procedures of the valve seat seating surface, refer to step 3).

Seating width W between valve and valve seat:
Intake
Standard
0.8 — 1.6 mm (0.031 — 0.063 in)
Exhaust
Standard
1.1 — 1.7 mm (0.043 — 0.067 in)



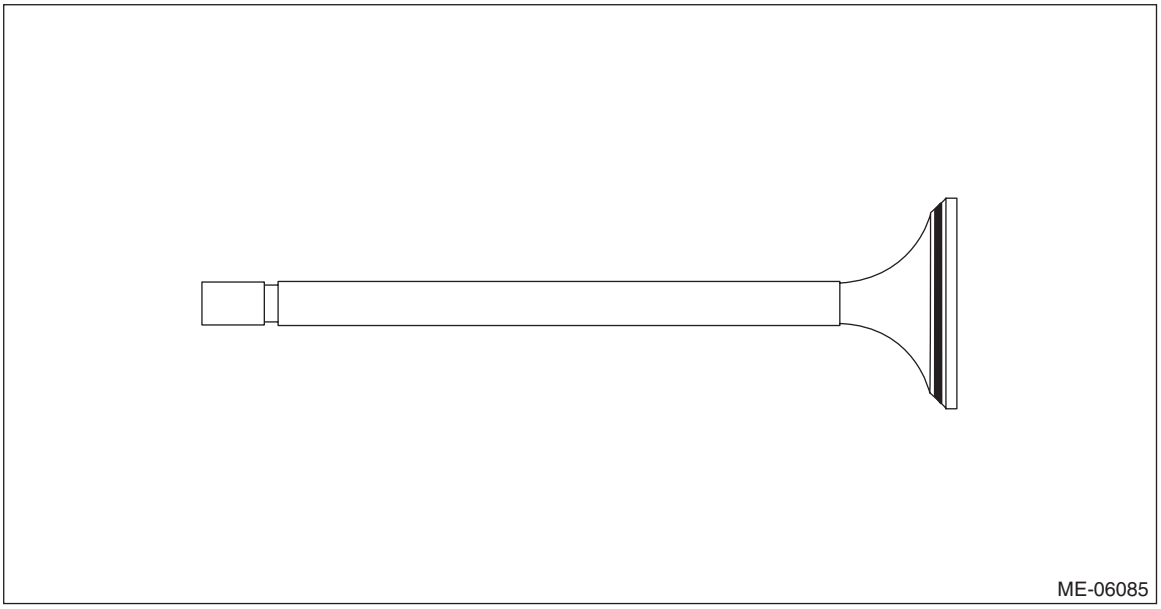
(5) Wipe off the red dye on the valve and valve seat completely.
(6) Coat the stem (A) of the valve lightly with engine oil and apply red dye evenly on the seating surface (B) between valve and valve seat.



(7) Using the valve lapper, slowly insert the valve into the valve guide. Lightly press the valve against the valve seat without turning the valve, and then slowly pull out the valve.

(8) Check the seating position between valve and valve seat. Check the seating position between valve and valve seat by checking the position of red dye on the valve face. If the seating position between valve and valve seat is not at the center of valve face, correct the seating surface of valve seat using the valve seat cutter. For correcting procedures of the valve seat seating surface, refer to step 3).

Seating position between valve and valve seat:
Valve face center

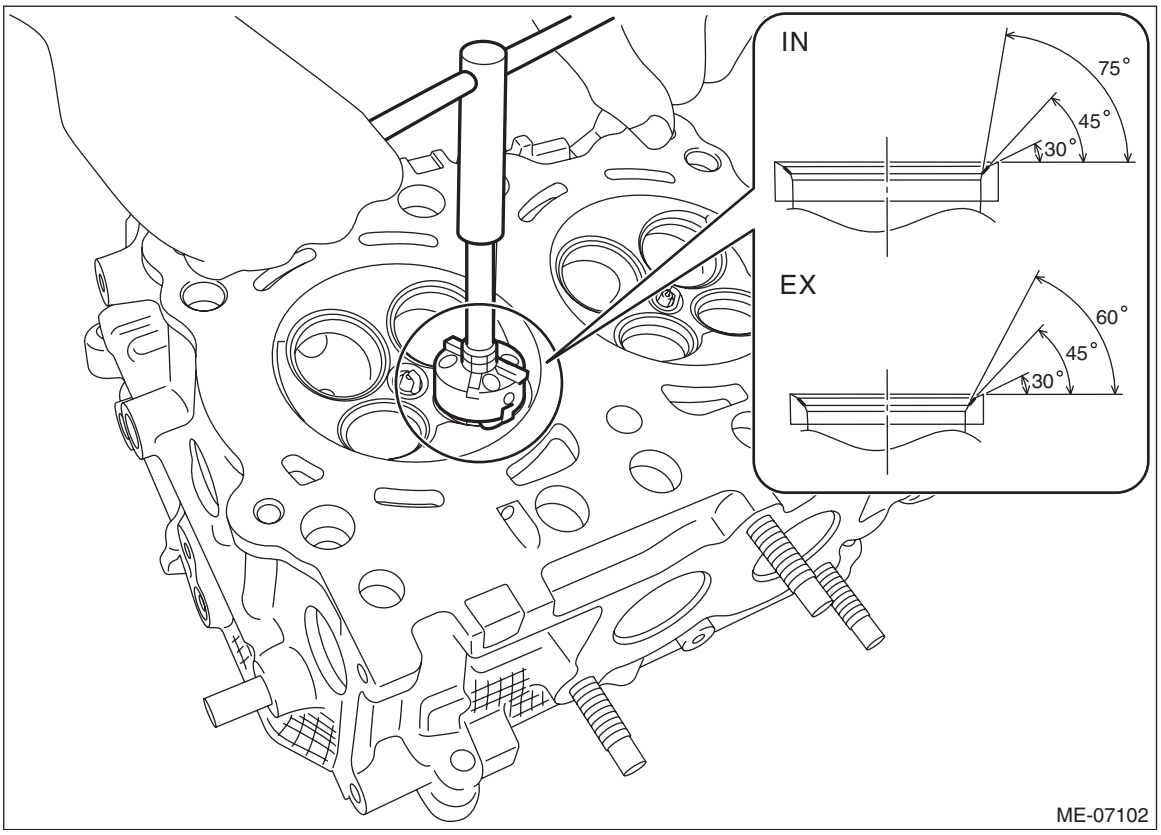


(9) After inspection, wipe off the red dye completely.

3) When correcting the seating surfaces of valve seat
(1) Correct the seating angle between valve and valve seat using the 45° valve seat cutter.

NOTE:
• Grind the seating surface so that the seating width between valve and valve seat becomes slightly larger than the standard value.
• Gradually reduce pressure at the end of grinding process in order to avoid creating a gap on the valve seat correcting surface.

Seating angle between valve and valve seat:
45°

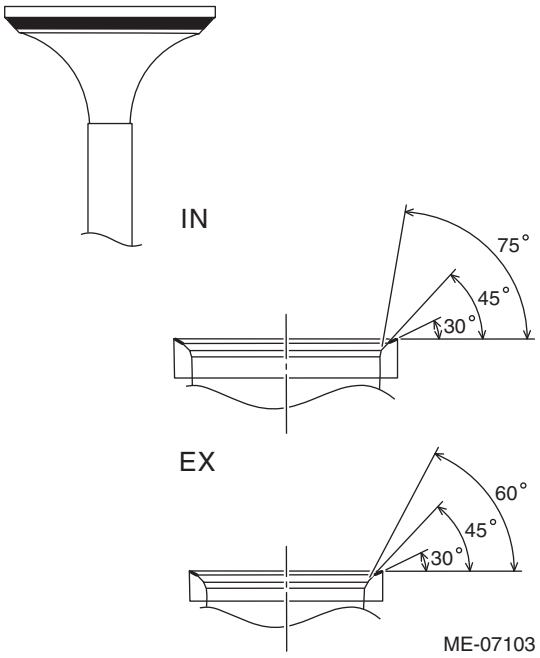
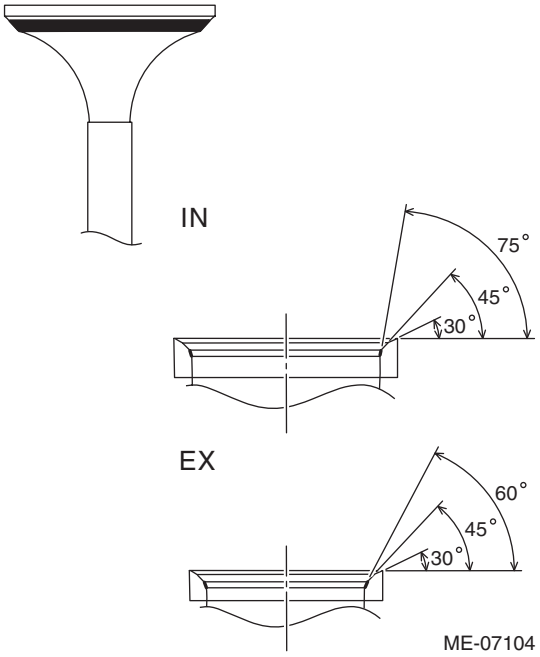


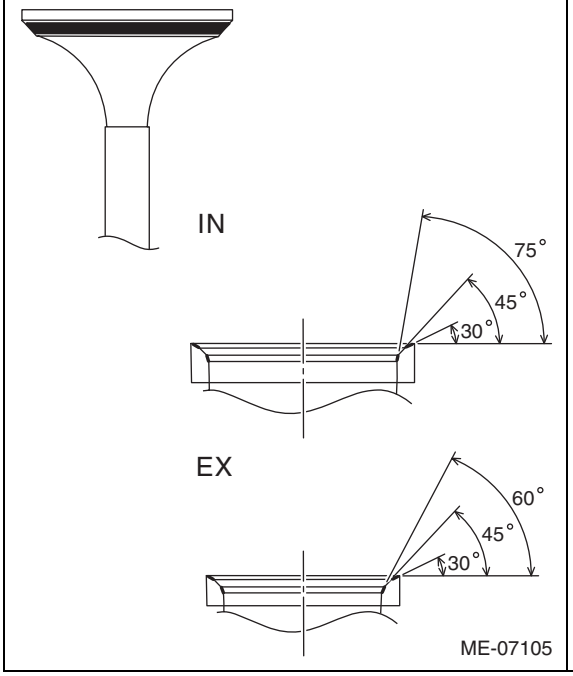
(2) Lap the valve. For lapping procedure of the valve, refer to step 4).
(3) Check the seating position between valve and valve seat. For inspection of the seating position between valve and valve seat, refer to step 2).

NOTE:
This procedure is necessary to select a seat cutter to be used in step (4).

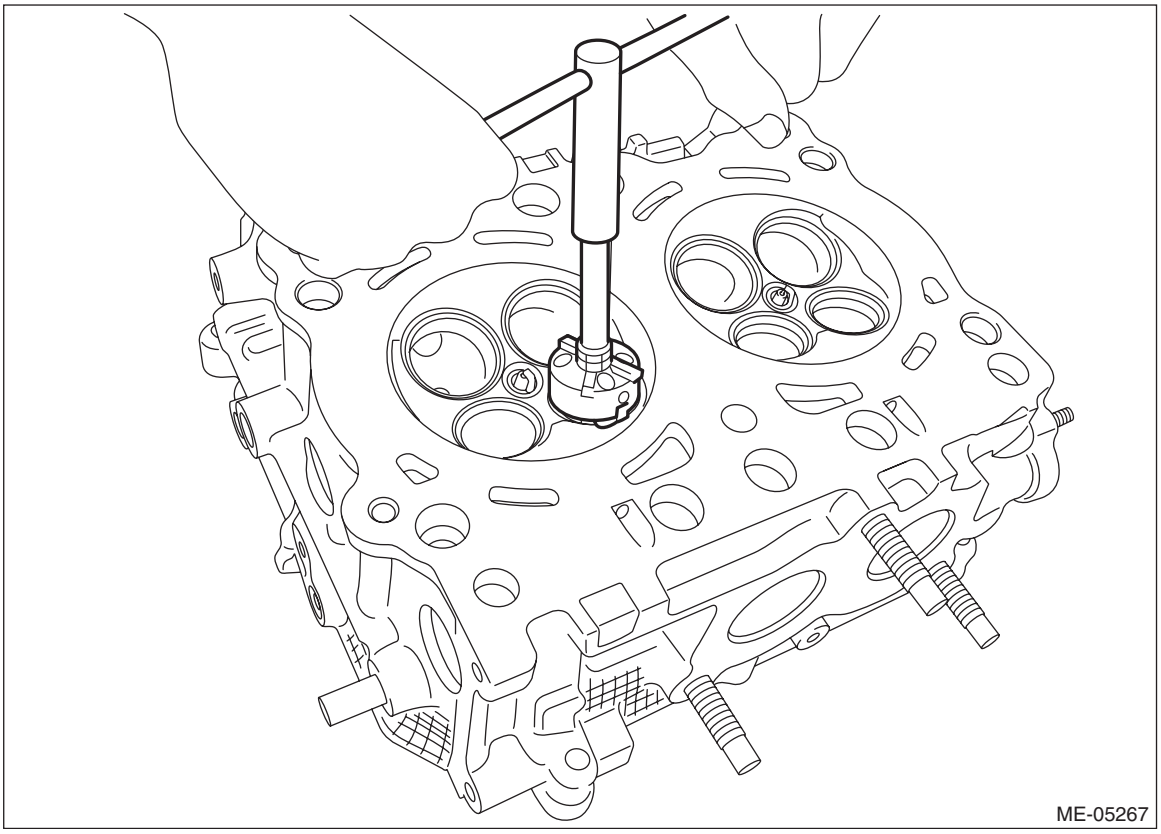
(4) Using a seat cutter, correct the valve seat so that the seating width between valve and valve seat becomes the standard value.

NOTE:
- Select a proper valve seat cutter according to the following table.

Seating position between valve and valve seat	Seat cutter selection
	When the seating position of valve face is high, grind the surface using the 30° seat cutter until seating width between valve and valve seat becomes the standard value.
	When the seating position of valve face is low, grind the surface using the 75° (IN) or 60° (EX) seat cutter until seating width between valve and valve seat becomes the standard value.

Seating position between valve and valve seat	Seat cutter selection
	When the seating position of valve face is at center, grind the surface evenly using the 30° and 75° (IN) or 60° (EX) seat cutters until seating width between valve and valve seat becomes the standard value.

• Gradually reduce pressure at the end of grinding process in order to avoid creating a gap on the valve seat correcting surface.

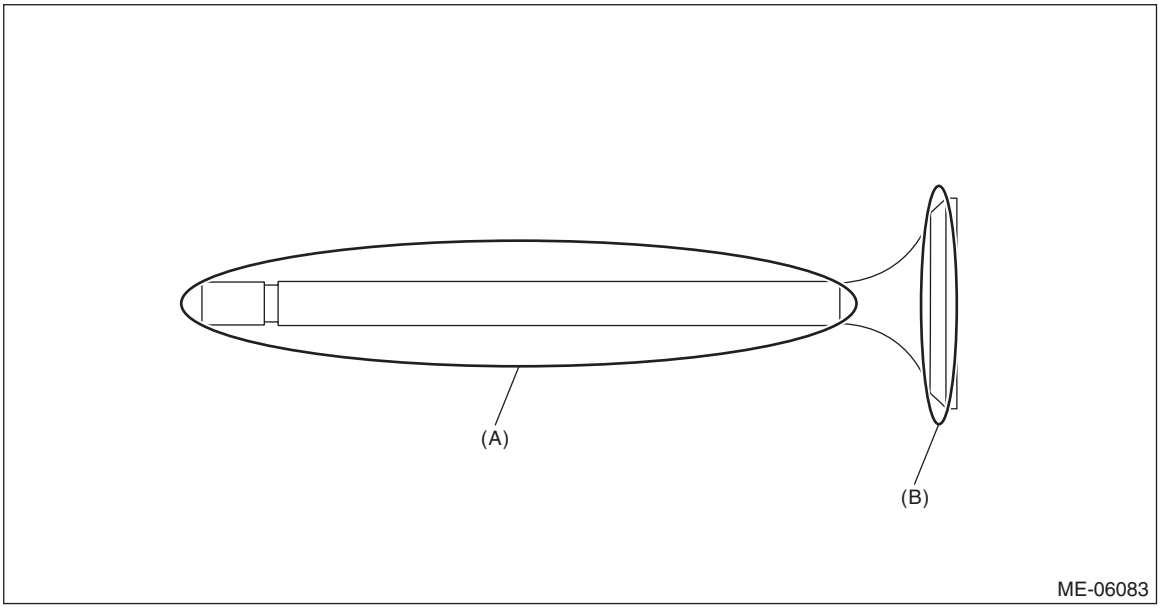


(5) Lap the valve. For lapping procedure of the valve, refer to step 4).

4) When lapping the valve

(1) Coat the stem (A) of the valve lightly with engine oil and put a small amount of valve compound evenly on the valve face (B).

NOTE:
- Be careful not to put the valve compound more than necessary.
- To avoid damaging the valve guide and valve stem, be careful not to let the valve compound contact the valve stem.



(2) Using the valve lapper, slowly insert the valve with the valve compound applied into the valve guide, and lap the seating surface between valve and valve seat. First, lift the valve and strike it against the valve seat twice, and then slightly turn the valve once. Repeat these steps as one set.

NOTE:
- To prevent the seating width between valve and valve seat from exceeding the standard value, be careful not to keep turning the valve while pressing it against the valve seat during lapping.
- Be careful not to lift the valve too far during lapping in order to prevent the valve from coming off the valve guide.

(3) Wipe off the valve compound on the valve and valve seat completely after lapping.

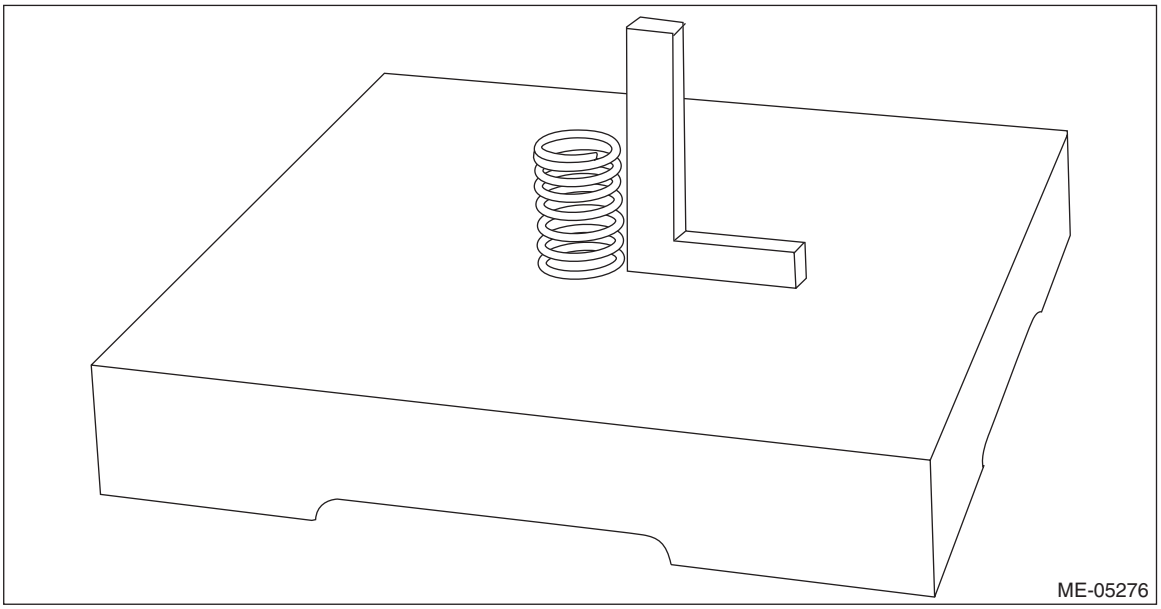
NOTE:
Be careful not to leave any valve compound in order to avoid malfunction.

(4) Check the seating width and seating position between valve and valve seat.

5. VALVE SPRING

1) Check the valve spring for damage and deformation.
2) Using a caliper gauge, valve spring tester, surface plate and try square, check the valve spring free length, tension/spring height and squareness. If it is not within the standard, replace the valve spring.

NOTE:
- Measurement should be performed at a temperature of 20°C (68°F).
- To check the squareness of the valve spring, stand the valve spring on a surface plate and check its deflection at the top of the valve spring using a try square.



Valve spring free length:

MT model
Standard
41.06 mm (1.617 in)

CVT model
Standard
41.68 mm (1.641 in)

Valve spring tension/spring height:

MT model
Set
Standard
182 — 210 N (18.56 — 21.41 kgf, 40.92 — 47.22 lbf)/33.0 mm (1.299 in)
Lift
Standard
552 — 610 N (56.29 — 62.20 kgf, 124.11 — 137.15 lbf)/22.0 mm (0.866 in)

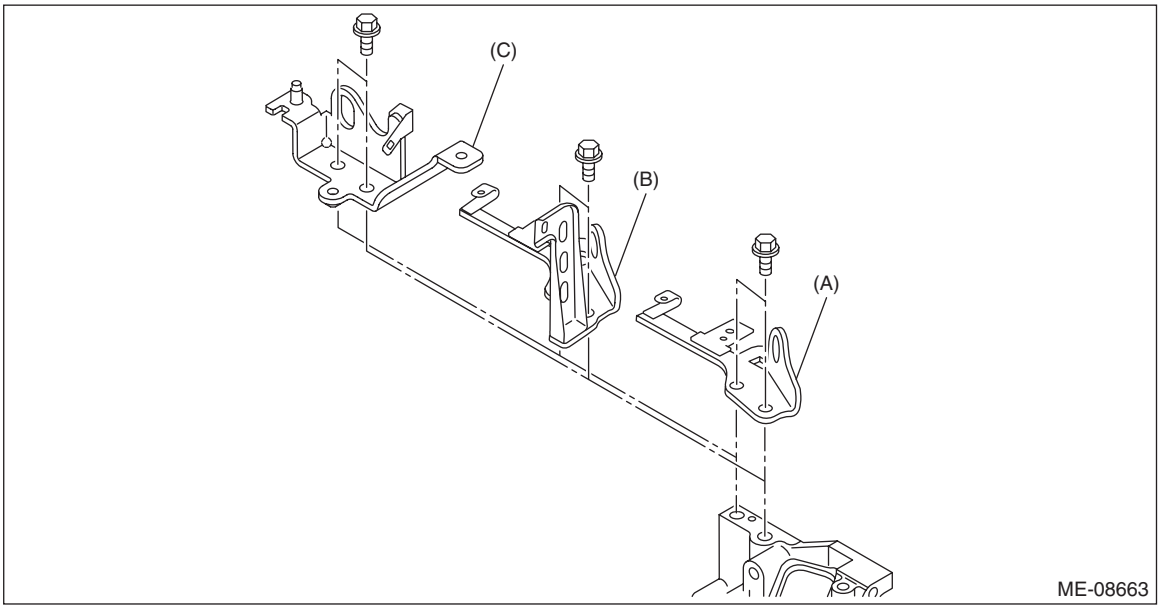
CVT model
Set
Standard
182 — 210 N (18.56 — 21.41 kgf, 40.92 — 47.22 lbf)/33.0 mm (1.299 in)
Lift
Standard
502 — 554 N (51.19 — 56.49 kgf, 112.87 — 124.56 lbf)/22.0 mm (0.866 in)

Valve spring squareness:
Standard
2.5°, 1.8 mm (0.071 in) or less

22.Cylinder Block

A: REMOVAL

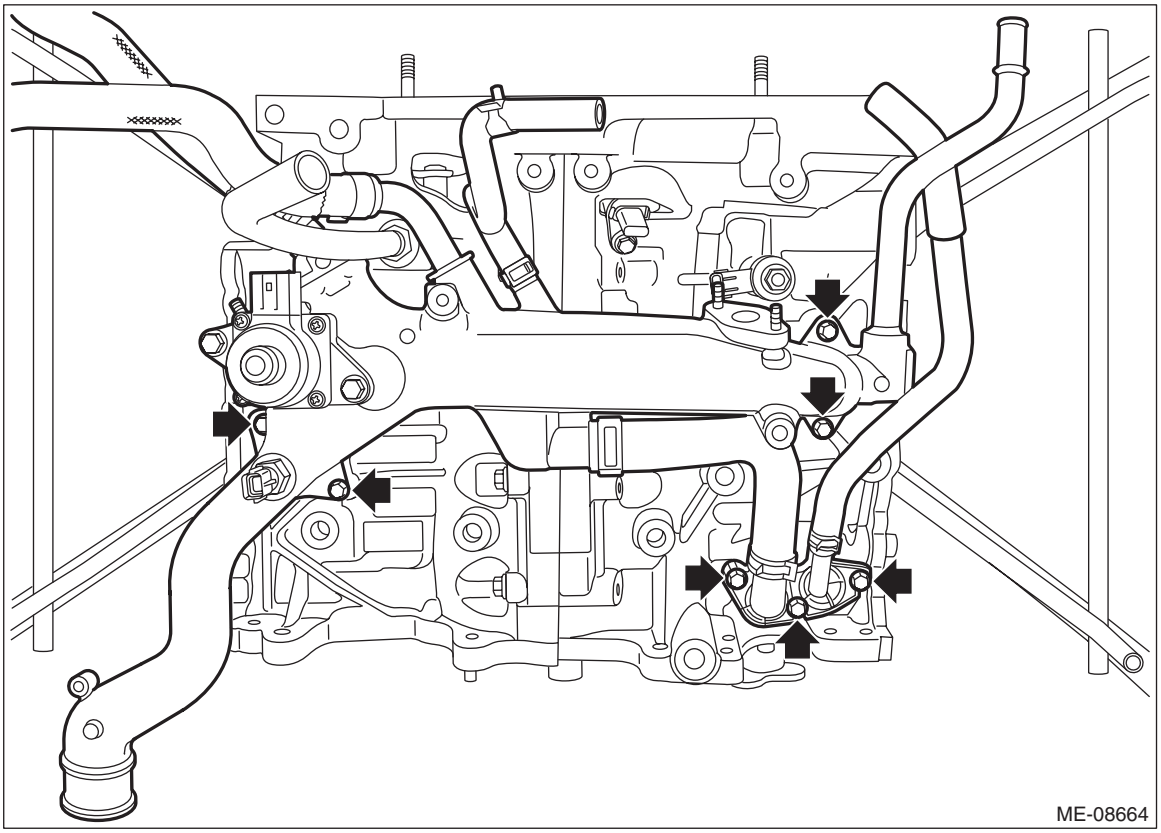
1) Remove the engine from the vehicle. <Ref. to ME(H4DO(w/o HEV))-55, REMOVAL, Engine Assembly.>
2) Remove the intake manifold. <Ref. to FU(H4DO(w/o HEV))-19, REMOVAL, Intake Manifold.> <Ref. to FU(H4DO(HEV))-19, REMOVAL, Intake Manifold.>
3) Remove the engine wiring harness. <Ref. to FU(H4DO(w/o HEV))-43, REMOVAL, Engine Wiring Harness.> <Ref. to FU(H4DO(HEV))-34, REMOVAL, Engine Wiring Harness.>
4) Remove the tumble generator valve assembly. <Ref. to FU(H4DO(w/o HEV))-85, REMOVAL, Tumble Generator Valve Assembly.> <Ref. to FU(H4DO(HEV))-73, REMOVAL, Tumble Generator Valve Assembly.>
5) Remove the chain cover. <Ref. to ME(H4DO(w/o HEV))-149, REMOVAL, Chain Cover.>
6) Remove the rocker cover. <Ref. to ME(H4DO(w/o HEV))-202, REMOVAL, Rocker Cover.>
7) Remove the cam carrier. <Ref. to ME(H4DO(w/o HEV))-220, REMOVAL, Cam Carrier.>
8) Remove the cylinder head. <Ref. to ME(H4DO(w/o HEV))-263, REMOVAL, Cylinder Head.>
9) Remove the crank sprocket. <Ref. to ME(H4DO(w/o HEV))-201, REMOVAL, Crank Sprocket.>
10) Remove the engine rear hanger from cylinder block RH.



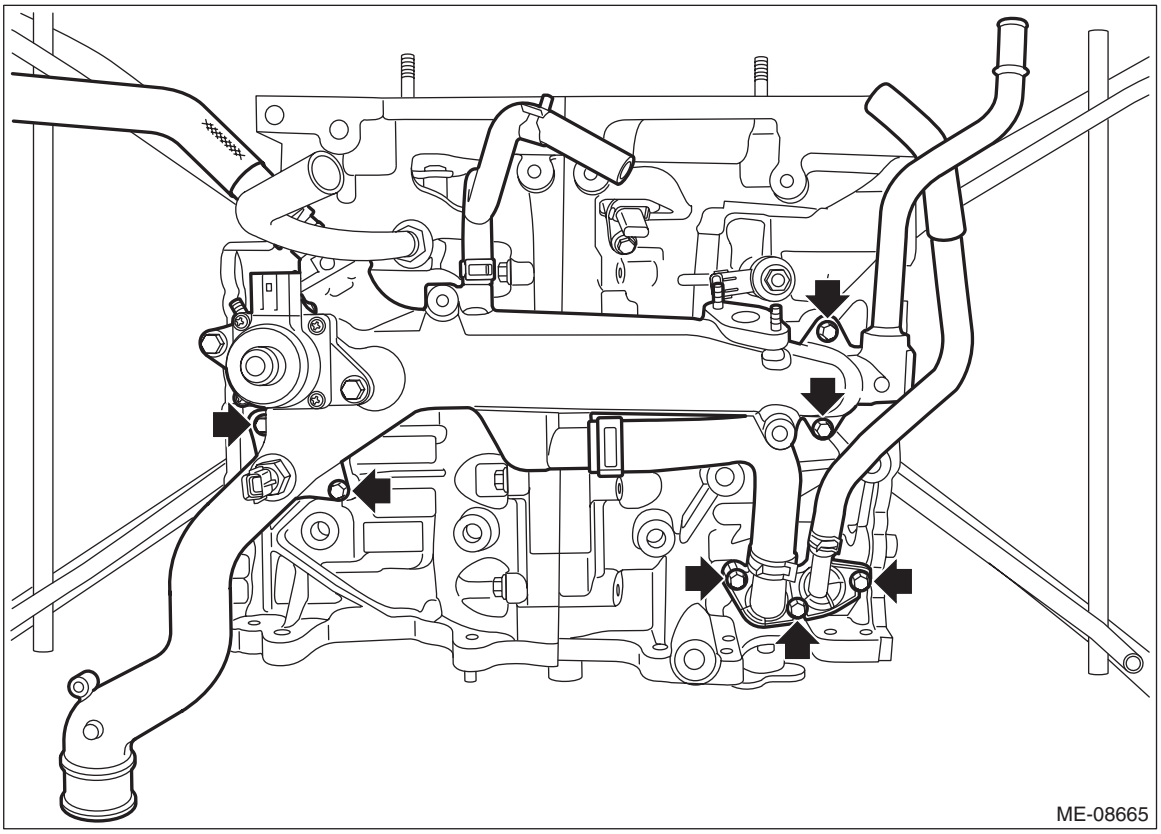
(A) Gasoline engine CVT model (B) Gasoline engine MT model (C) HEV model

11) Remove the bolts securing the water pipe assembly and PCV connector to the cylinder block, and remove the water pipe assembly, PCV connector and brake vacuum pipe (HEV model) as a set from cylinder block.

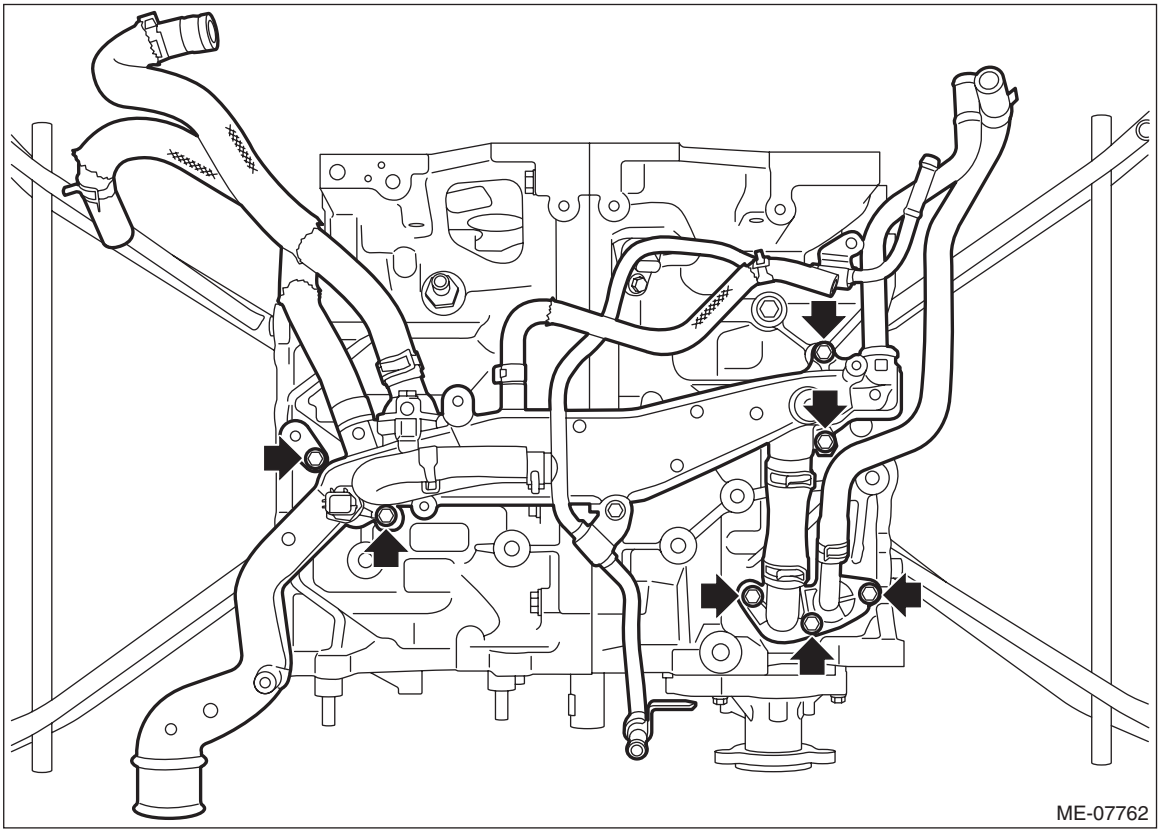
- Gasoline engine CVT model



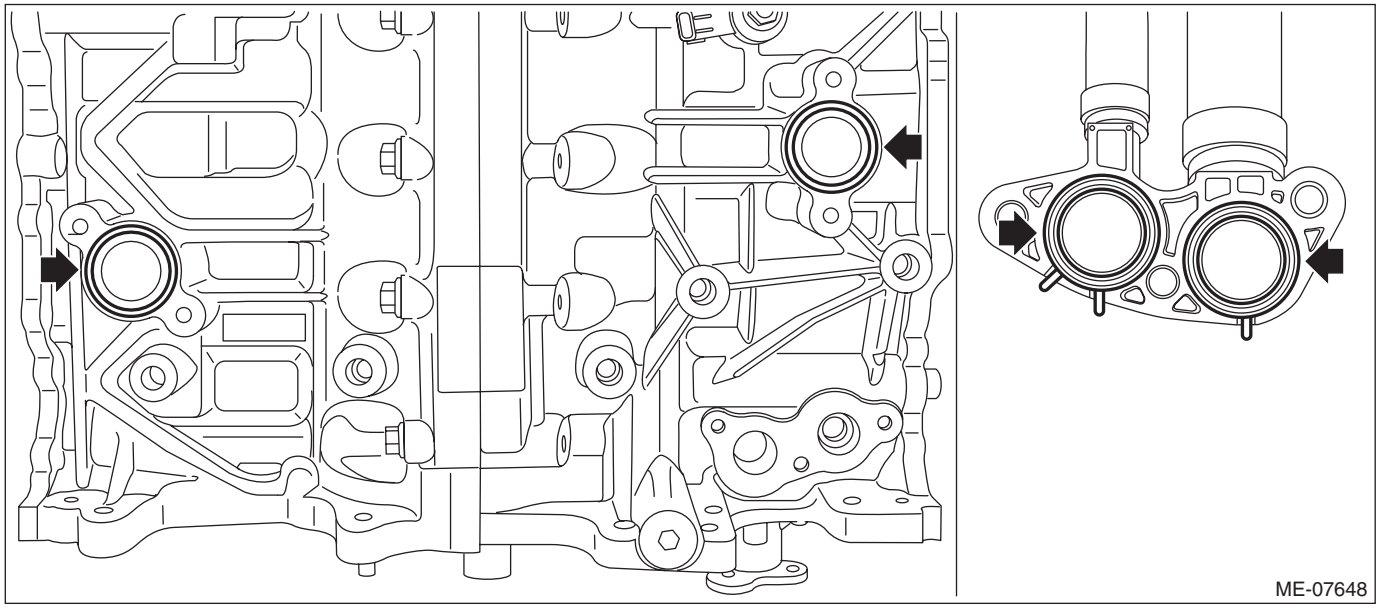
- Gasoline engine MT model



- HEV model

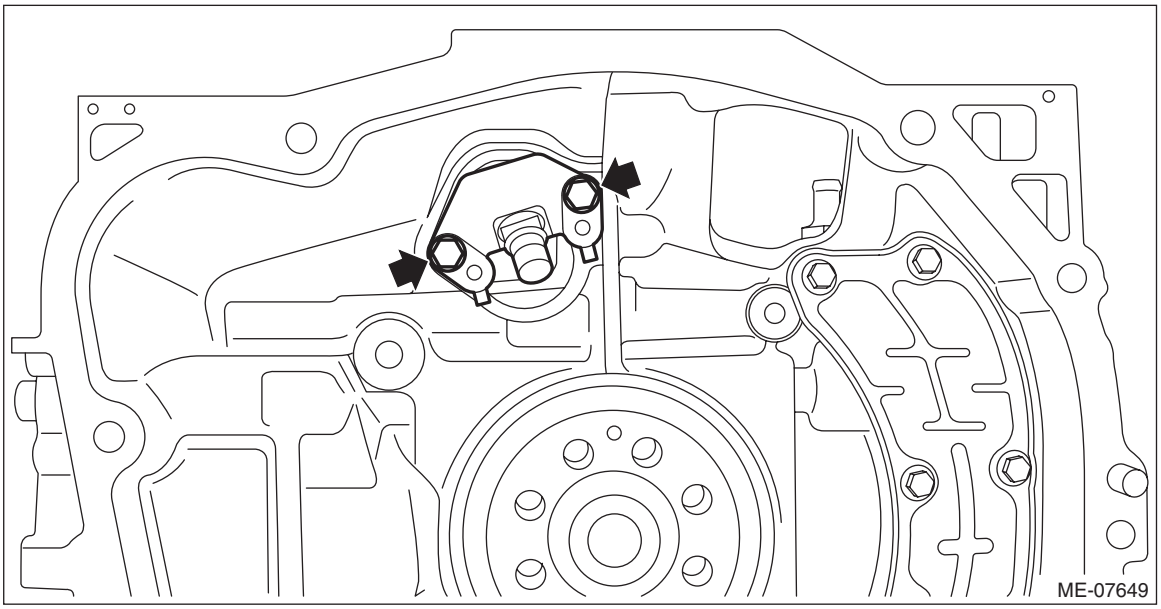


12) Remove the O-ring from the cylinder block and PCV connector.

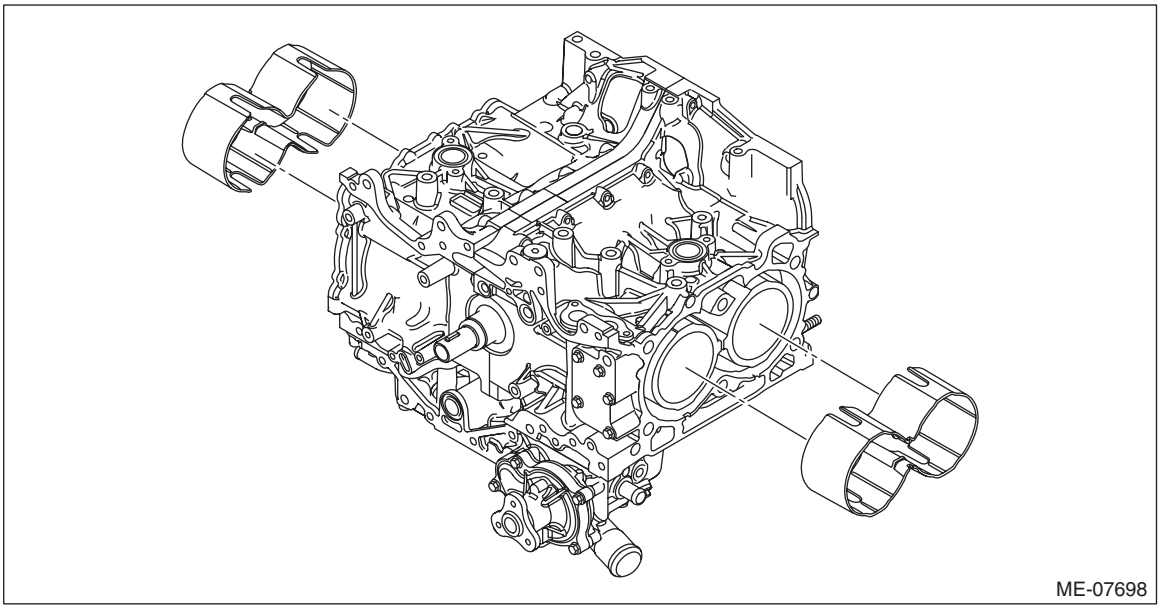


13) Remove the knock sensor. <Ref. to FU(H4DO(w/o HEV))-68, REMOVAL, Knock Sensor.> <Ref. to FU(H4DO(HEV))-59, REMOVAL, Knock Sensor.>
14) Remove the PCV valve. <Ref. to EC(H4DO(w/o HEV))-65, REMOVAL, PCV Valve.> <Ref. to EC(H4DO(HEV))-53, REMOVAL, PCV Valve.>
15) Remove the crankshaft position sensor plate with drive plate. (CVT model) <Ref. to CVT(TR580)-162, REMOVAL, Drive Plate.> <Ref. to CVT(TH58A)-175, REMOVAL, Drive Plate.>
16) Remove the clutch disc and cover. (MT model) <Ref. to CL-9, REMOVAL, Clutch Disc and Cover.>
17) Remove the crankshaft position sensor plate with flywheel. (MT model) <Ref. to CL-11, REMOVAL, Flywheel.>

18) Remove the bolts securing the crankshaft position sensor holder from the cylinder block LH, and remove the crankshaft position sensor with crankshaft position sensor holder.

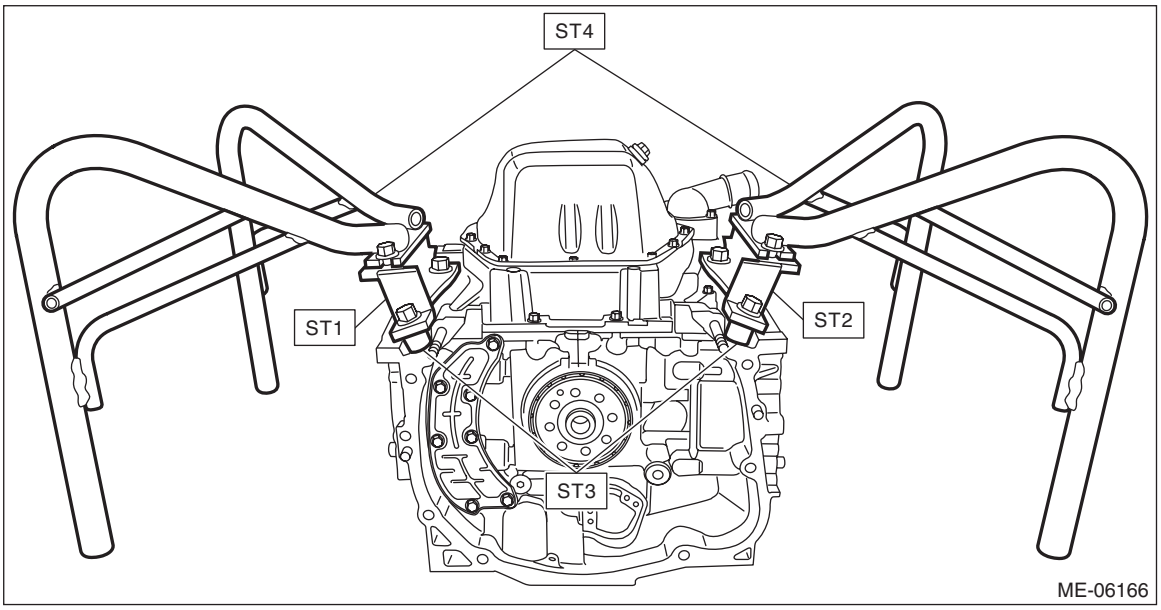


19) Remove the water jacket spacer from the cylinder block RH and cylinder block LH.

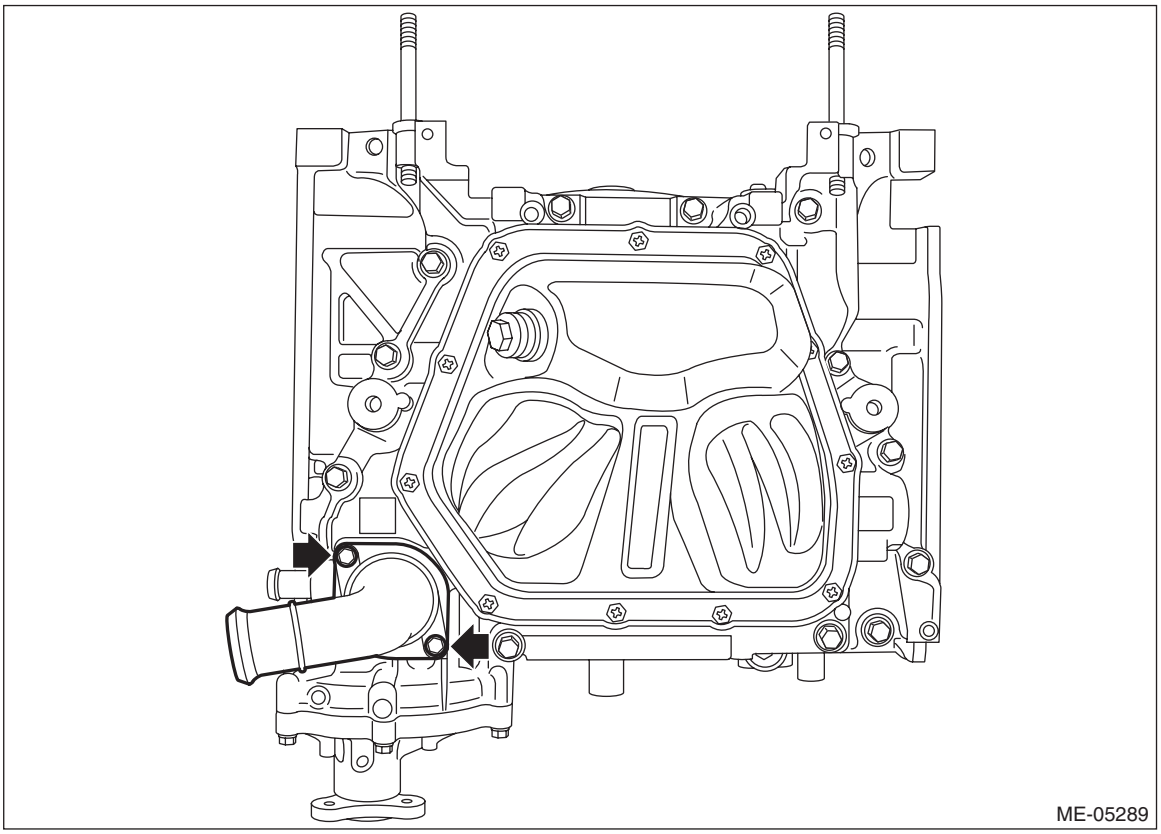


20) Set the cylinder block so that the oil pan is on the upper side, remove the ST1, ST2, ST3 and ST4 from cylinder block and oil pan upper.

ST1	498457000	ENGINE STAND ADAPTER RH
ST2	498457100	ENGINE STAND ADAPTER LH
ST3	18362AA020	ADAPTER
ST4	499817100	ENGINE STAND

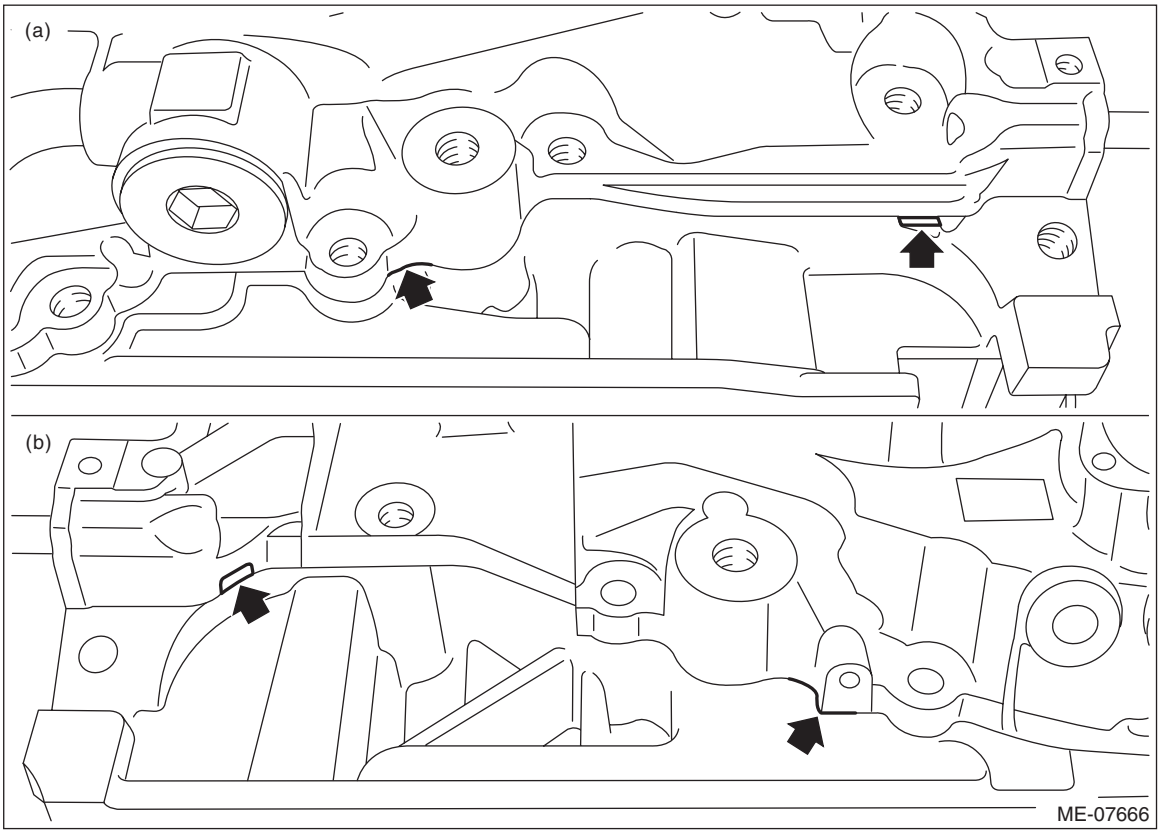


21) Remove the thermostat cover from oil pan upper, and then remove the thermostat.

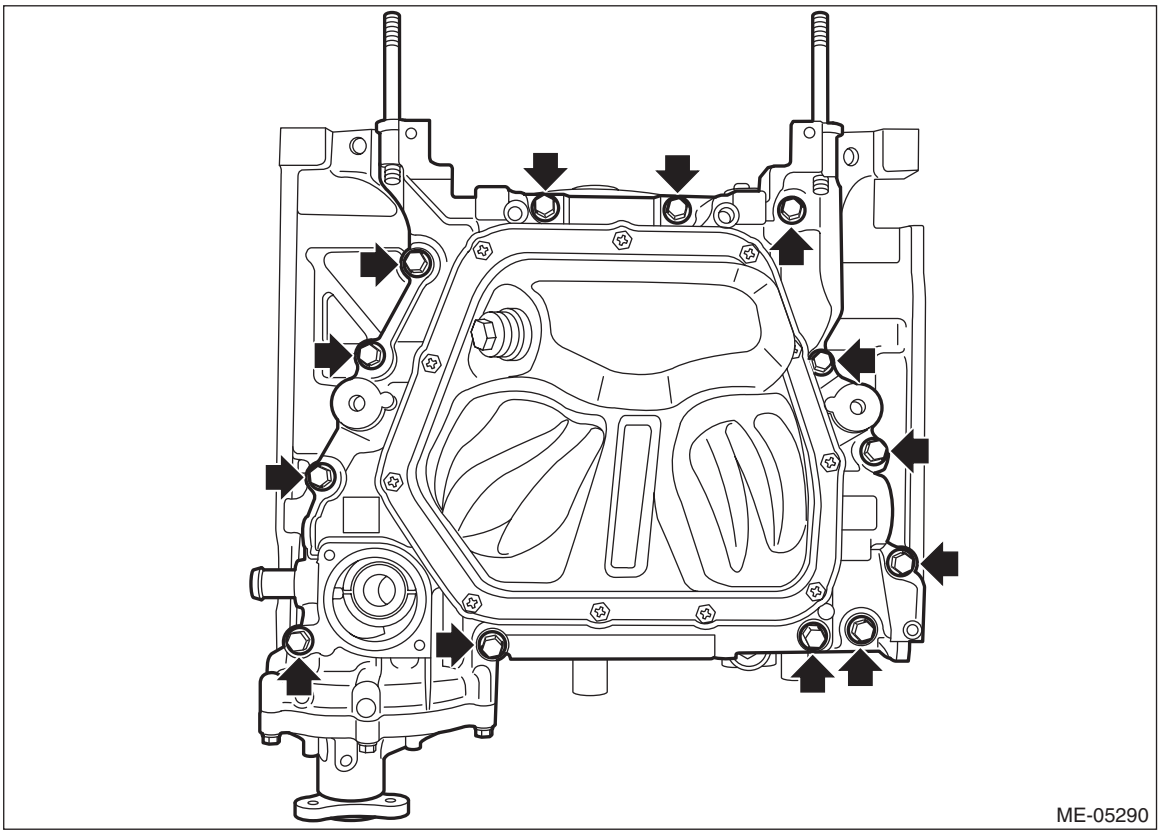


22) Remove the oil pan upper with oil pan from cylinder block.

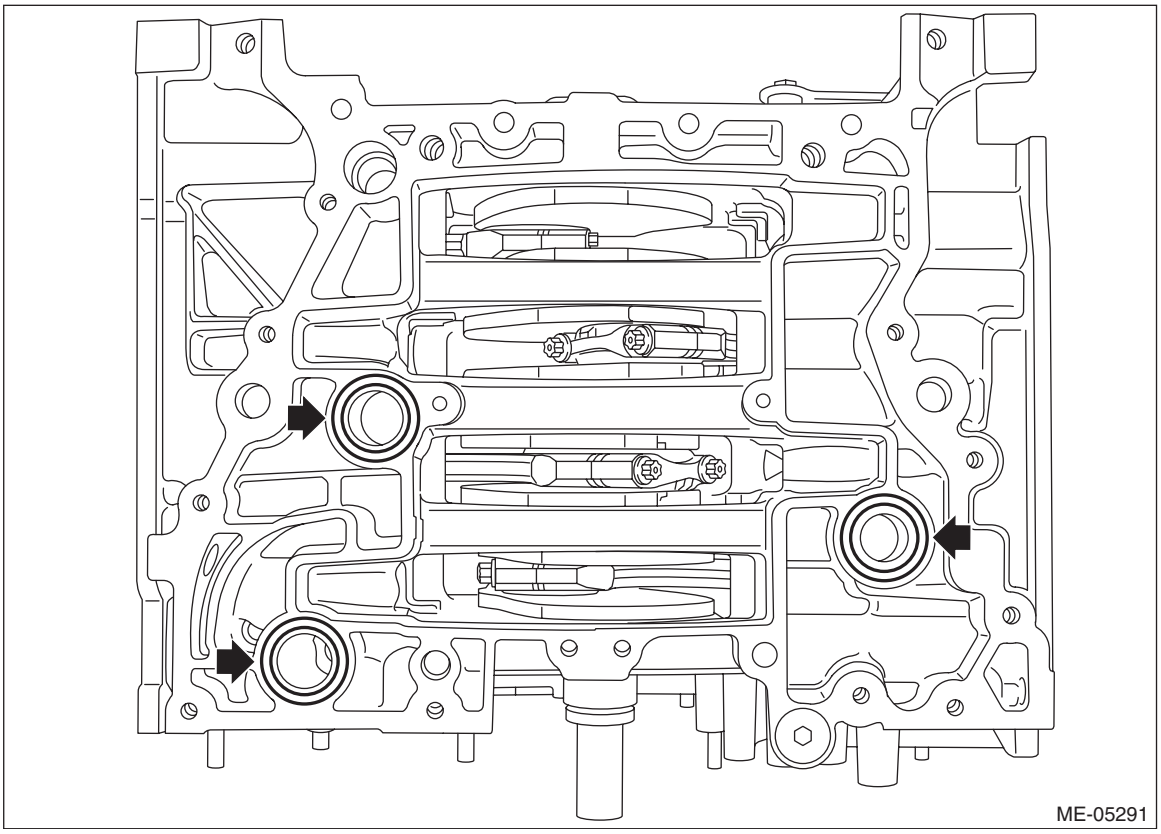
NOTE:
Pry the points shown in the figure with a crowbar wrapped by protective tape, and then remove the oil pan upper.



(a) RH side (b) LH side

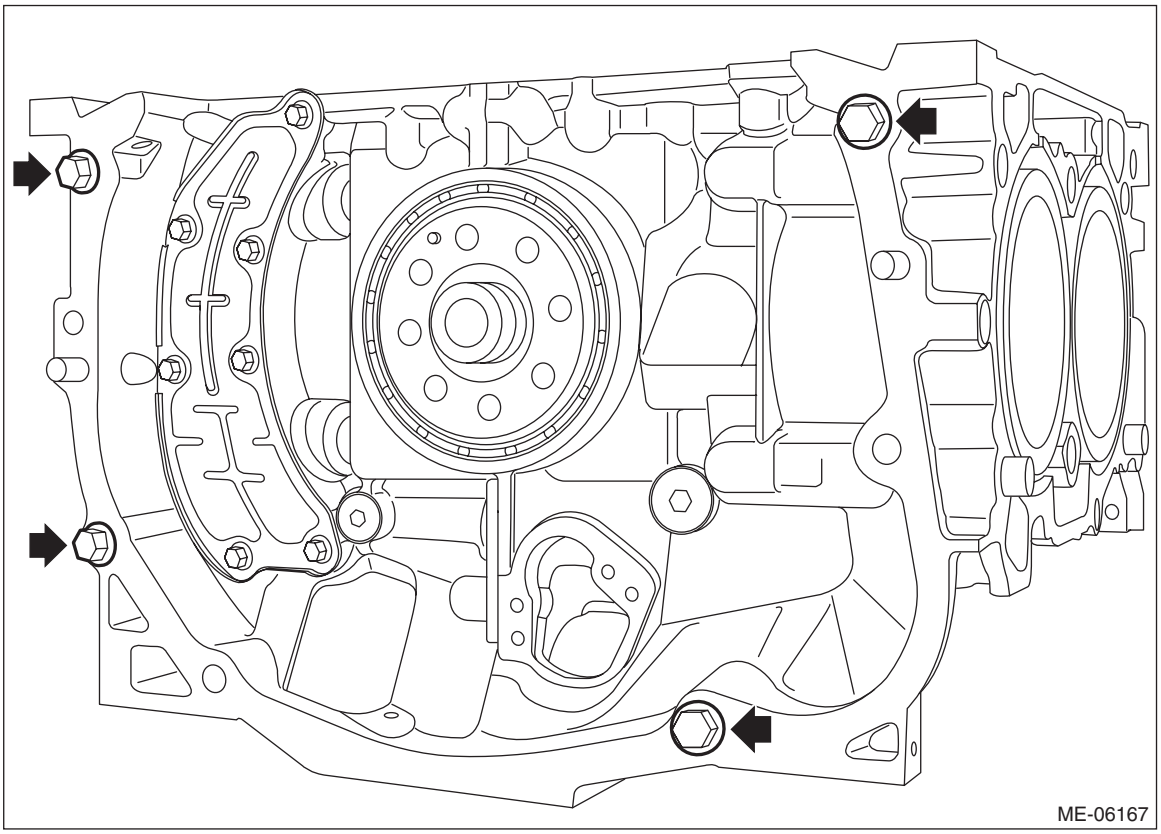


23) Remove the O-ring from the cylinder block.



24) Install a bolt of suitable length (M10 × P1.25) at the locations shown in the figure.

NOTE:
• This procedure is required to prevent the knock pin damage when the cylinder block is raised in the next step.
• Use the same length of bolt for the four bolts.



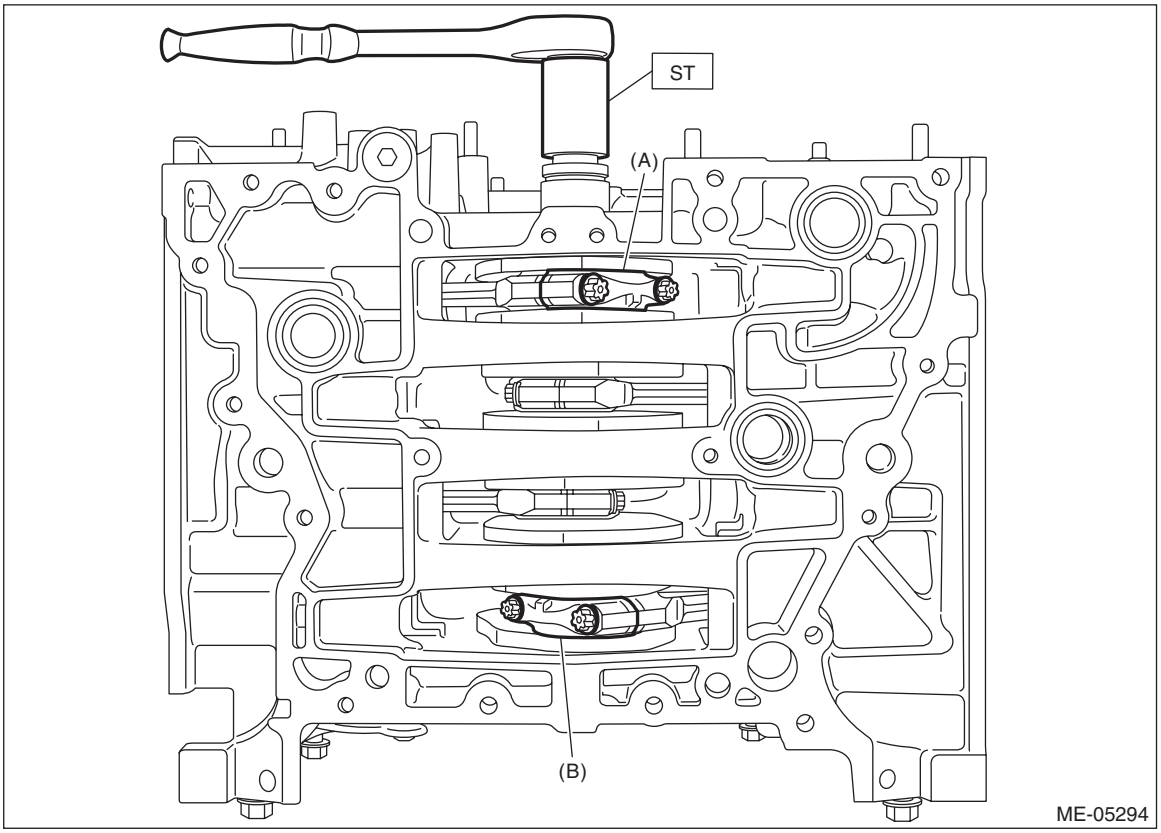
25) Raise the cylinder block so that the rear oil seal is on the lower side.

26) Remove the #1 and #4 connecting rod caps and pistons from the cylinder block.

NOTE:
Mark each connecting rod cap and piston with a cylinder number.

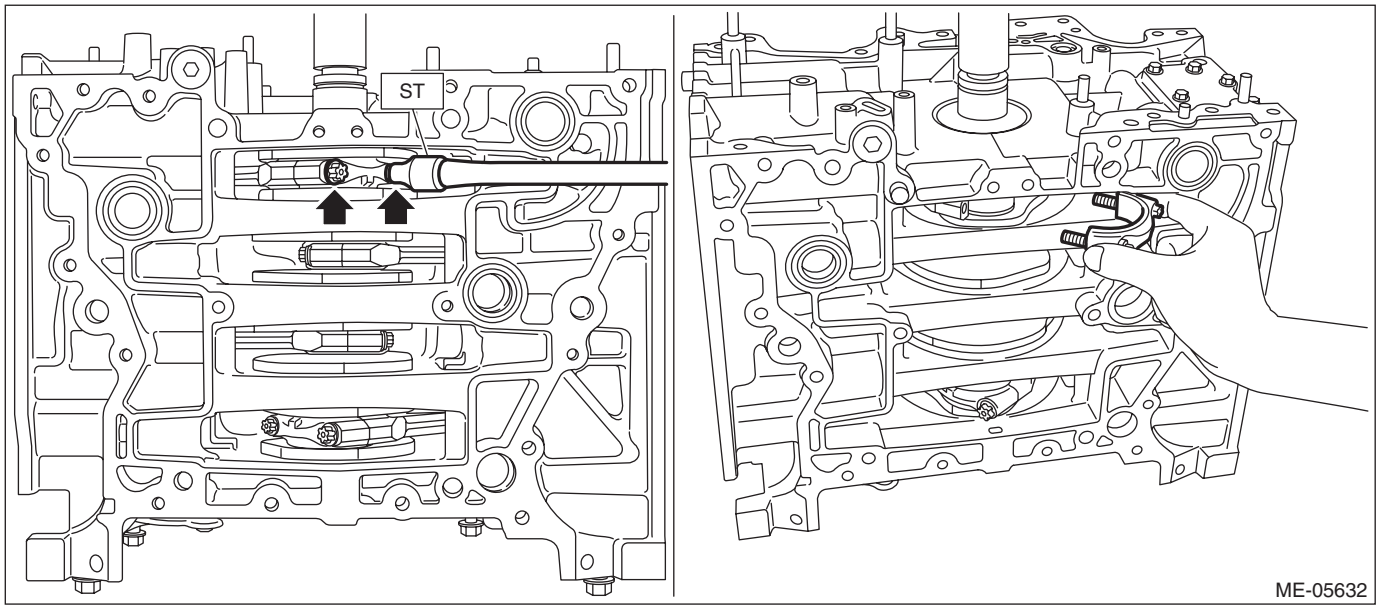
(1) Turn the crankshaft so that the #1 connecting rod cap (A) and #4 connecting rod cap (B) is located at the position shown in the figure using ST.

ST 18252AA000 CRANKSHAFT SOCKET



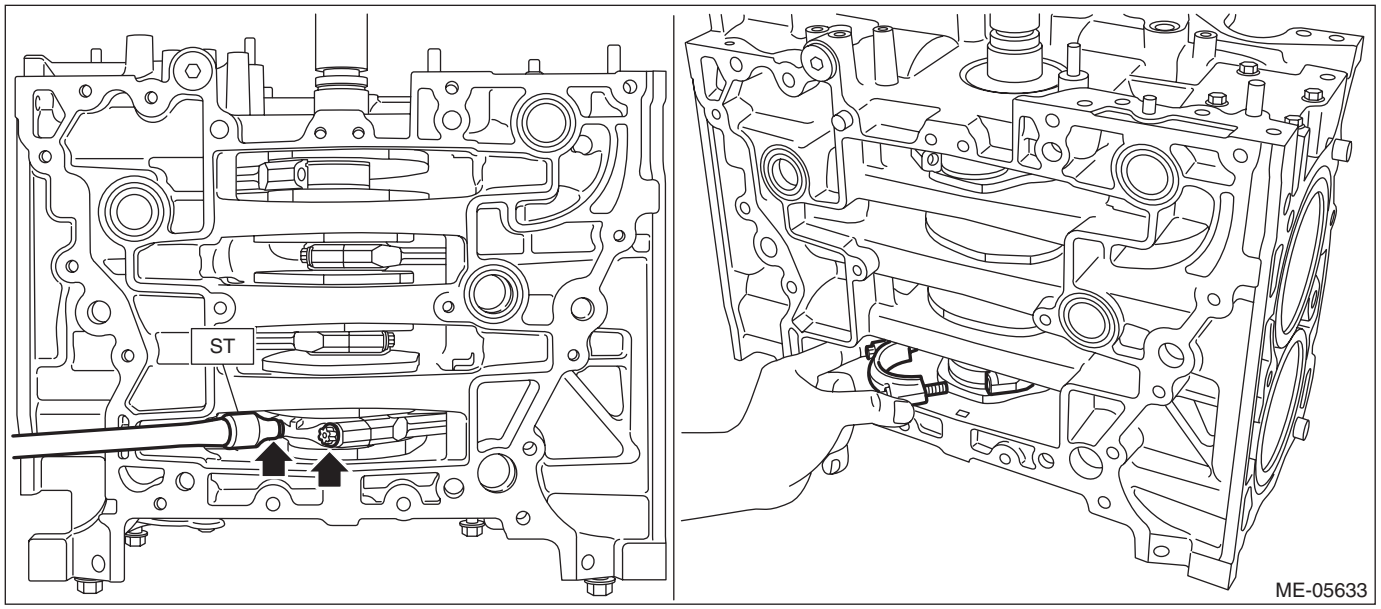
(2) Using ST, loosen the #1 connecting rod cap bolt, and remove the #1 connecting rod cap bolt and #1 connecting rod cap.

ST 18270AA020 SOCKET



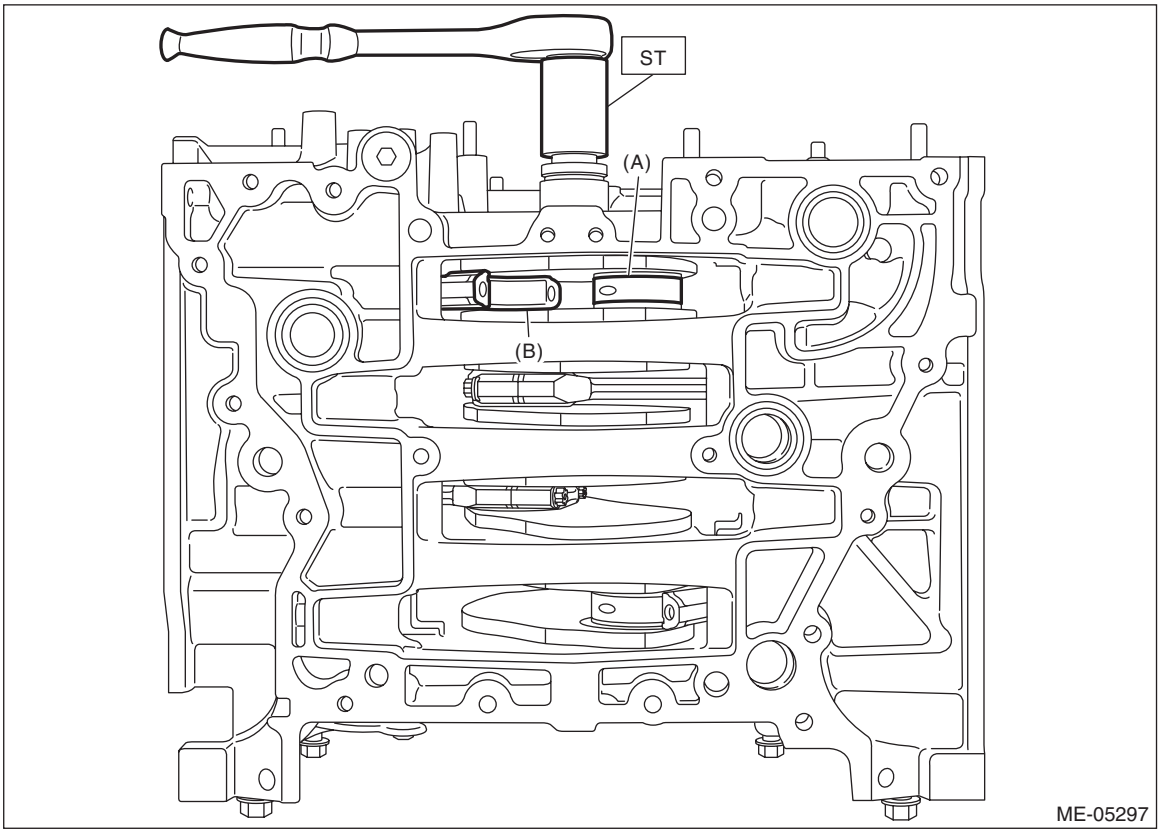
(3) Using ST, loosen the #4 connecting rod cap bolt, and remove the #4 connecting rod cap bolt and #4 connecting rod cap.

ST 18270AA020 SOCKET

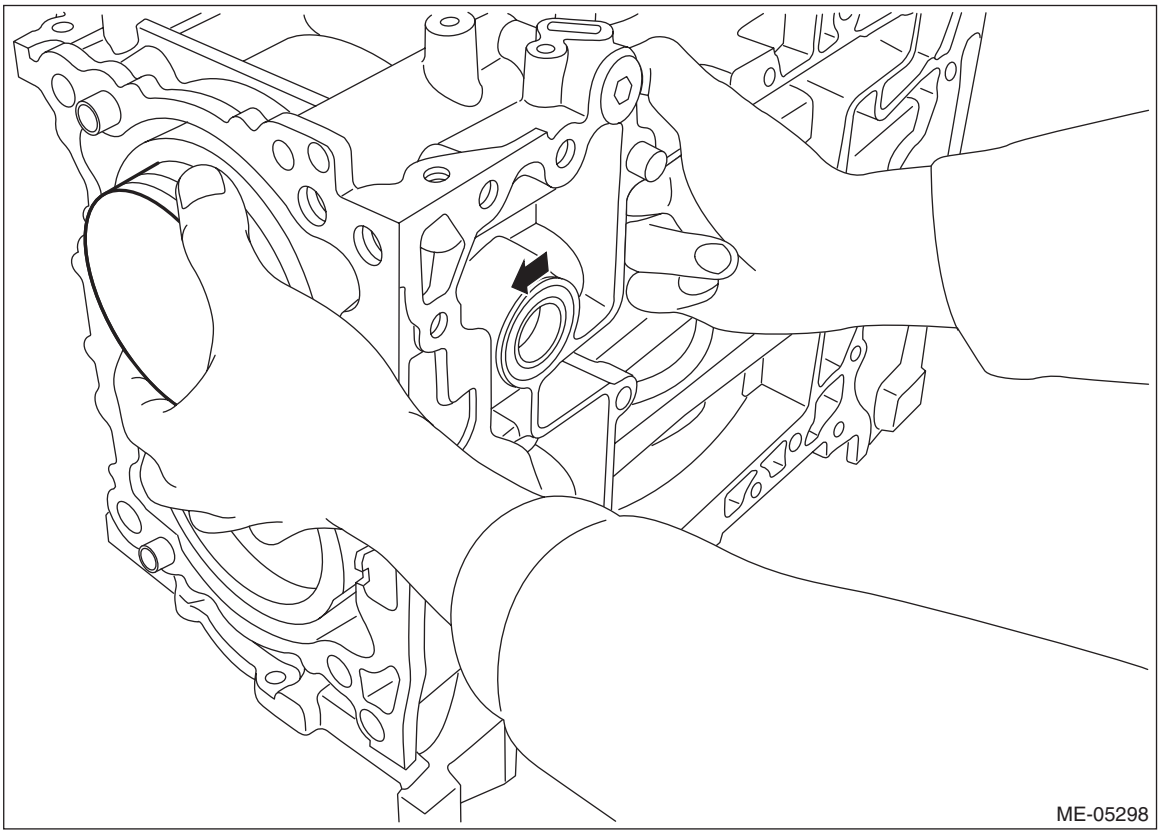


(4) Using the ST, turn the crankshaft counterclockwise and separate the positions of the #1 pin (A) of crankshaft and the large end (B) of #1 connecting rod.

ST 18252AA000 CRANKSHAFT SOCKET

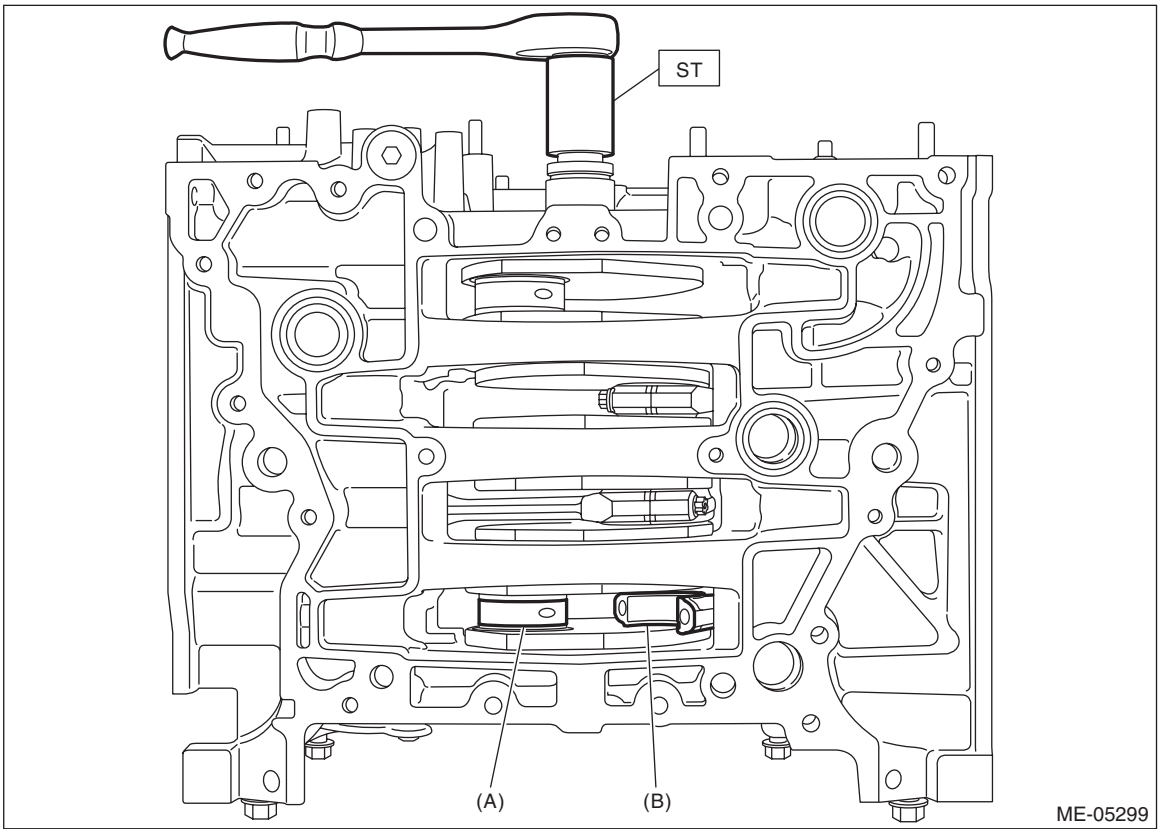


(5) Push the #1 connecting rod in the direction of the arrow, and remove the #1 piston with #1 connecting rod from the cylinder block.

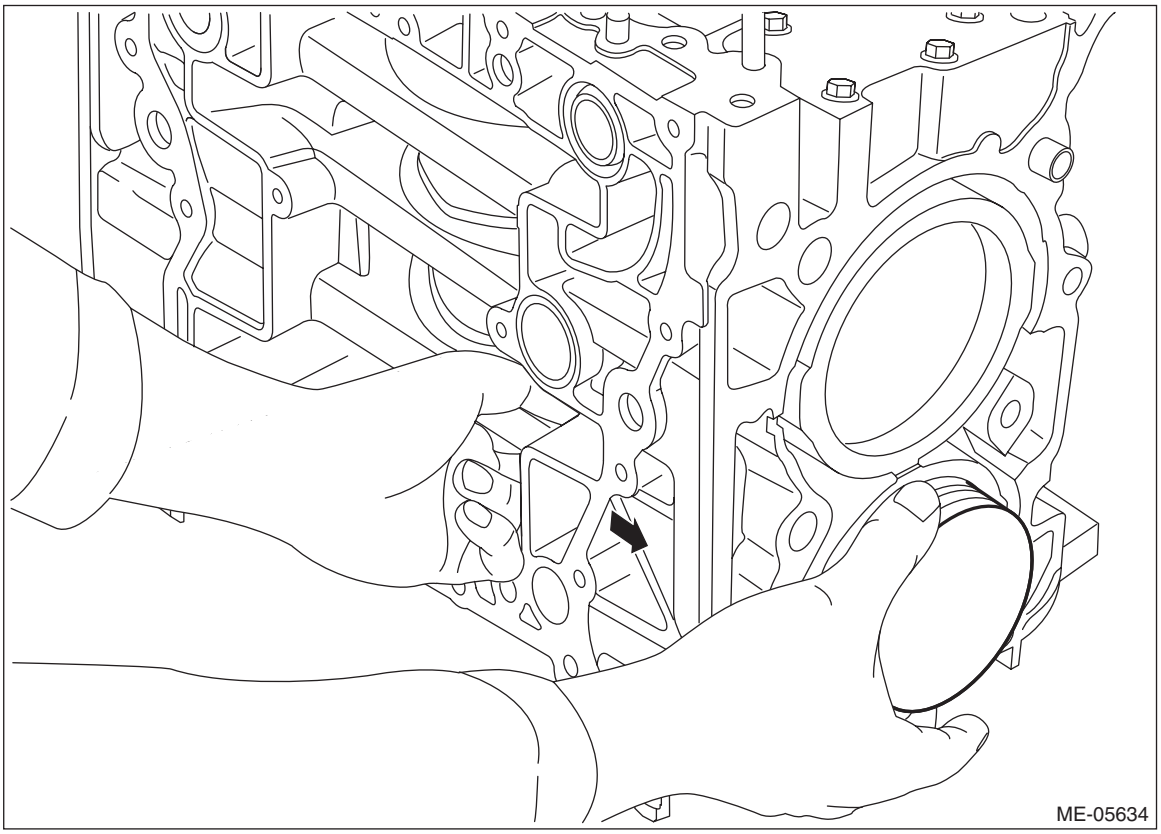


(6) Using the ST, turn the crankshaft clockwise and separate the positions of the #4 pin (A) of crankshaft and the large end (B) of #4 connecting rod.

ST 18252AA000 CRANKSHAFT SOCKET



(7) Push the #4 connecting rod in the direction of the arrow, and remove the #4 piston with #4 connecting rod from the cylinder block.

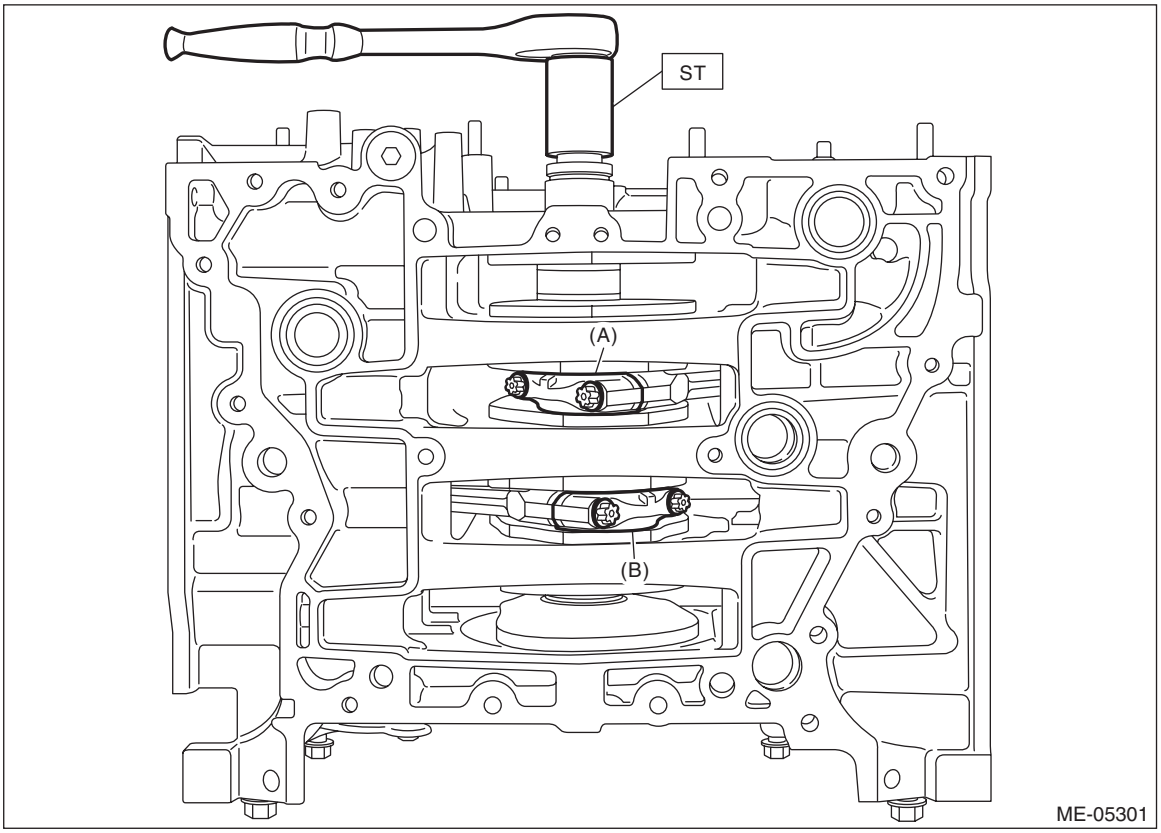


27) Remove the #2 and #3 connecting rod caps and pistons from the cylinder block.

NOTE:
Mark each connecting rod cap and piston with a cylinder number.

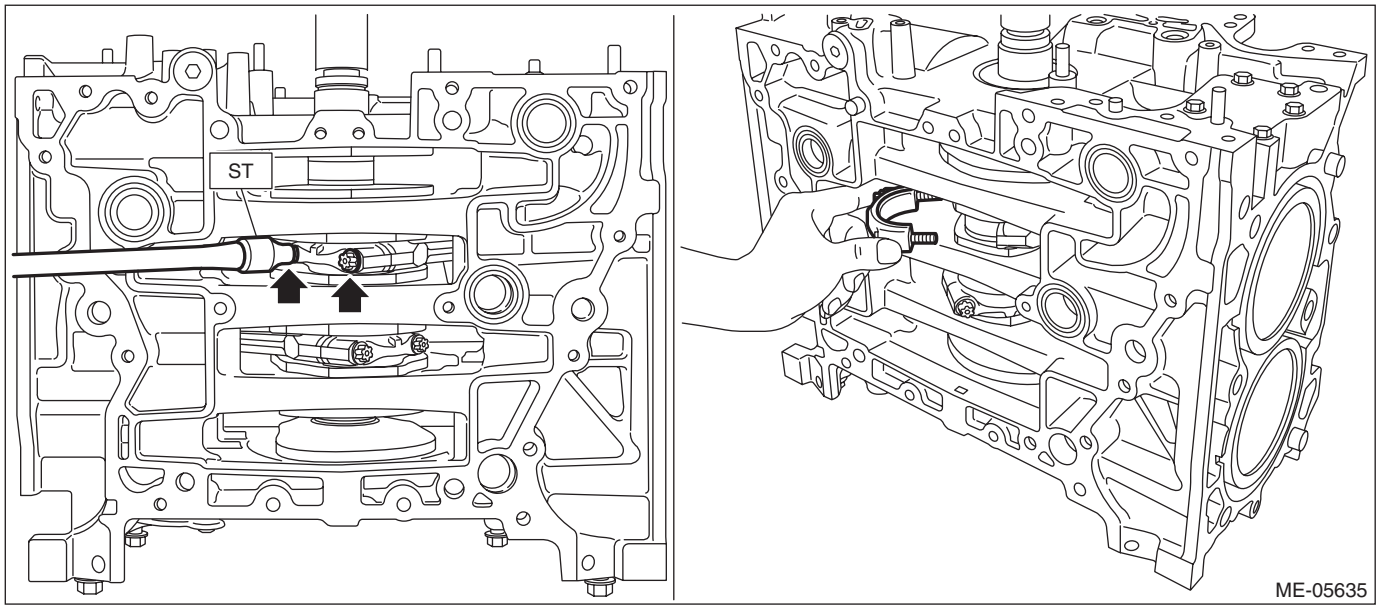
(1) Turn the crankshaft so that the #2 connecting rod cap (A) and #3 connecting rod cap (B) is located at the position shown in the figure using ST.

ST 18252AA000 CRANKSHAFT SOCKET



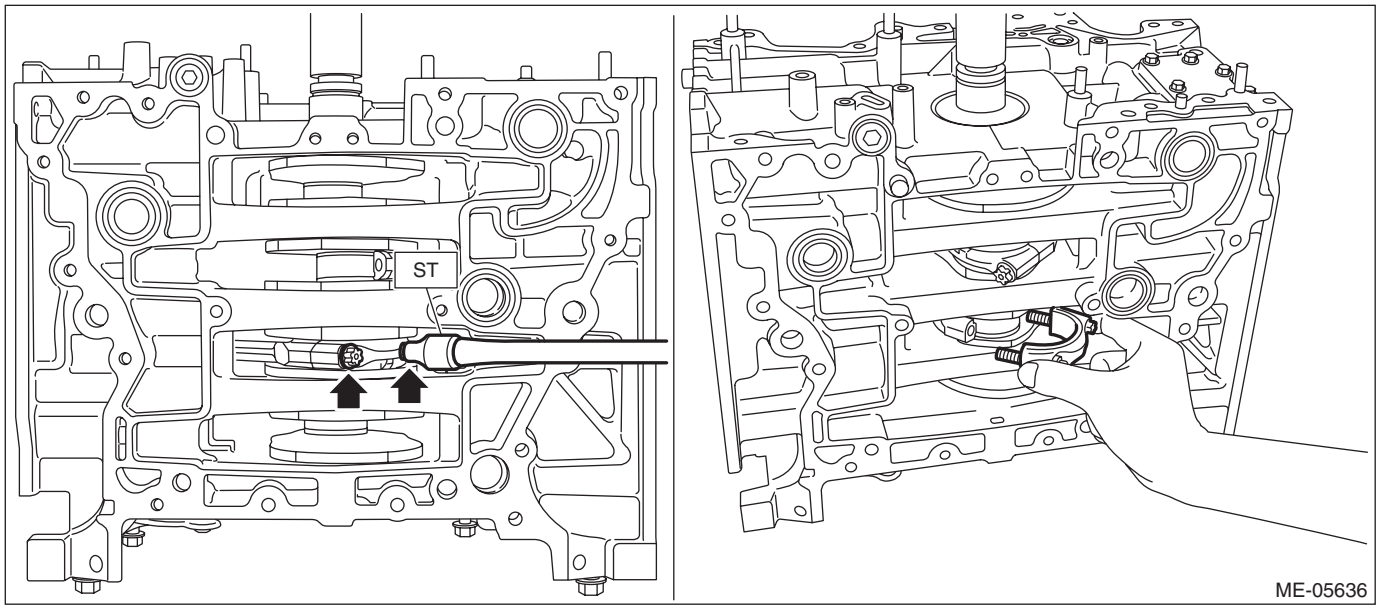
(2) Using ST, loosen the #2 connecting rod cap bolt, and remove the #2 connecting rod cap bolt and #2 connecting rod cap.

ST 18270AA020 SOCKET



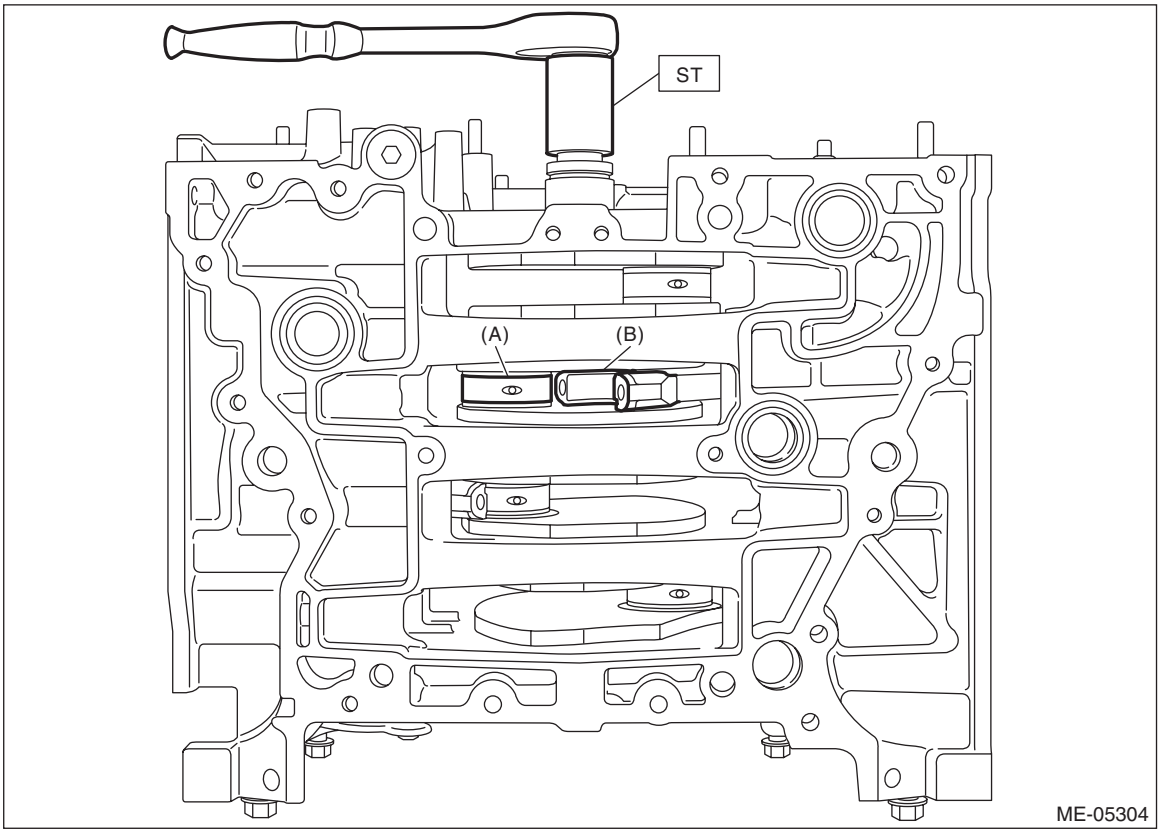
(3) Using ST, loosen the #3 connecting rod cap bolt, and remove the #3 connecting rod cap bolt and #3 connecting rod cap.

ST 18270AA020 SOCKET

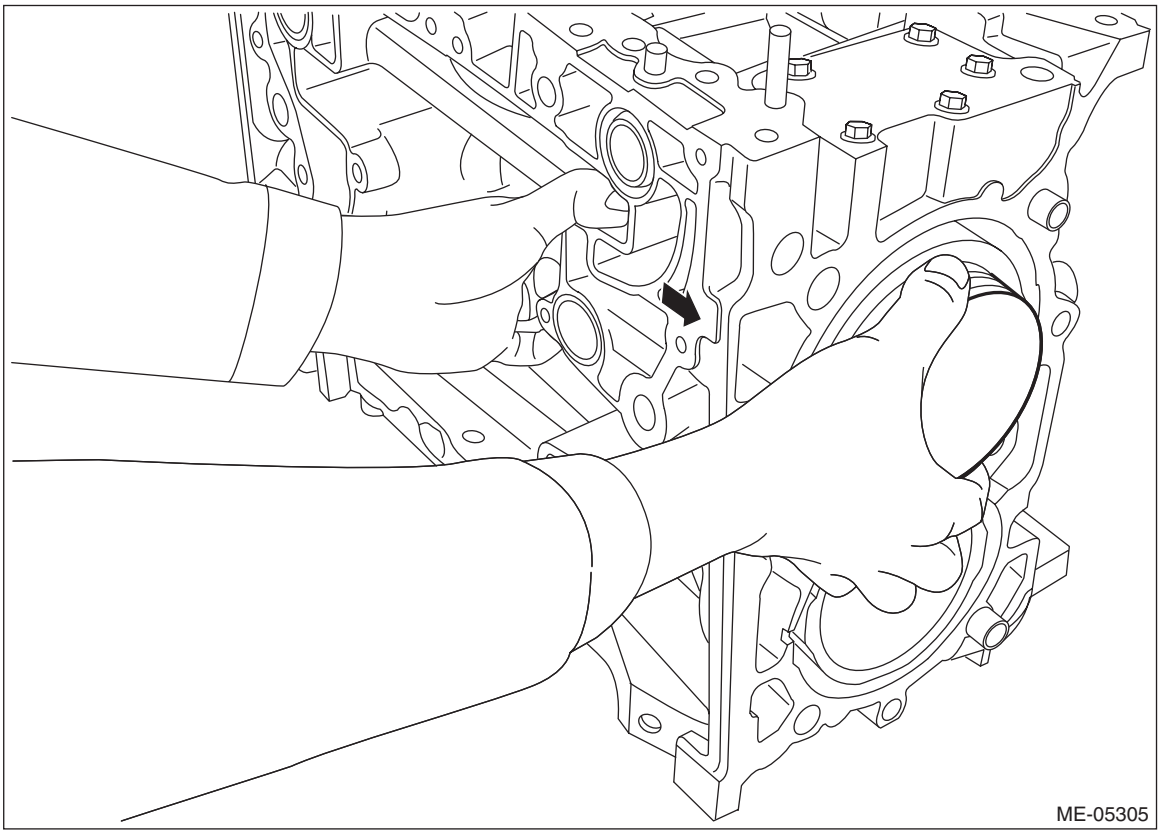


(4) Using the ST, turn the crankshaft clockwise and separate the positions of the #2 pin (A) of crankshaft and the large end (B) of #2 connecting rod.

ST 18252AA000 CRANKSHAFT SOCKET

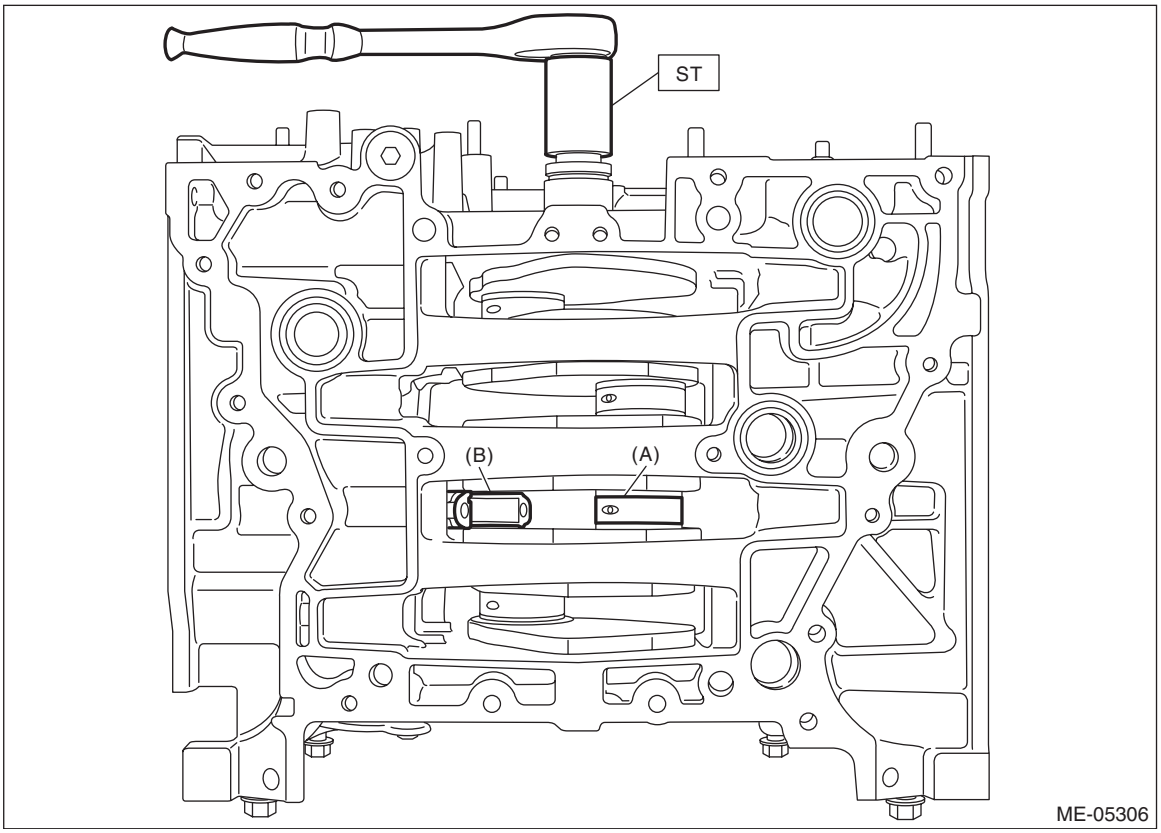


(5) Push the #2 connecting rod in the direction of the arrow, and remove the #2 piston with #2 connecting rod from the cylinder block.

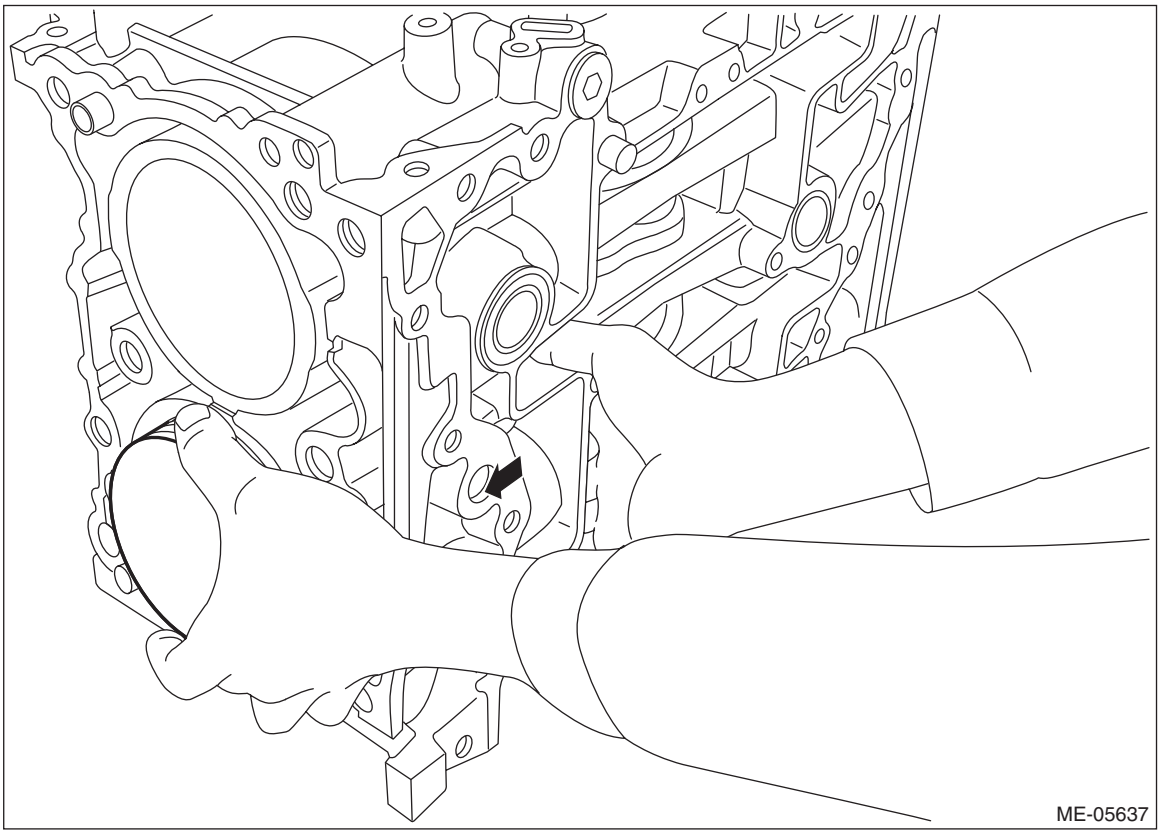


(6) Using the ST, turn the crankshaft counterclockwise and separate the positions of the #3 pin (A) of crankshaft and the large end (B) of #3 connecting rod.

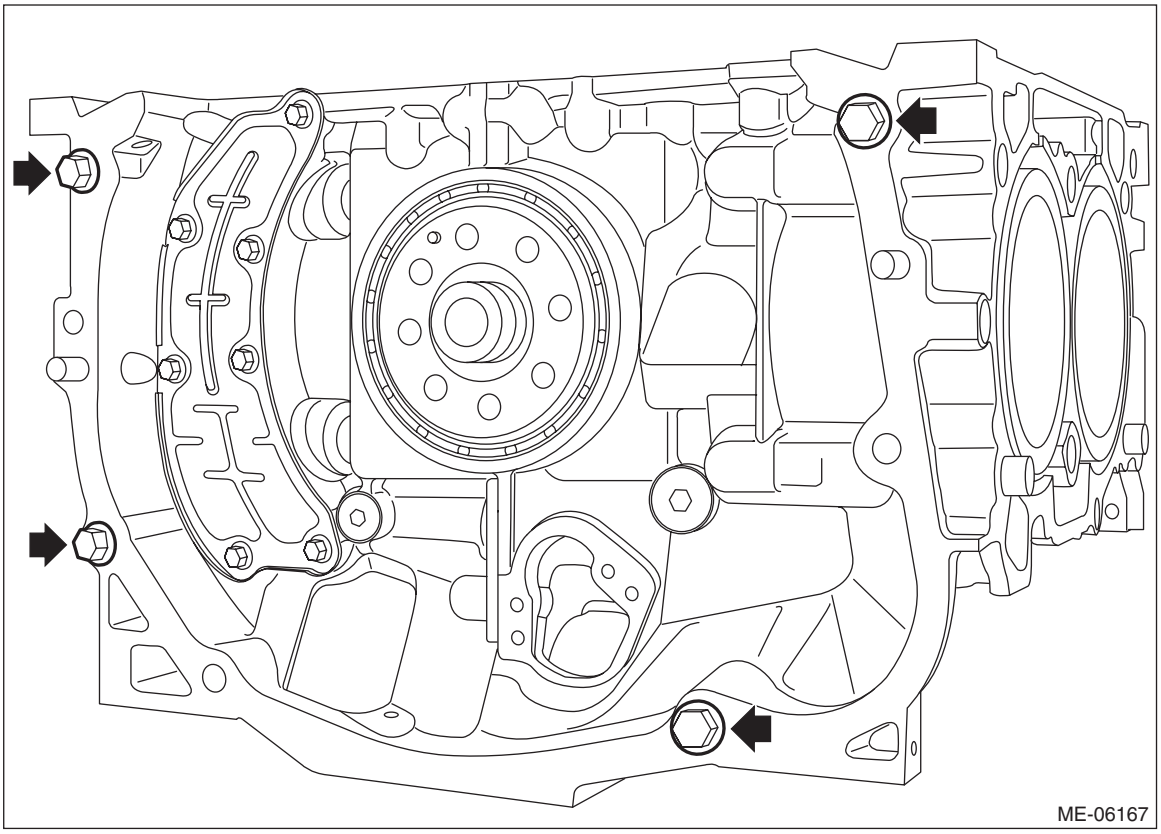
ST 18252AA000 CRANKSHAFT SOCKET



(7) Push the #3 connecting rod in the direction of the arrow, and remove the #3 piston with #3 connecting rod from the cylinder block.

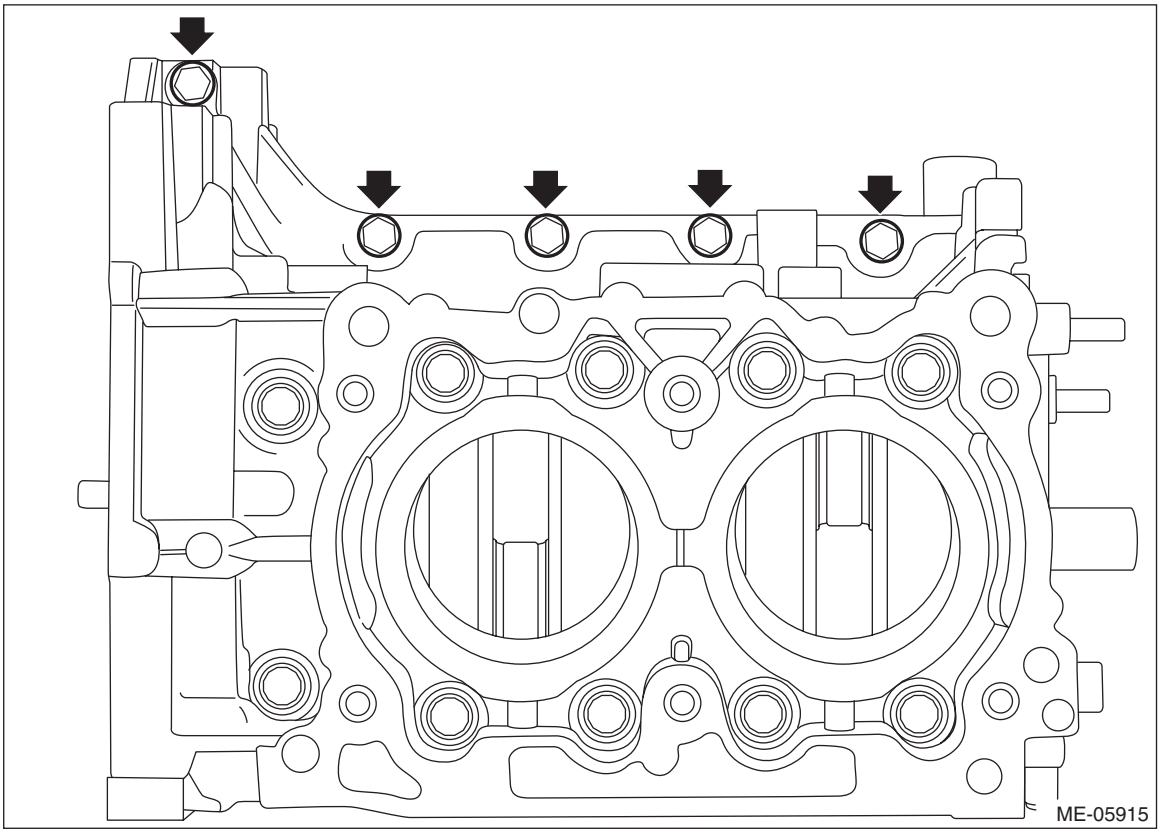


28) Set the cylinder block so that the oil pan side faces upward, and remove the mounting bolts attached to the locations shown in the figure.



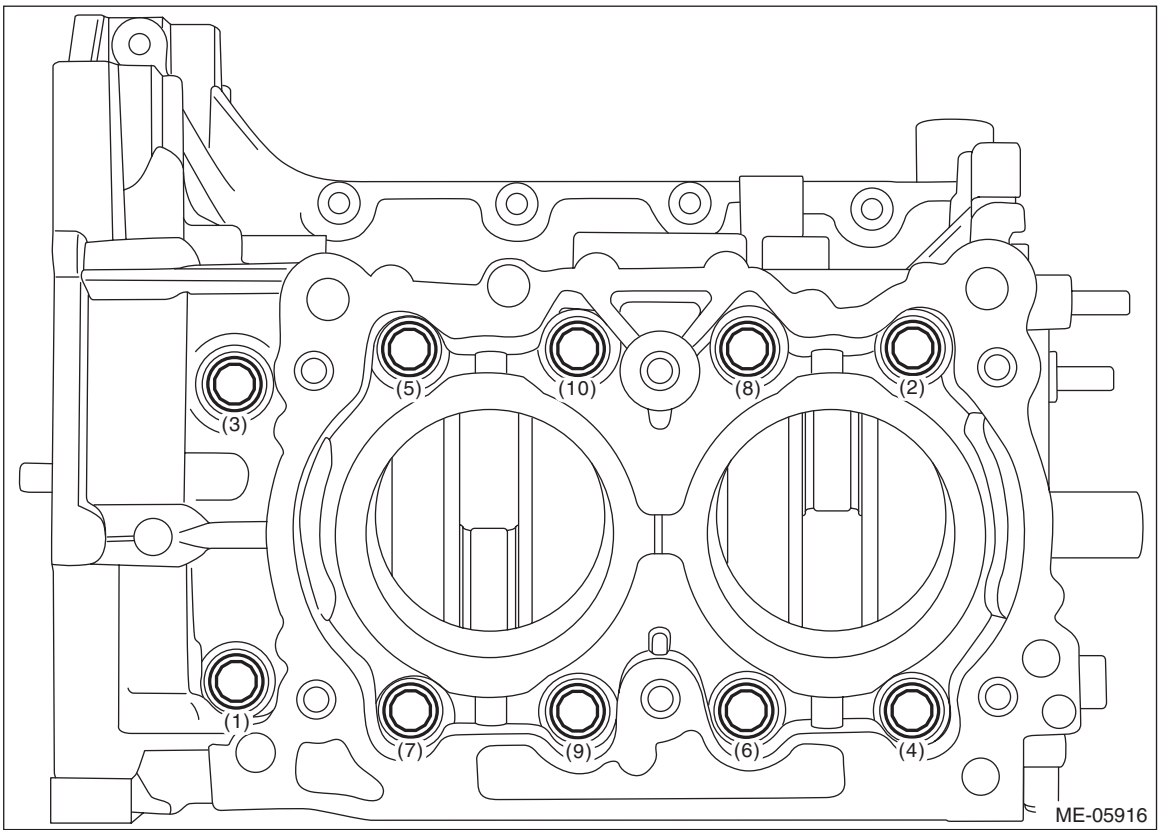
29) Set the part so that the cylinder block RH is on the upper side, and separate the cylinder block.

CAUTION:
• Place a wood board wrapped with a waste cloth to prevent the knock pin damage and to stabilize the cylinder block before work.
• Be careful not to scratch the mating surface of cylinder block during work.
(1) Remove the bolt shown in the figure.



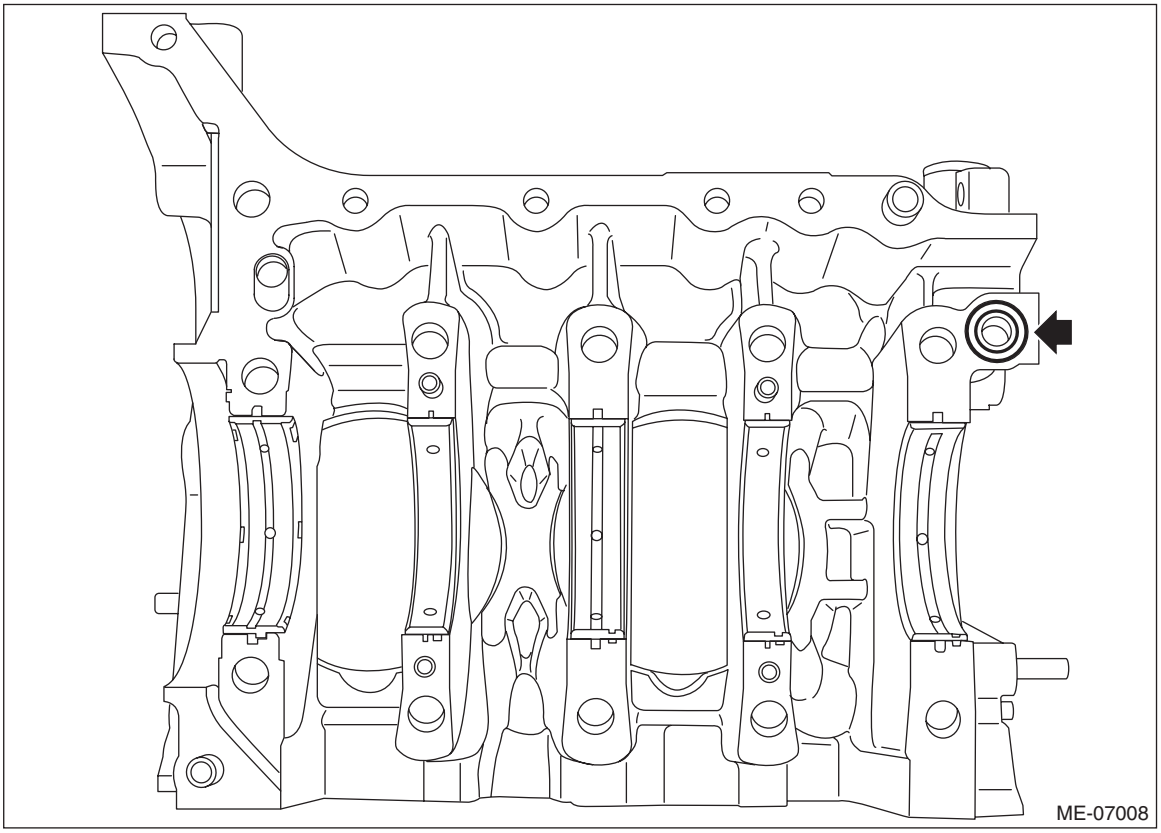
(2) Loosen the cylinder block mounting bolts in numerical order as shown in the figure, and separate the cylinder block RH and LH.

NOTE:
Lift the cylinder block RH slightly, and confirm that the crankshaft is remaining in the cylinder block LH. If the cylinder block RH is lifted carelessly when separating, the crankshaft may stick to cylinder block RH, then fall off.



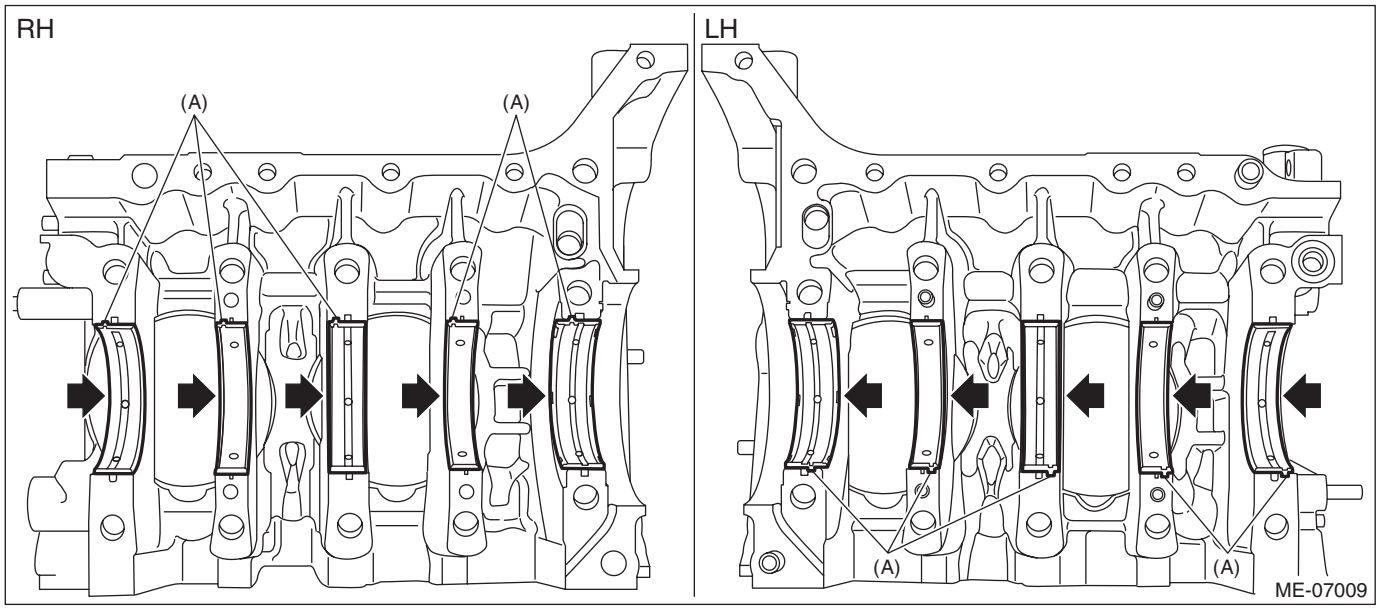
30) Remove the crankshaft from cylinder block LH, and remove the rear oil seal.

31) Remove the O-ring from the cylinder block LH.



32) Remove the crankshaft bearings from the cylinder block.

NOTE:
- Be careful not to confuse the crankshaft bearing combination.
- Press the bearing at the end opposite to locking lip (A).

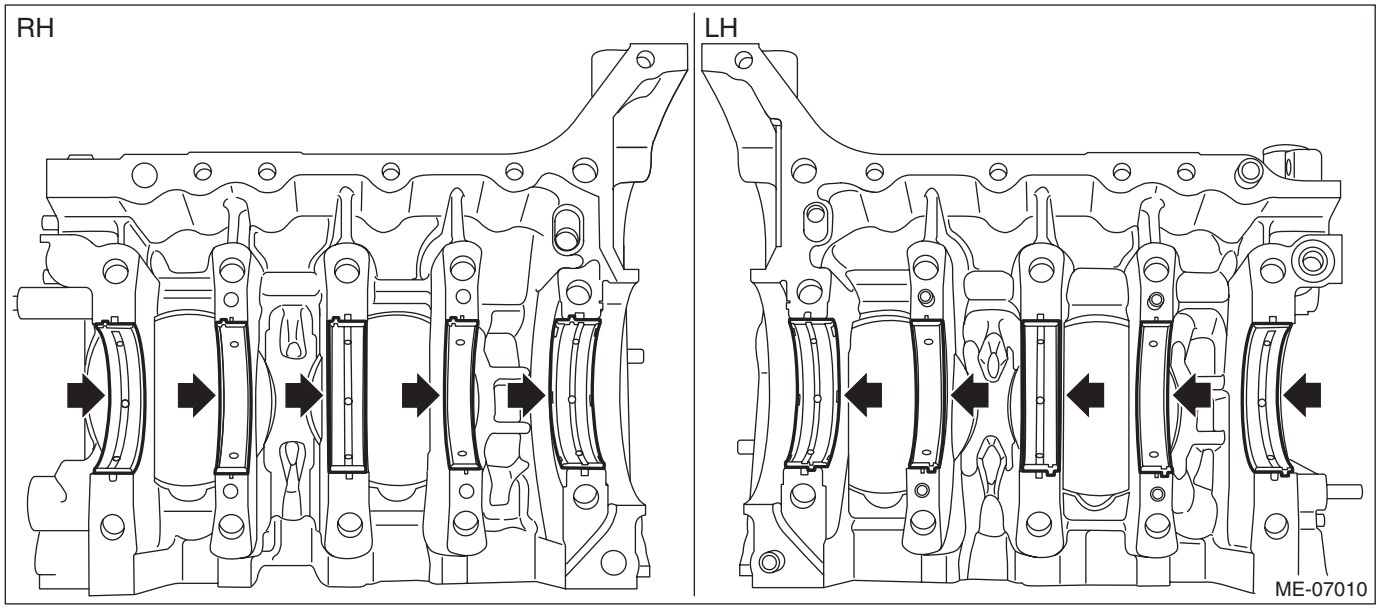


33) Remove the liquid gasket from cylinder block.

B: INSTALLATION

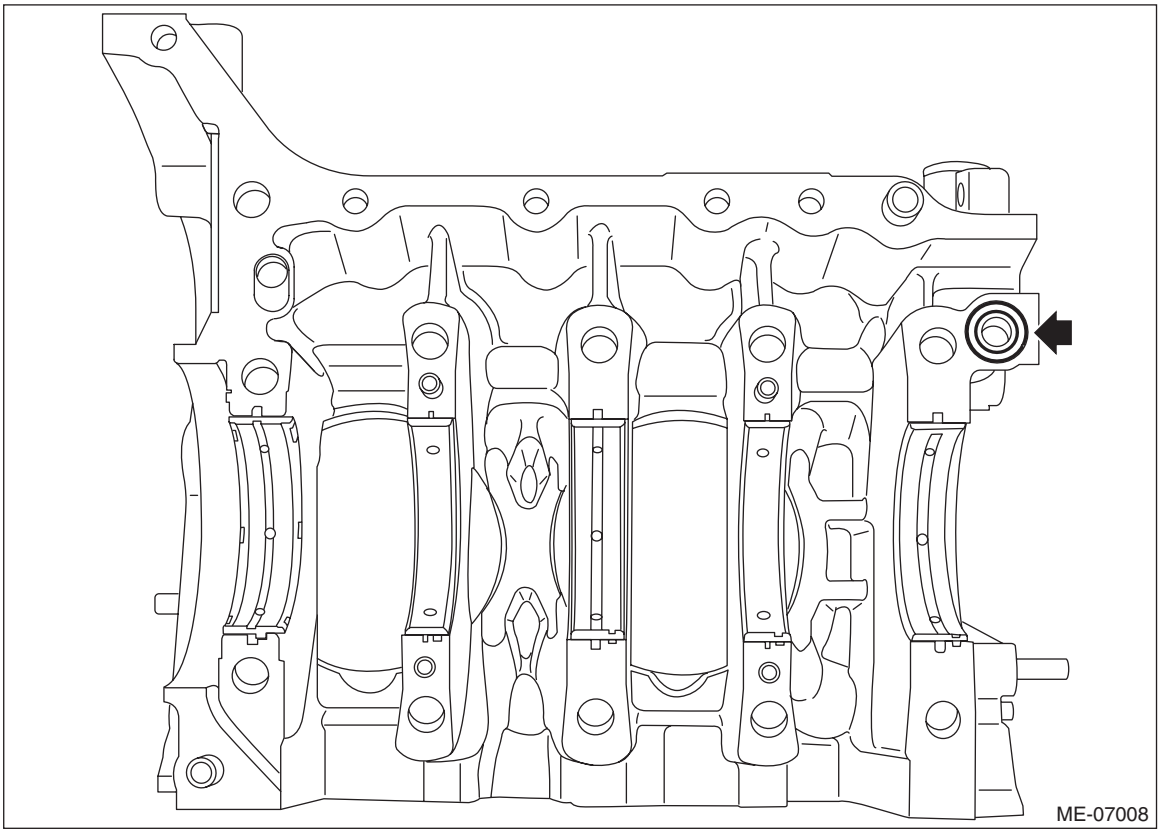
1) Apply engine oil to the crankshaft bearing, and install the crankshaft bearing to the cylinder block.

CAUTION:
• Place a wood board wrapped with a waste cloth to prevent the knock pin damage and to stabilize the cylinder block before work.
• Be careful not to scratch the mating surface of cylinder block during work.

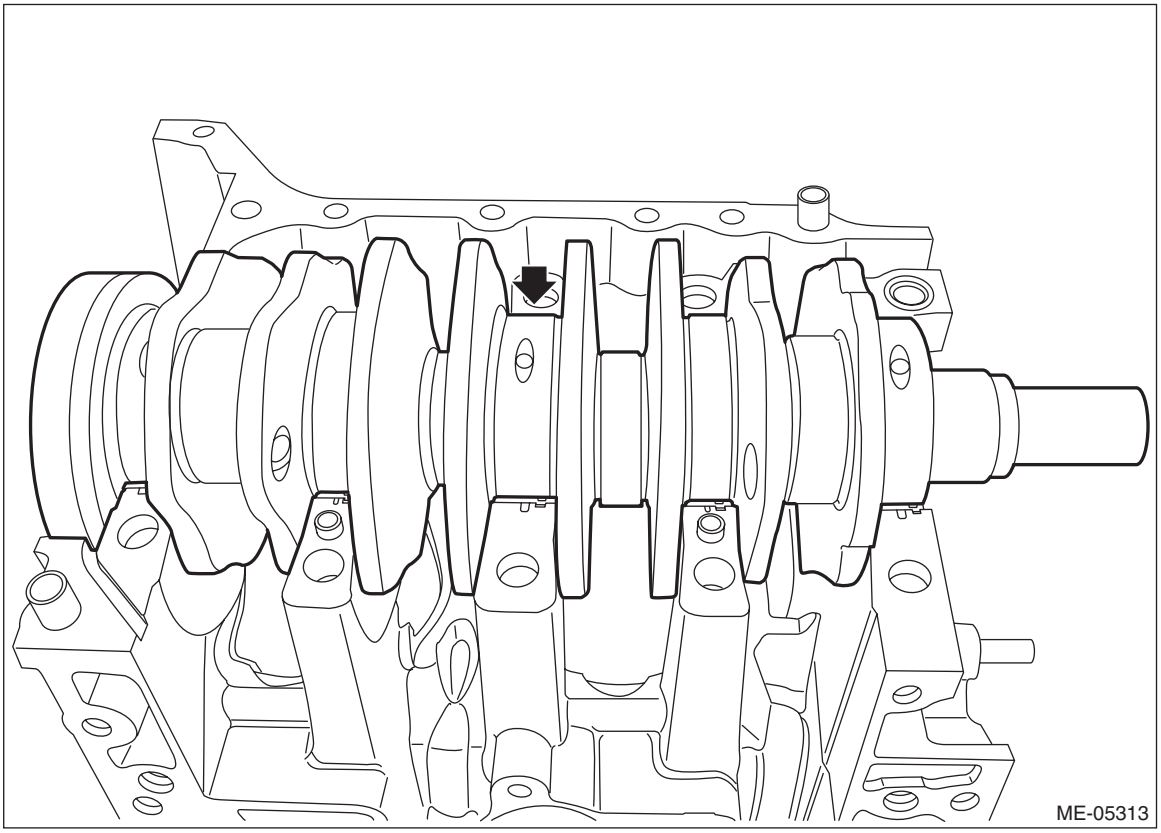


2) Install O-rings to the cylinder block LH.

NOTE:
Use new O-rings.



3) Apply engine oil to the crankshaft journal, and set the crankshaft to cylinder block LH.



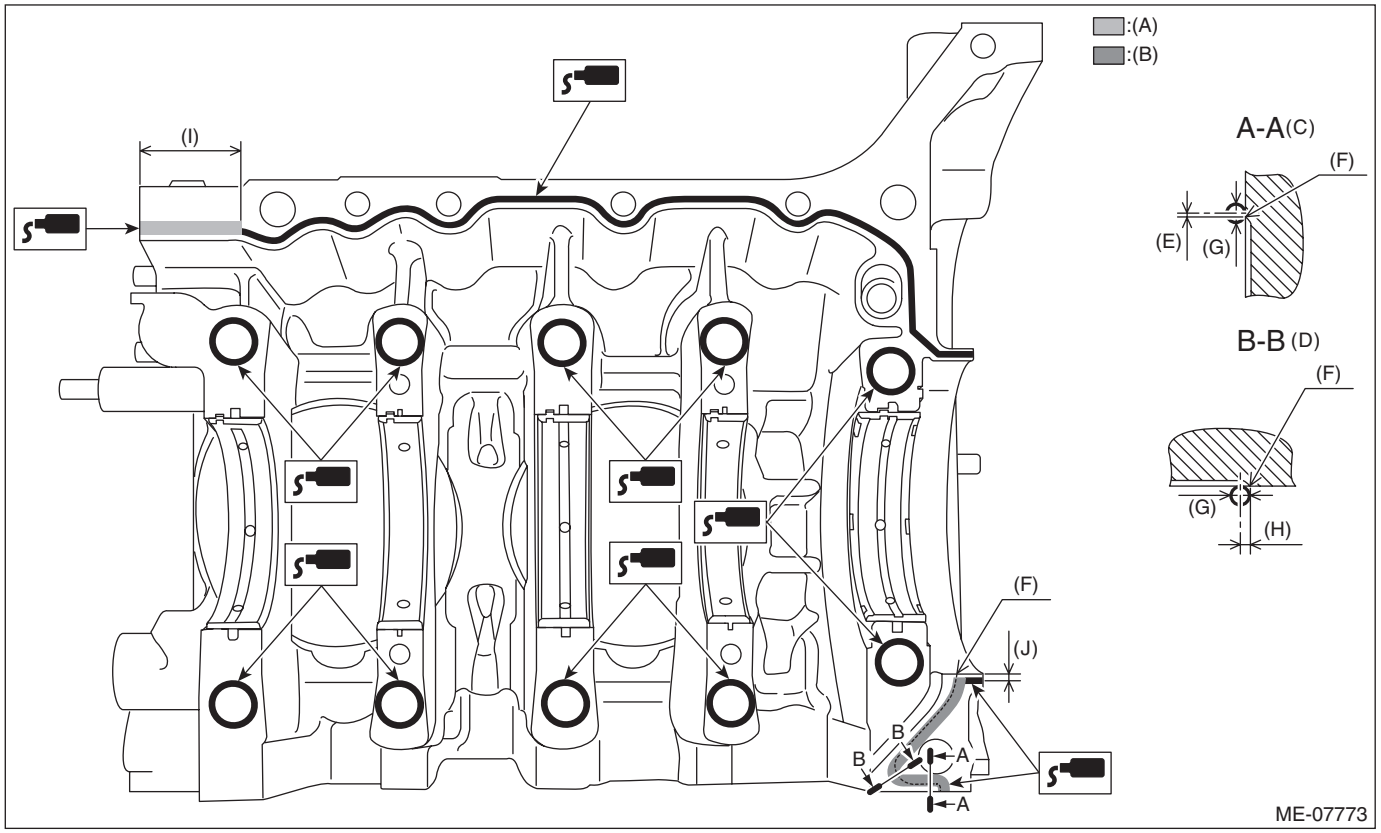
4) Apply liquid gasket to the mating surface of cylinder block RH as shown in the figure.

CAUTION:
Do not let the liquid gasket overflow to the oil passage and crankshaft bearing portions, because the engine seizure may result.

NOTE:
• Before applying liquid gasket, degrease the old liquid gasket seal surface of the cylinder block RH and cylinder block LH.
• Install within 5 min. after applying liquid gasket.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:
Mating surfaces other than ranges A and B
1±0.5 mm (0.0394±0.0197 in)
Mating surfaces of ranges A and B
4±0.5 mm (0.1575±0.0197 in)



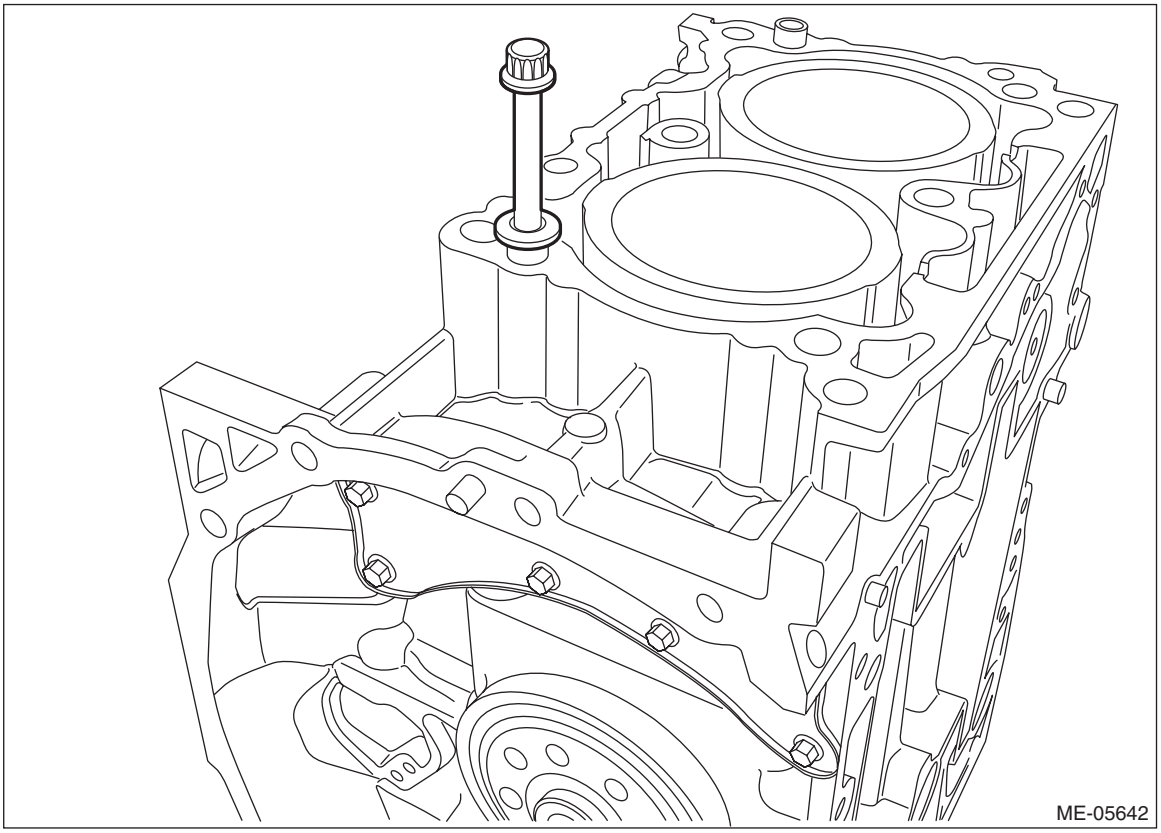
(A)	Range A	(E)	1 mm (0.0394 in) or less	(I)	36 mm (1.4173 in)
(B)	Range B	(F)	Chamfer edge	(J)	2.5 mm (0.0984 in)
(C)	Liquid gasket applying position of mating surfaces (other than the edge) of range B	(G)	ϕ4±0.5 mm (0.1575±0.0197 in)		
(D)	Liquid gasket applying position of mating surfaces (the edge) of range B	(H)	2 mm (0.0787 in)		

5) Install the cylinder block RH to the cylinder block LH.

6) Join the cylinder blocks.
(1) Apply a coat of engine oil to the washers and cylinder block mounting bolt threads.

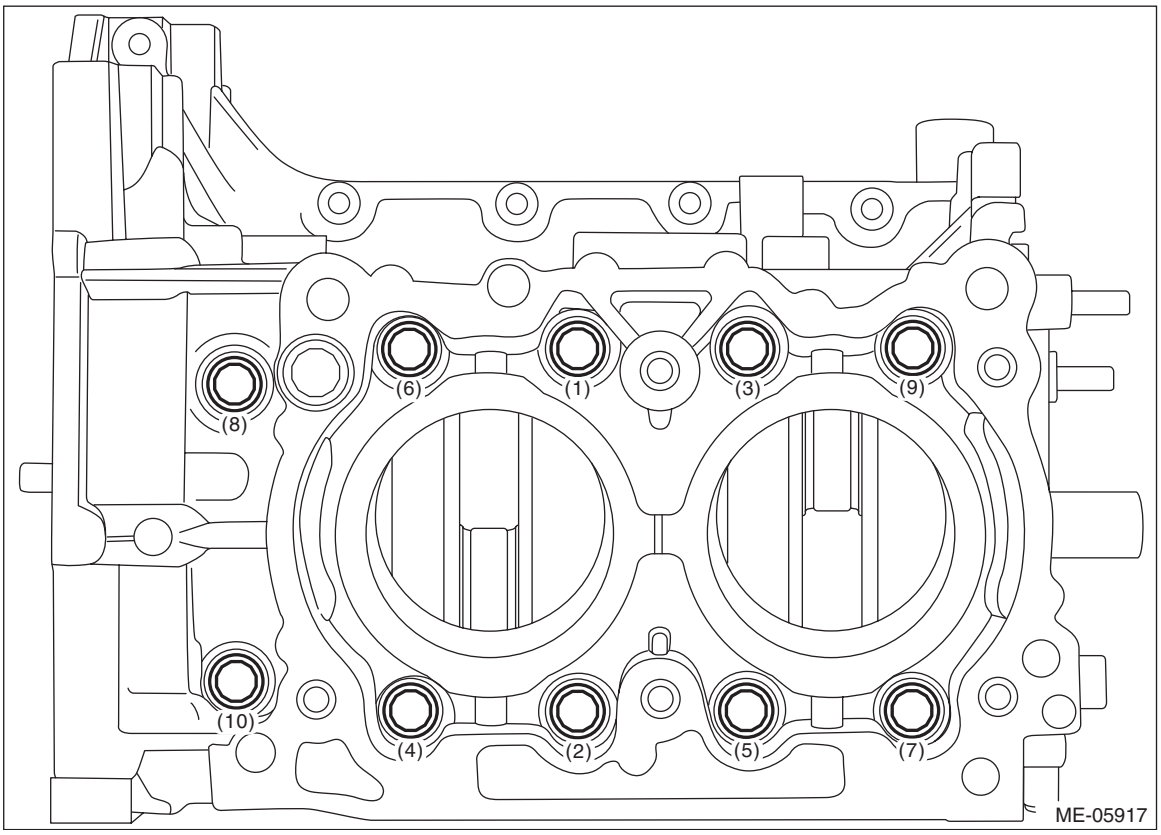
NOTE:
To prevent mixture of engine oil into the water jacket, do not apply a large amount.
(2) Install the cylinder head bolt at the locations shown in the figure.

NOTE:
This procedure is required to tighten the cylinder block mounting bolts with specified angle using ST.



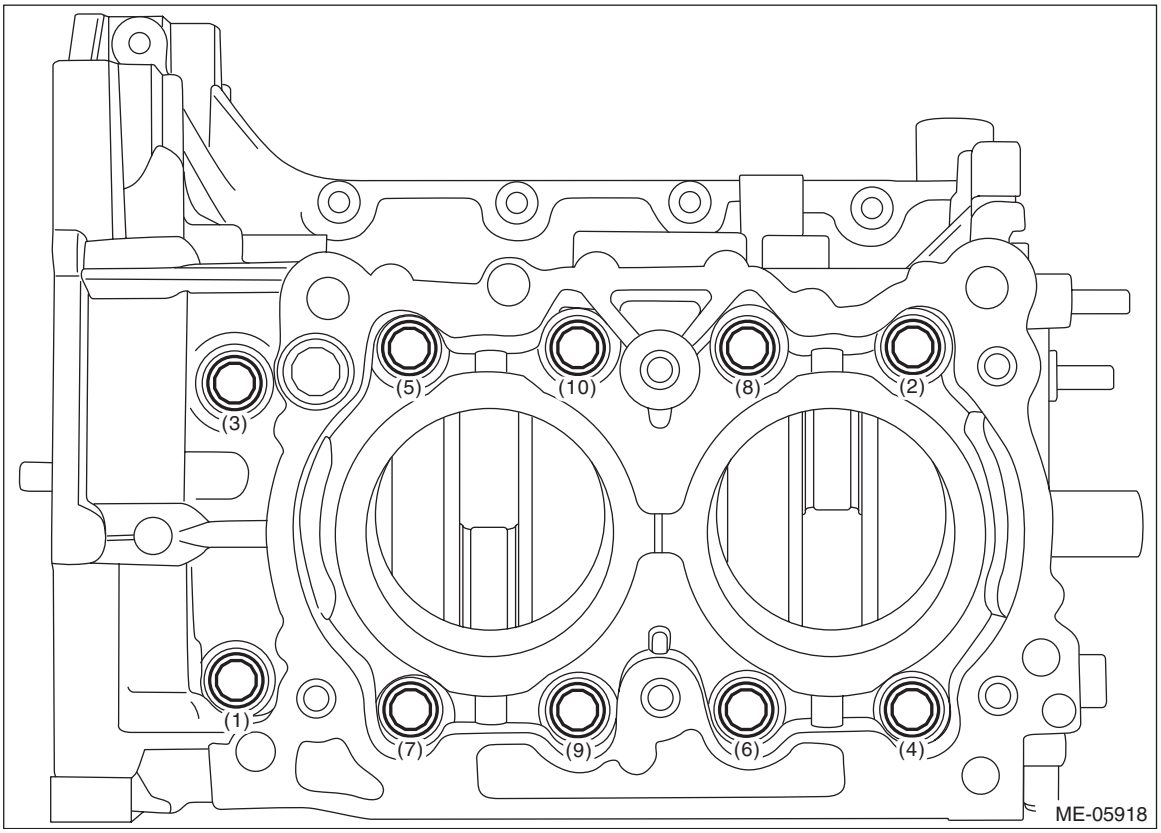
(3) Tighten all mounting bolts with a torque of 35 N·m (3.6 kgf-m, 25.8 ft-lb) in numerical order as shown in the figure.

CAUTION:
When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



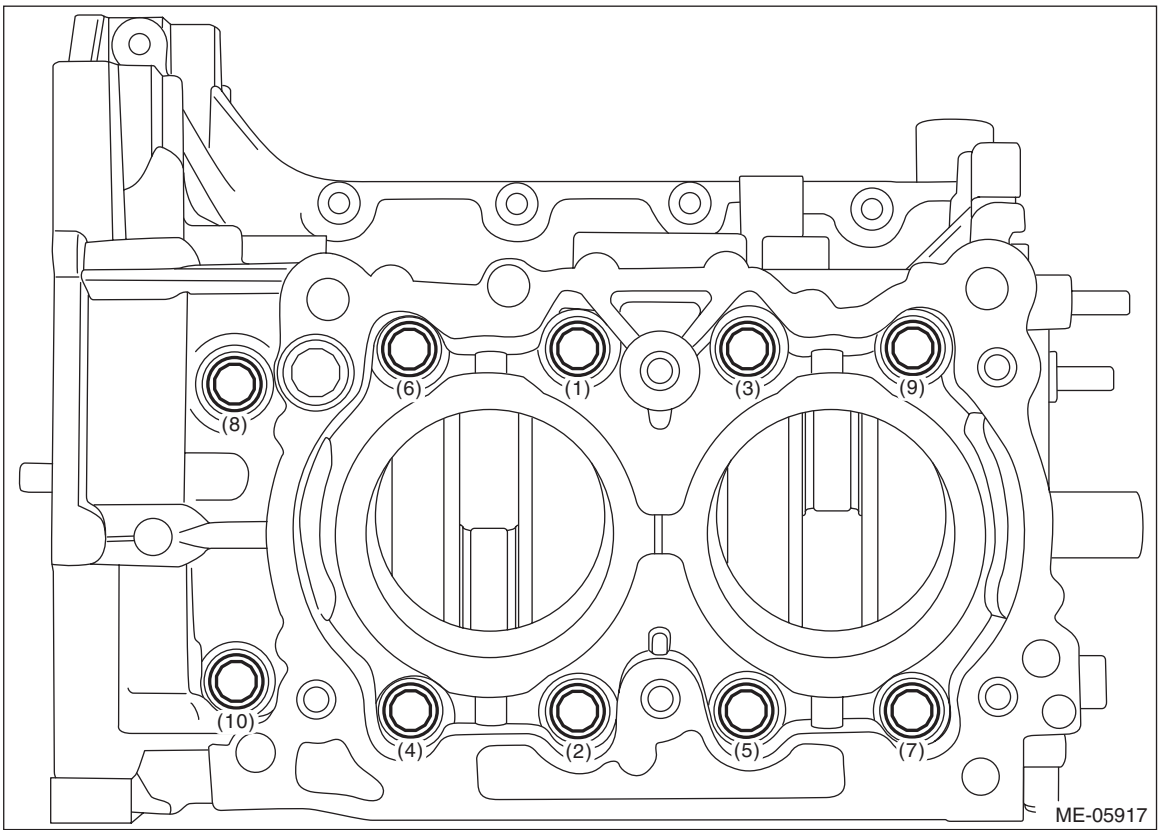
(4) Loosen all mounting bolts by 180° in numerical order as shown in the figure.

CAUTION:
When loosening the mounting bolts, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



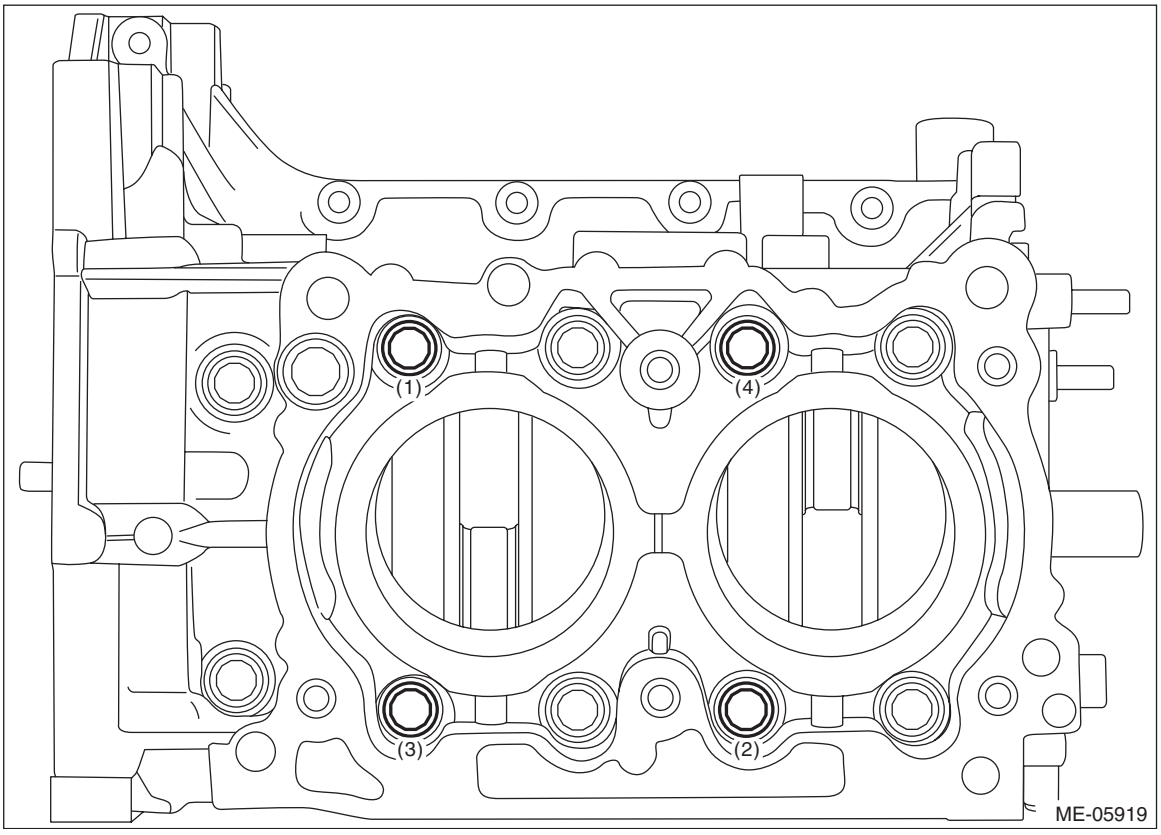
(5) Tighten all mounting bolts with a torque of 35 N·m (3.6 kgf-m, 25.8 ft-lb) in numerical order as shown in the figure.

CAUTION:
When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



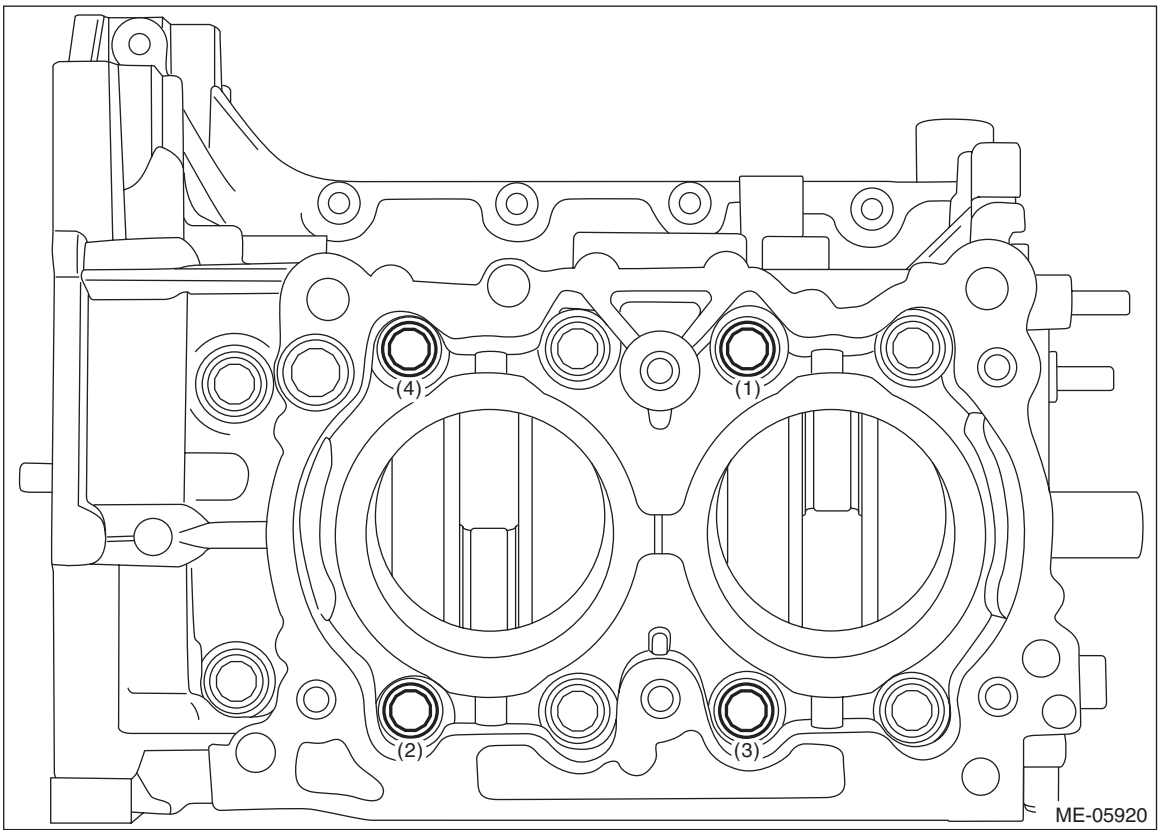
(6) Loosen the mounting bolts (4 places) by 180° in numerical order as shown in the figure.

CAUTION:
When loosening the mounting bolts, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



(7) Tighten the mounting bolts (4 places) with a torque of 17 N·m (1.7 kgf-m, 12.5 ft-lb) in numerical order as shown in the figure.

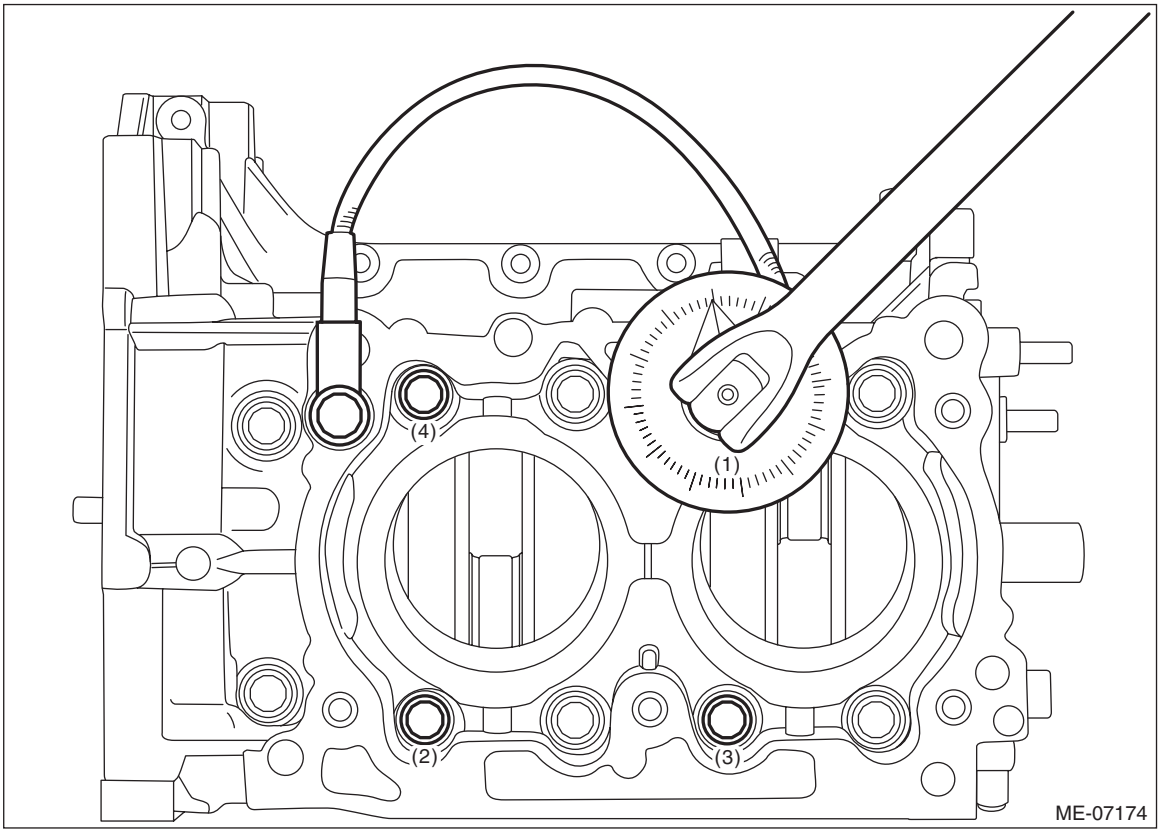
CAUTION:
When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



(8) Using angle gauge, tighten the mounting bolts (4 places) with specified angle in numerical order as shown in the figure.

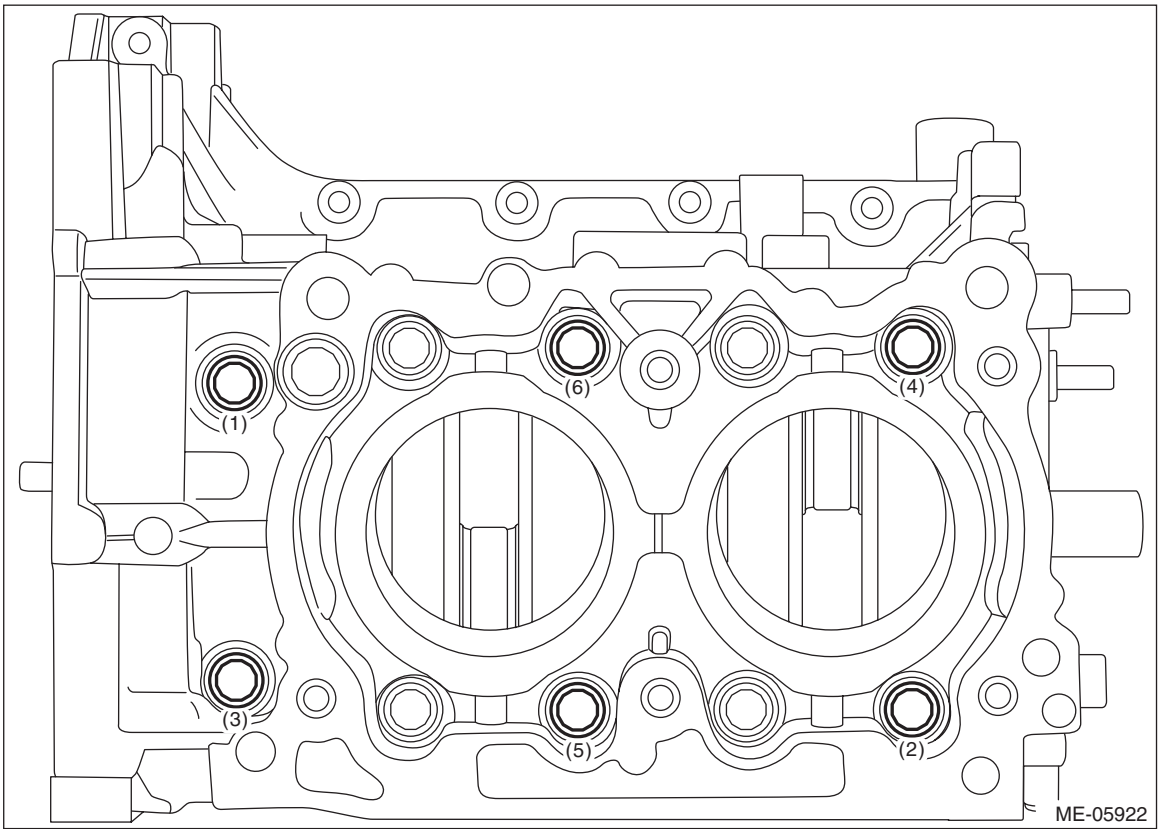
CAUTION:
When tightening the mounting bolts with specified angle, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.

Tightening angle:
60°±2°



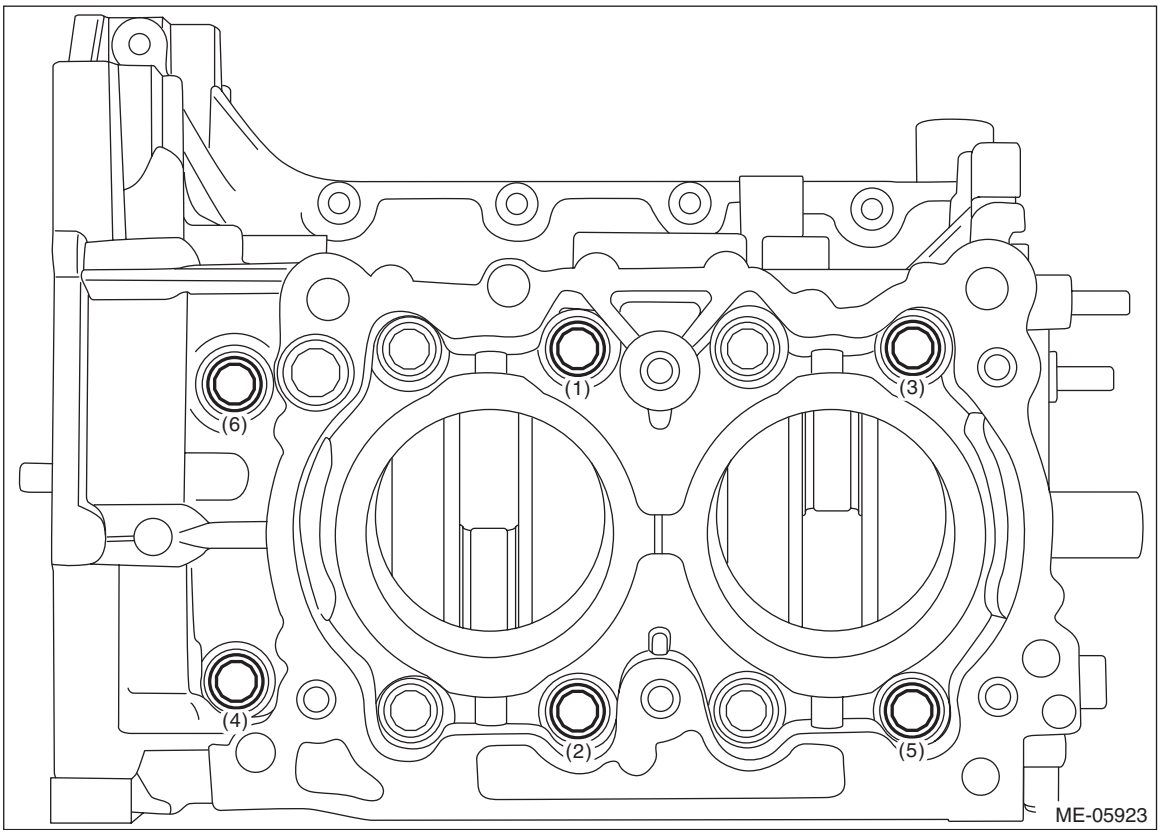
(9) Loosen the mounting bolts (6 places) by 180° in numerical order as shown in the figure.

CAUTION:
When loosening the mounting bolts, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



(10) Tighten the mounting bolts (6 places) with a torque of 17 N·m (1.7 kgf-m, 12.5 ft-lb) in numerical order as shown in the figure.

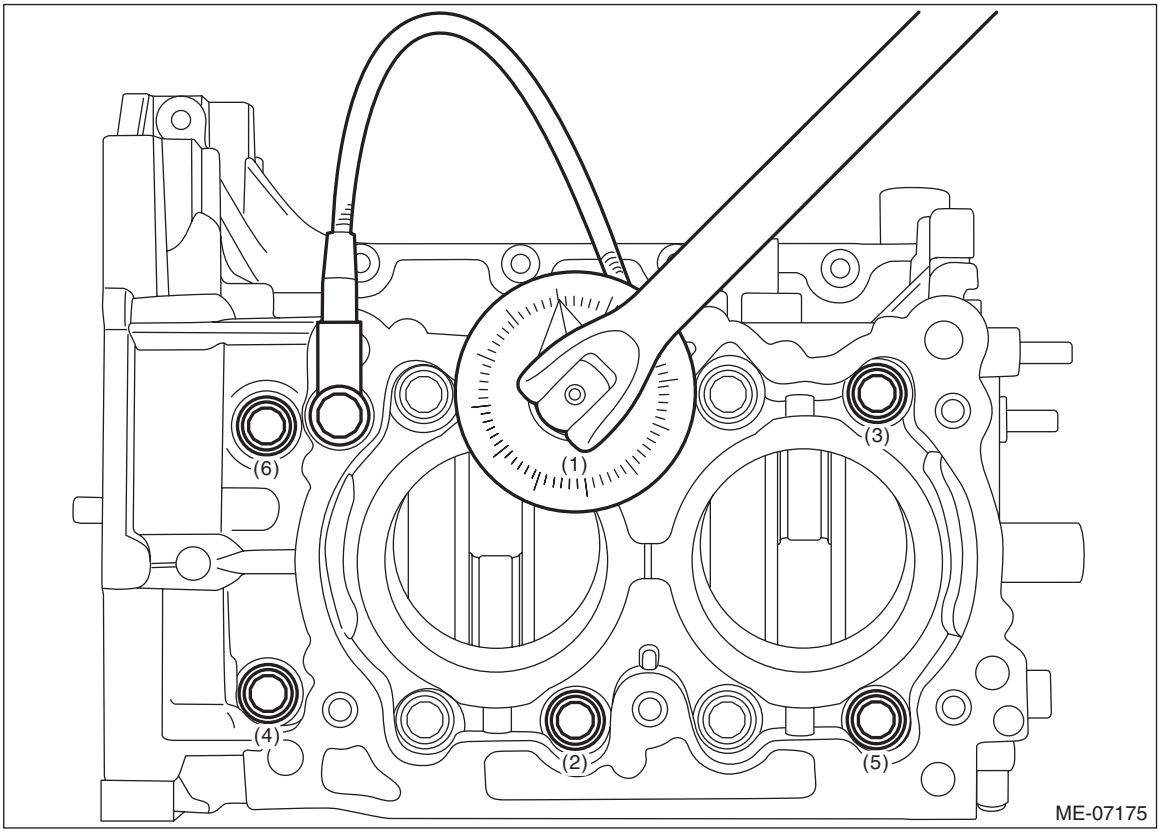
CAUTION:
When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



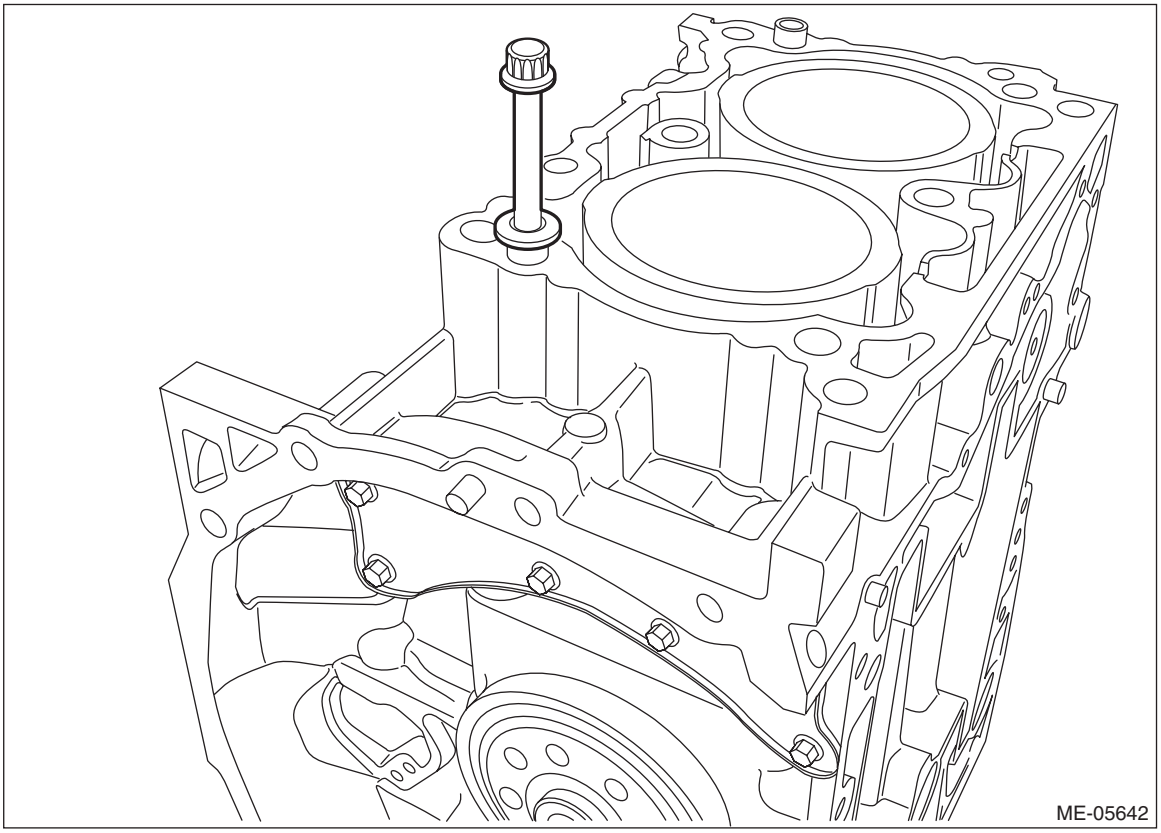
(11) Using angle gauge, tighten the mounting bolts (6 places) with specified angle in numerical order as shown in the figure.

CAUTION:
When tightening the mounting bolts with specified angle, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.

Tightening angle:
60°±2°



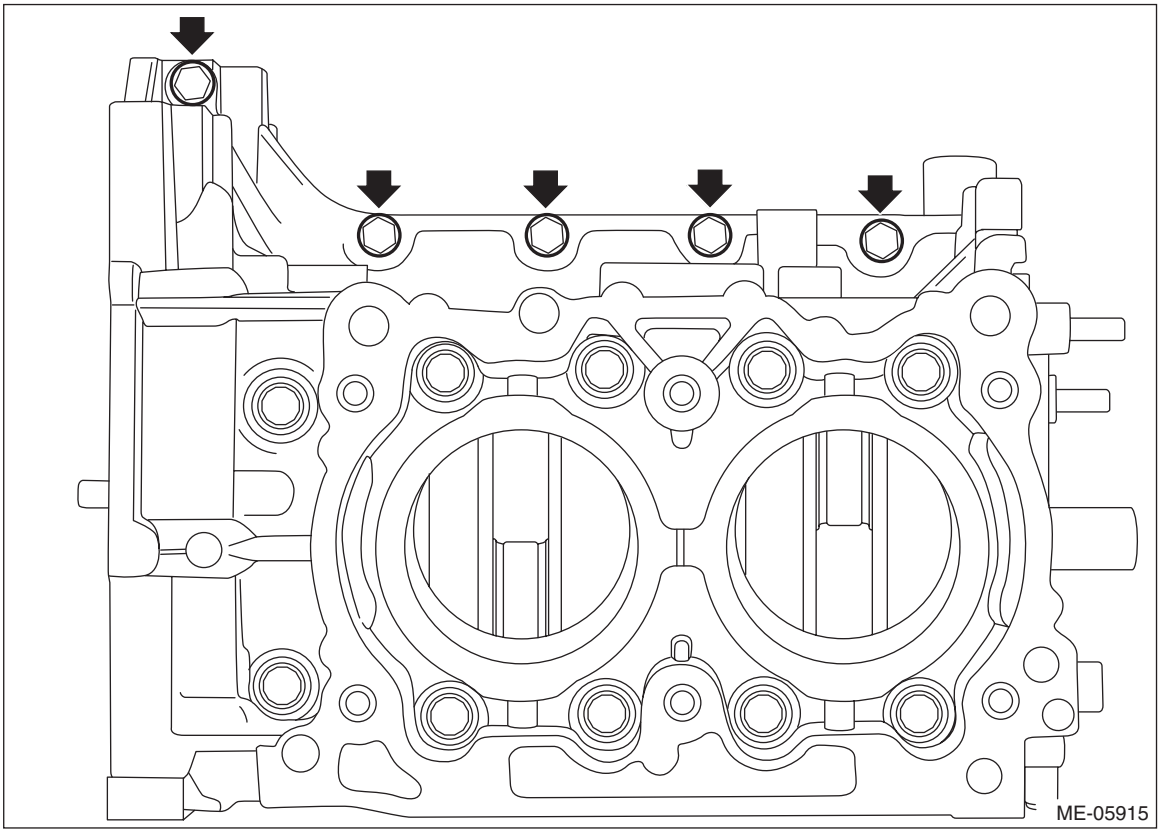
(12) Remove the cylinder head bolt attached at the locations shown in the figure.



(13) Install the bolt shown in the figure.

NOTE:
After tightening, if the liquid gasket is squeezed out in the seal surface area of the chain cover and oil pan upper, completely remove any liquid gasket that is squeezed out. Any liquid gasket on the chamfer area, however, should not be removed.

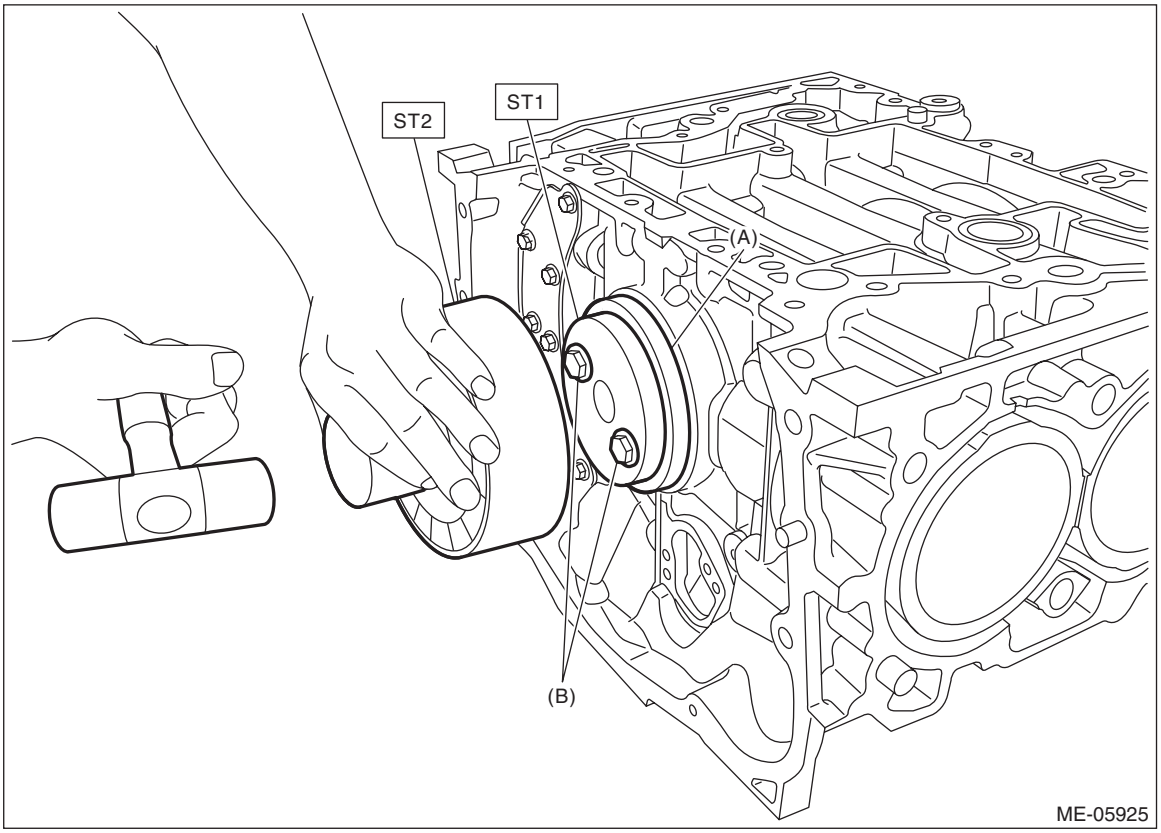
Tightening torque:
25 N·m (2.5 kgf-m, 18.4 ft-lb)



7) Set the part so that the oil pan side of cylinder block is on the upper side.

8) Apply a coat of engine oil to the oil seal inner periphery and outer periphery, and install the rear oil seal using ST1 and ST2.

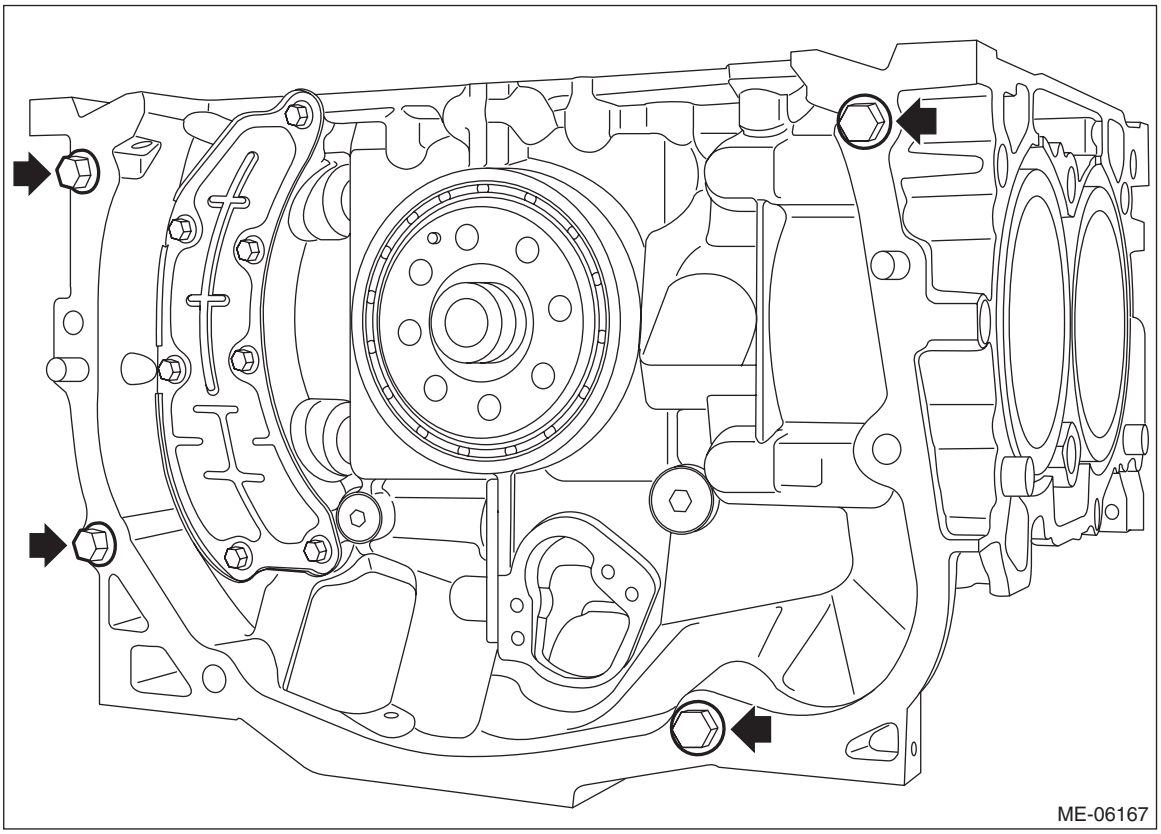
NOTE:
Use a new rear oil seal.
ST1 18671AA020 OIL SEAL GUIDE
ST2 18657AA030 OIL SEAL INSTALLER



(A) Rear oil seal
(B) Drive plate or flywheel mounting bolt

9) Install a bolt of suitable length (M10 × P1.25) at the locations shown in the figure.

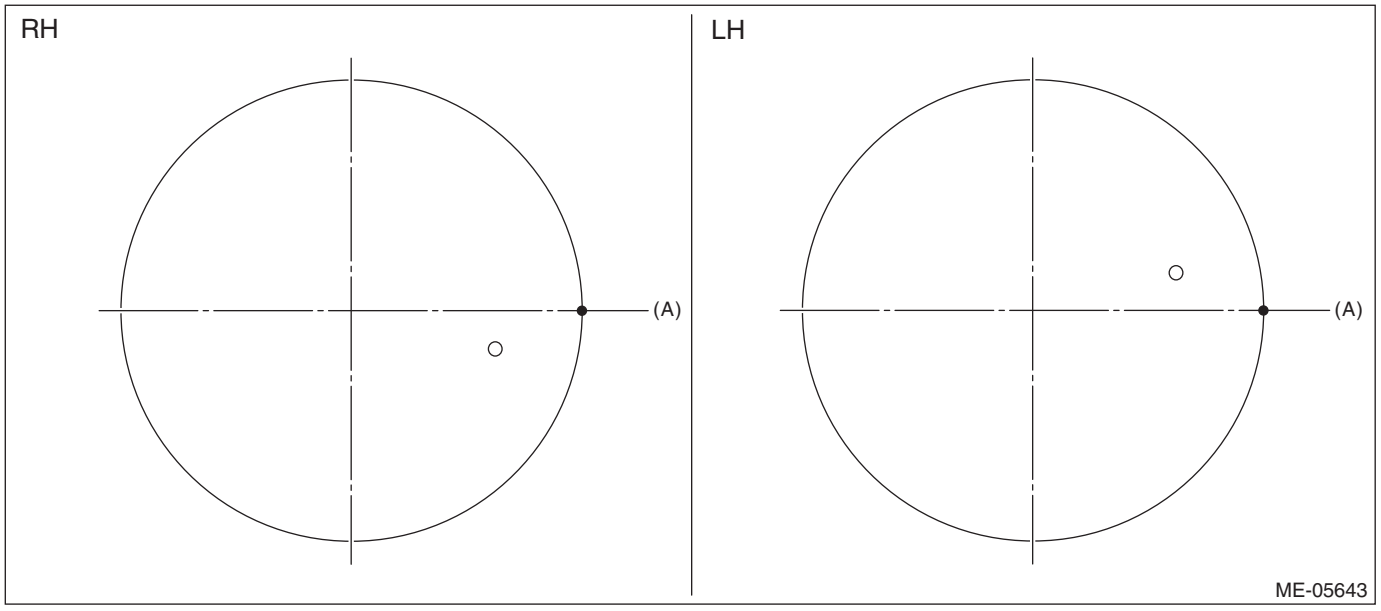
NOTE:
• This procedure is required to prevent the knock pin damage when the cylinder block is raised in the next step.
• Use the same length of bolt for the four bolts.



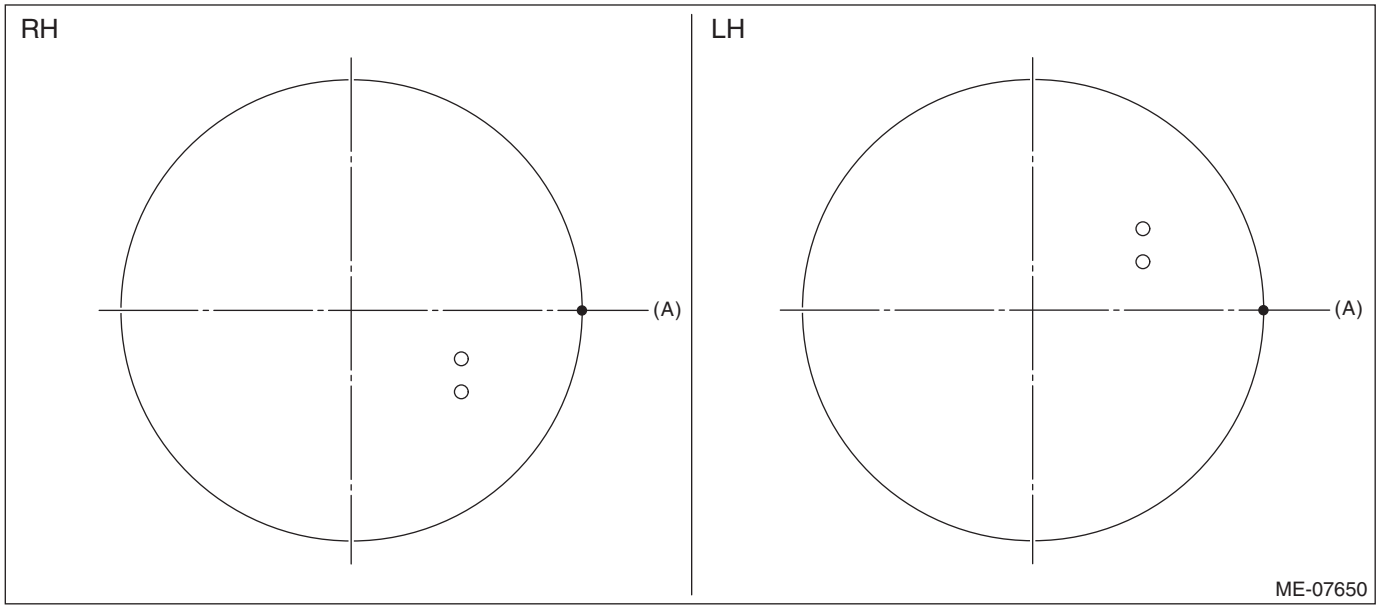
10) Raise the cylinder block so that the rear oil seal is on the lower side.
11) Adjust the positions of piston ring gap for each piston.

NOTE:
Check that the piston ring mark of compression ring faces the top side of the piston.

(1) Set the ring gap of the top ring to the position (A) in the figure.
• Gasoline engine model

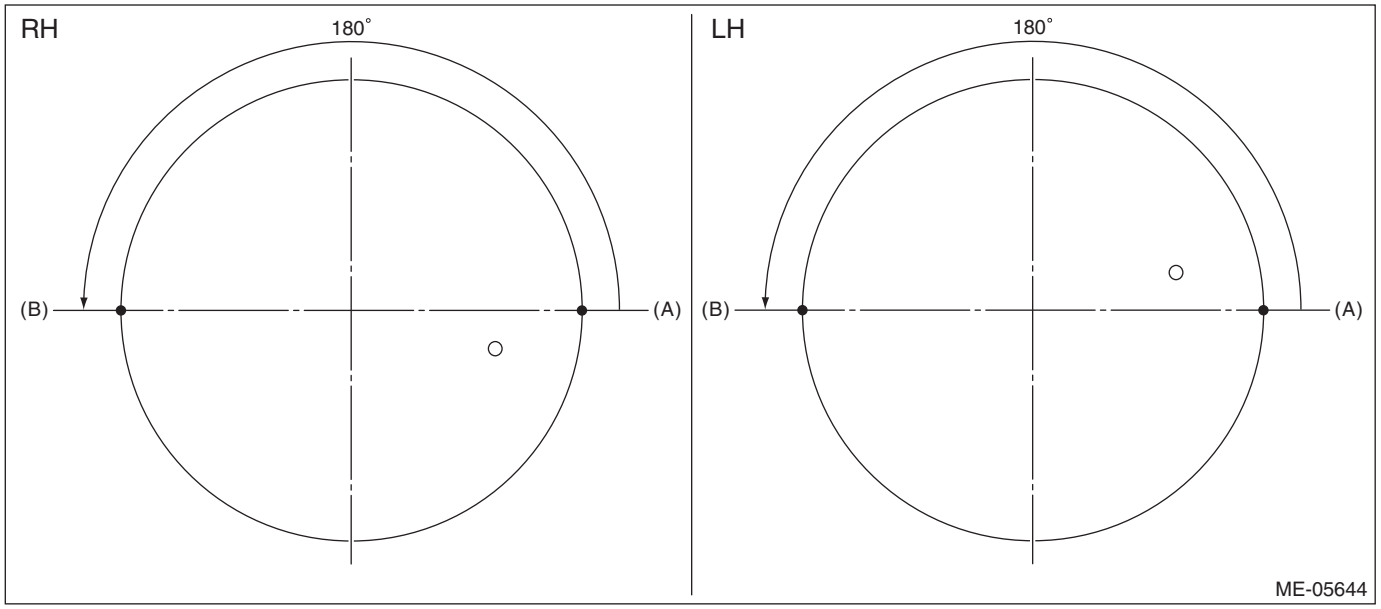


- HEV model

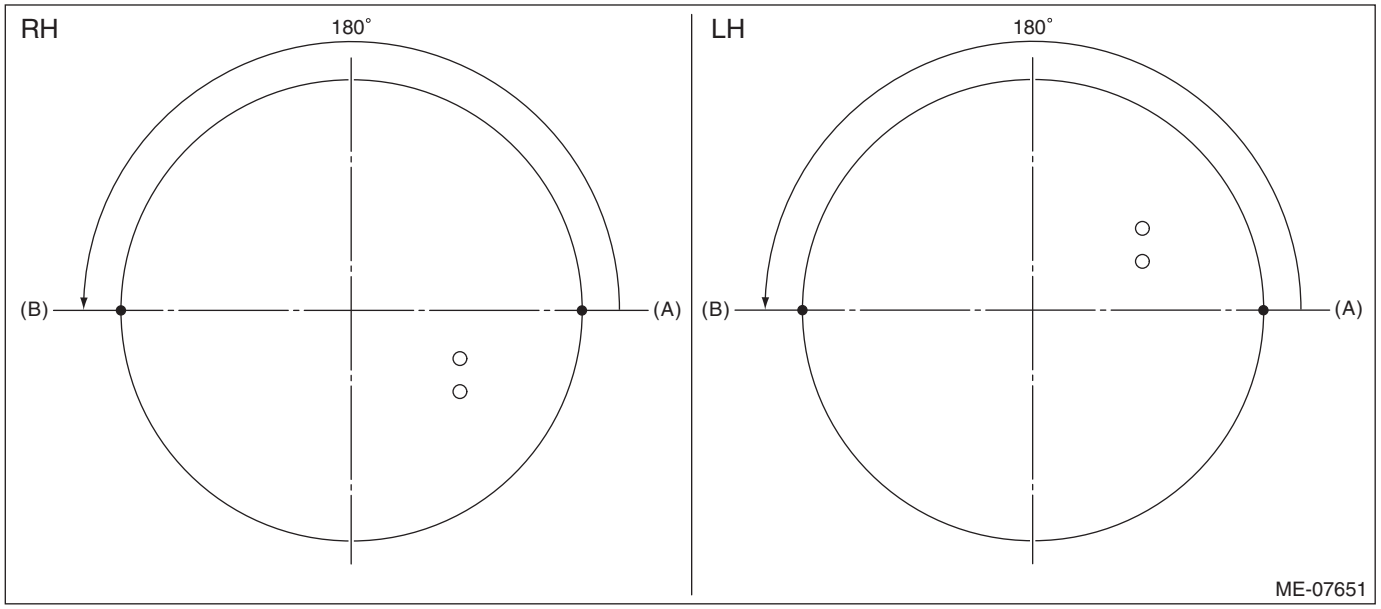


(2) Position the ring gap of second ring at (B) in the figure on the 180° opposite direction of (A).

- Gasoline engine model

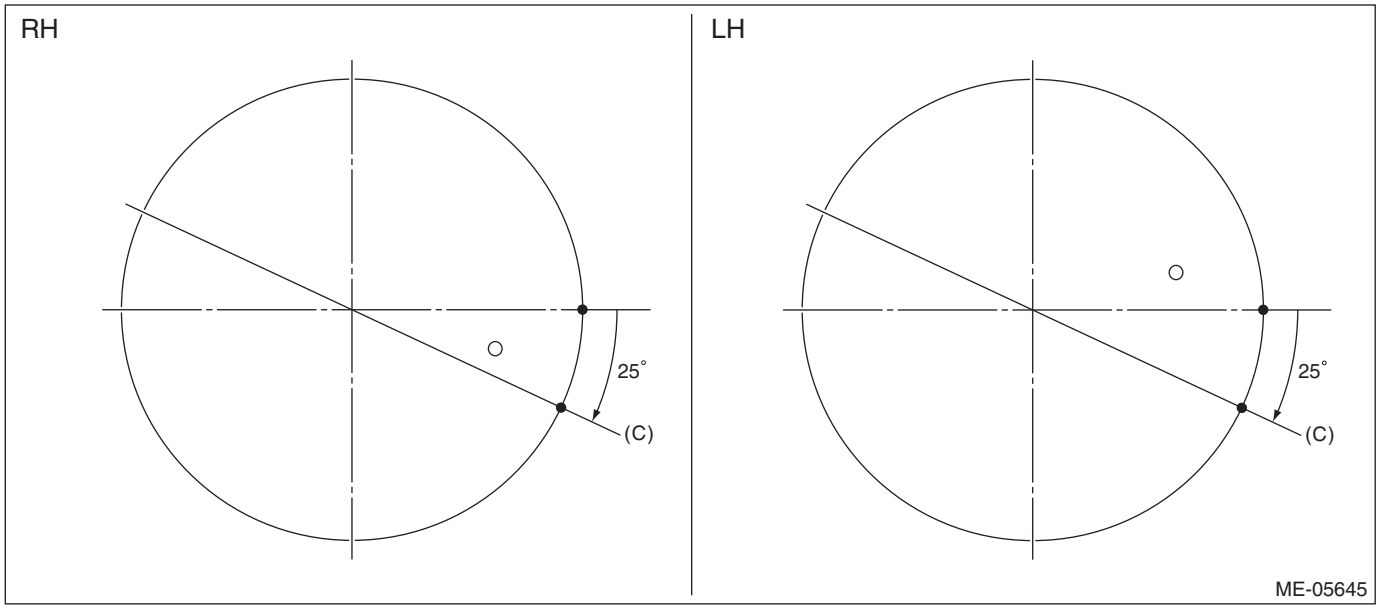


- HEV model

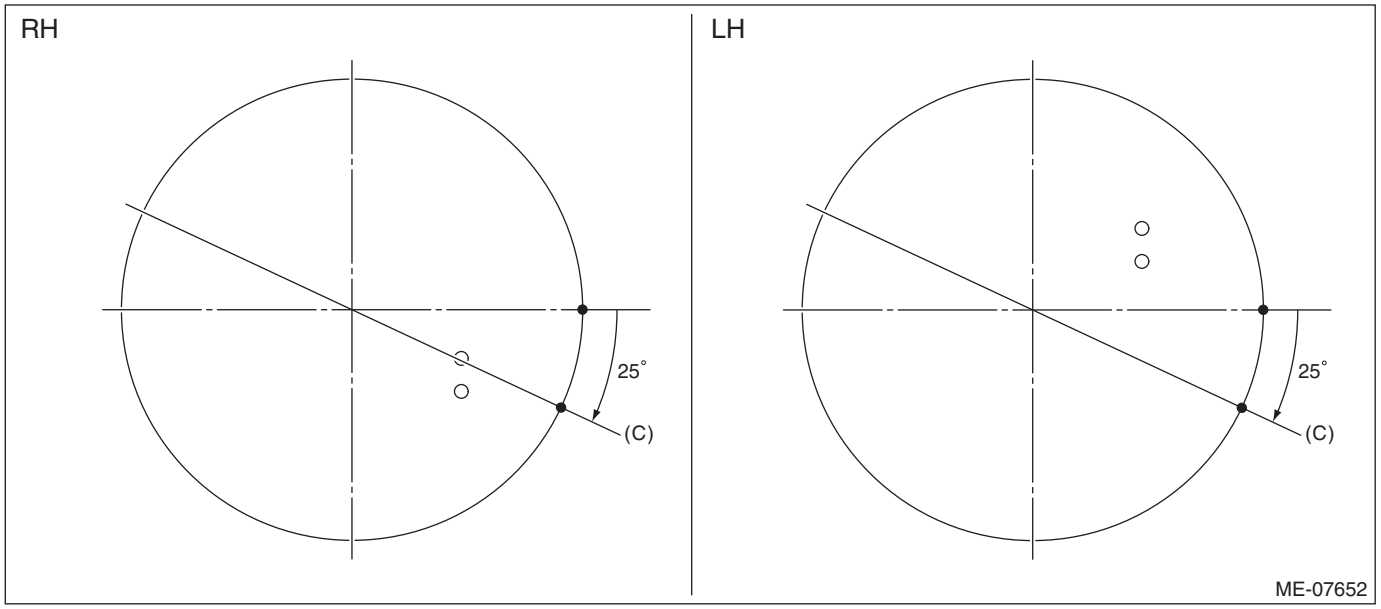


(3) Set the ring gap of the upper rail to the position (C) in the figure.

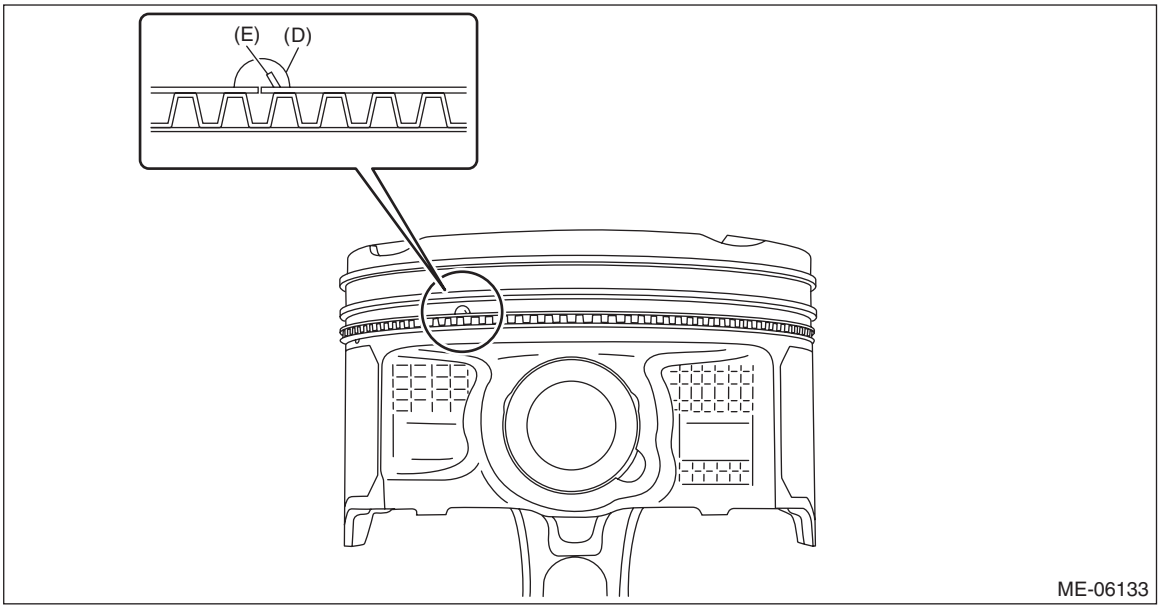
- Gasoline engine model



- HEV model

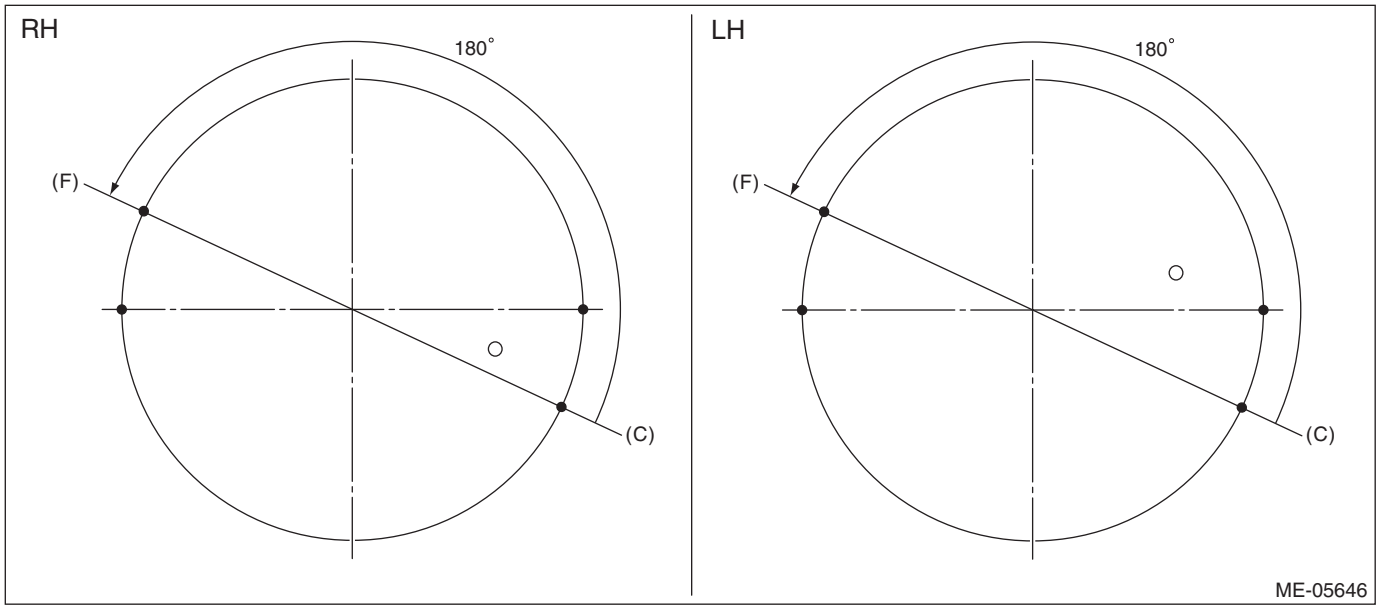


(4) Align the upper rail spin stopper (E) to the side hole (D) on the piston.

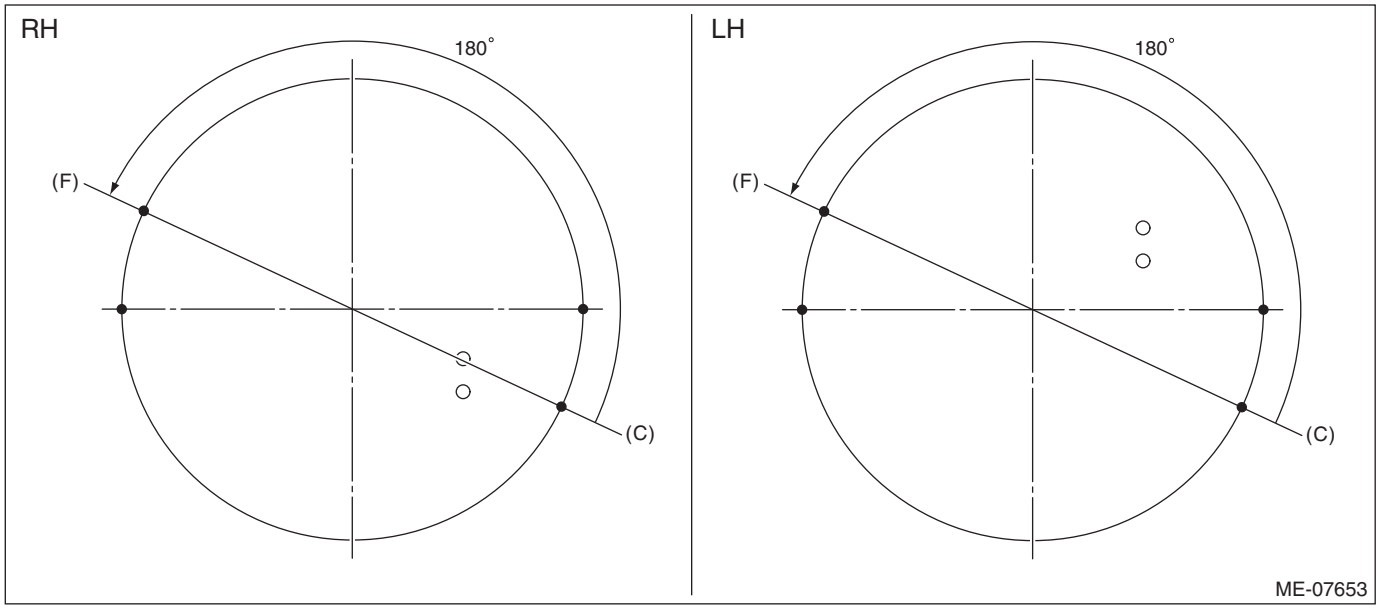


(5) Position the ring gap of expander at (F) in the figure on the 180° opposite direction of (C).

- Gasoline engine model

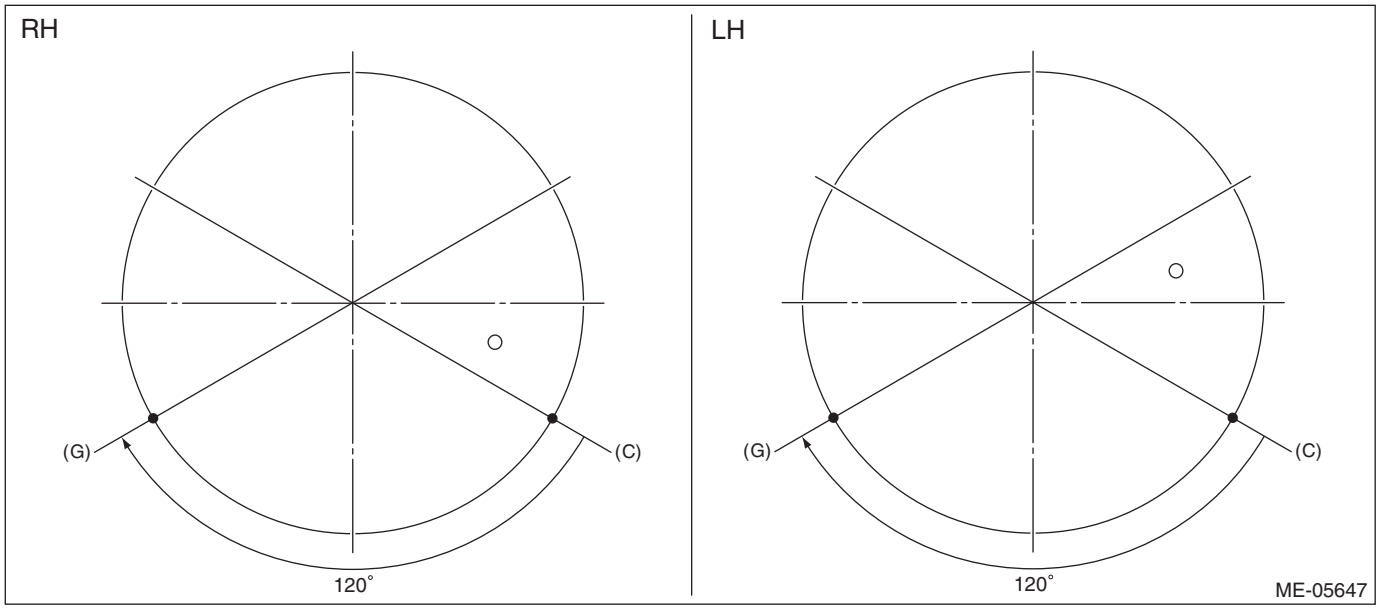


- HEV model

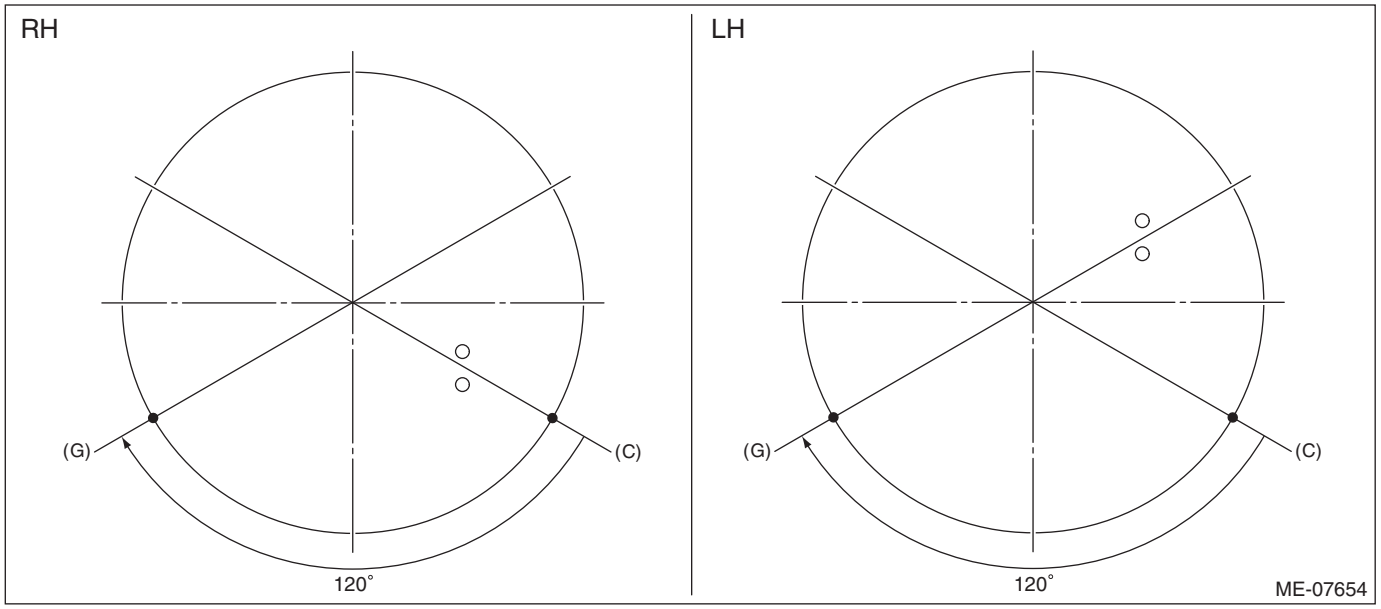


(6) Set the ring gap of lower rail at position (G), located 120° clockwise from (C) in the figure.

- Gasoline engine model



- HEV model

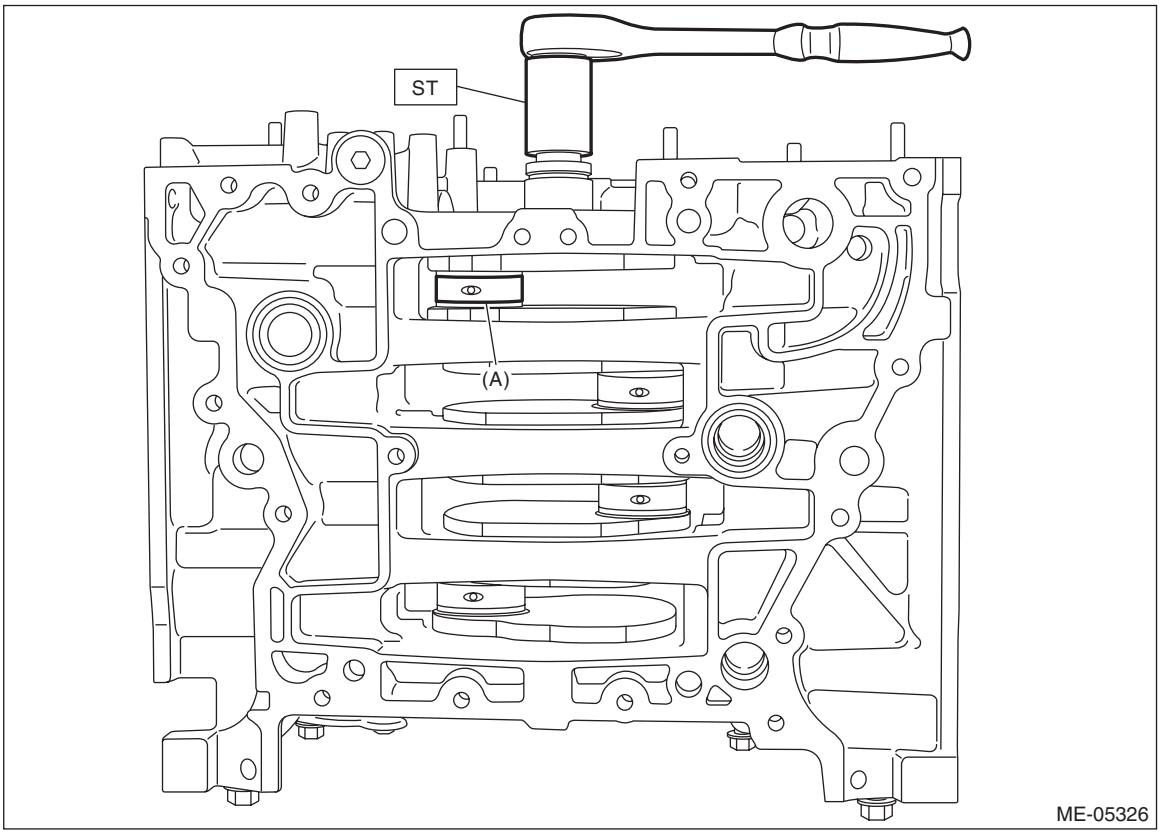


(7) Check that the positions of piston ring gap are properly adjusted.

NOTE:
When checking the positions of piston ring gap, also check that the piston ring gaps are not positioned within the range of piston skirt extended line.

12) Install the piston and connecting rod to the cylinder block.
(1) Apply engine oil to the outer circumference of each piston, crankshaft pin, and in the cylinder block.
(2) Turn the crankshaft so that the #1 pin (A) of crankshaft is positioned at TDC using ST.

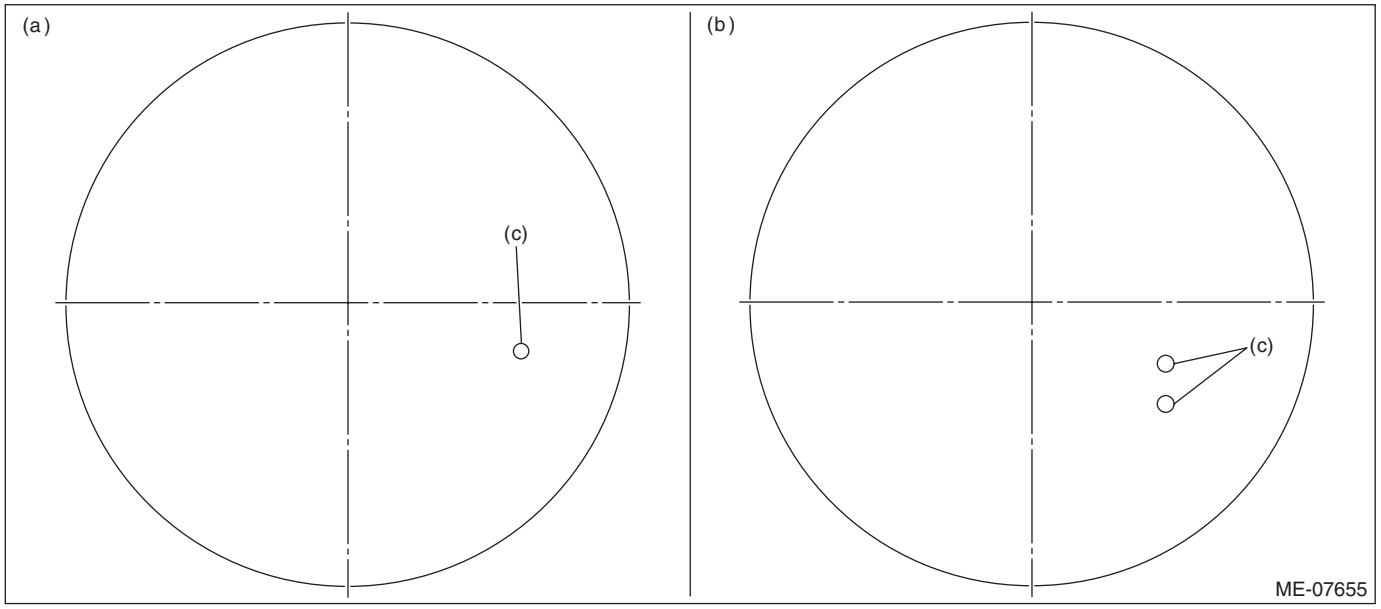
ST 18252AA000 CRANKSHAFT SOCKET



(3) Compress the piston ring using piston ring compressor, and insert the #1 connecting rod with #1 piston into cylinder block.

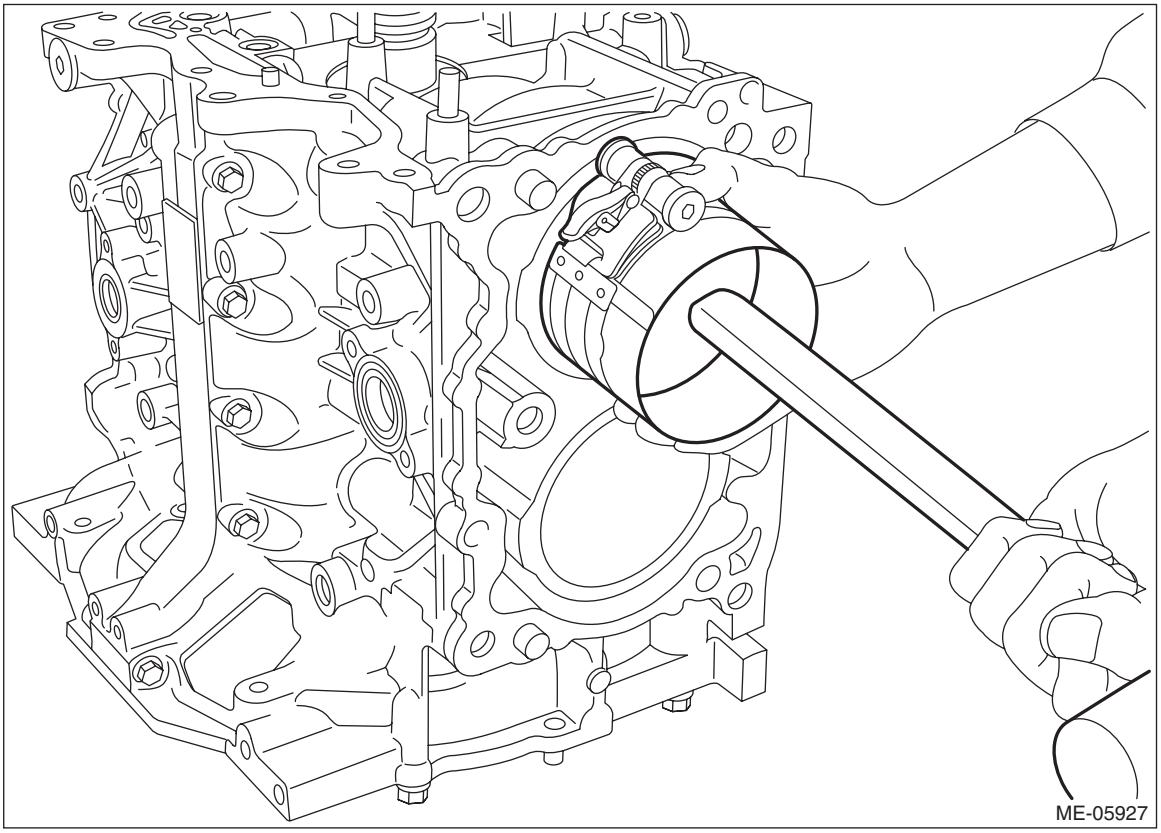
CAUTION:
• Be careful not to damage the cylinder liner and #1 pin of crankshaft by the #1 connecting rod large end.
• Be careful not to apply strong impact when inserting to prevent connecting rod bearing from falling off.

NOTE:
• Face the piston front mark (round mark) towards the front of the engine.



(a) Gasoline engine model (b) HEV model (c) Front mark

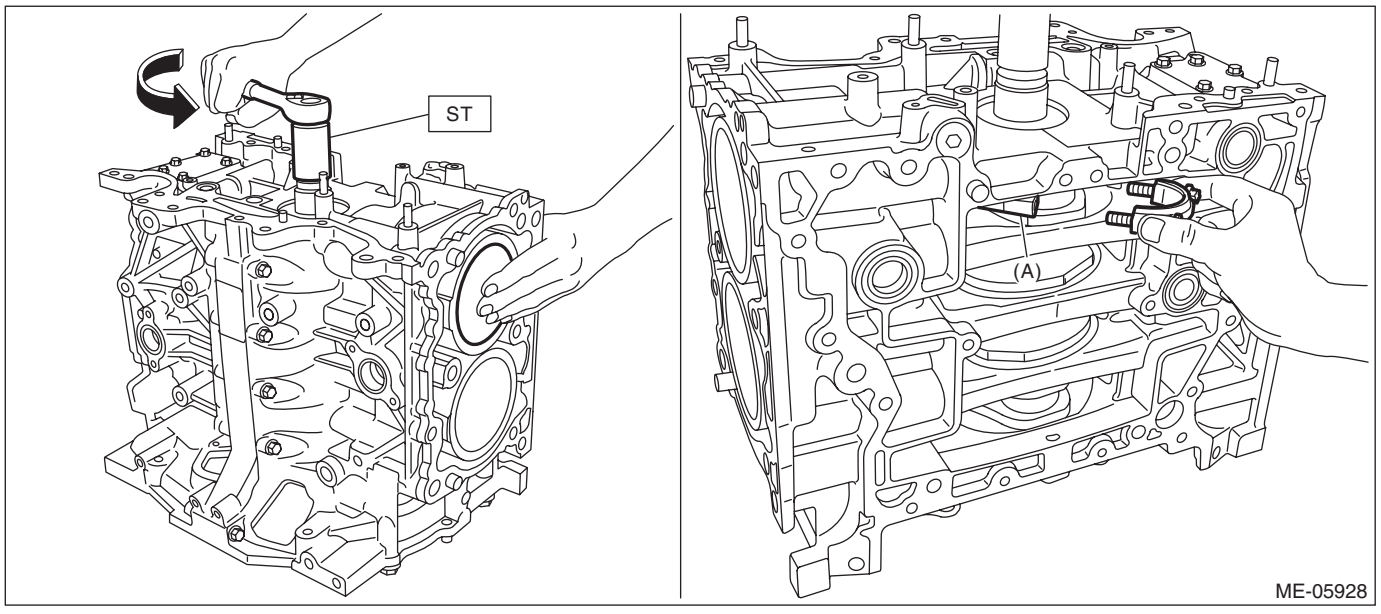
- Insert while lightly tapping the crown of the piston with the handle of a plastic hammer.



(4) Turn the crankshaft counterclockwise so that the #1 pin of crankshaft and the large end (A) of #1 connecting rod are positioned as shown in the figure using ST, while pressing the #1 piston crown, and then set the #1 connecting rod cap and #1 connecting rod cap bolt.

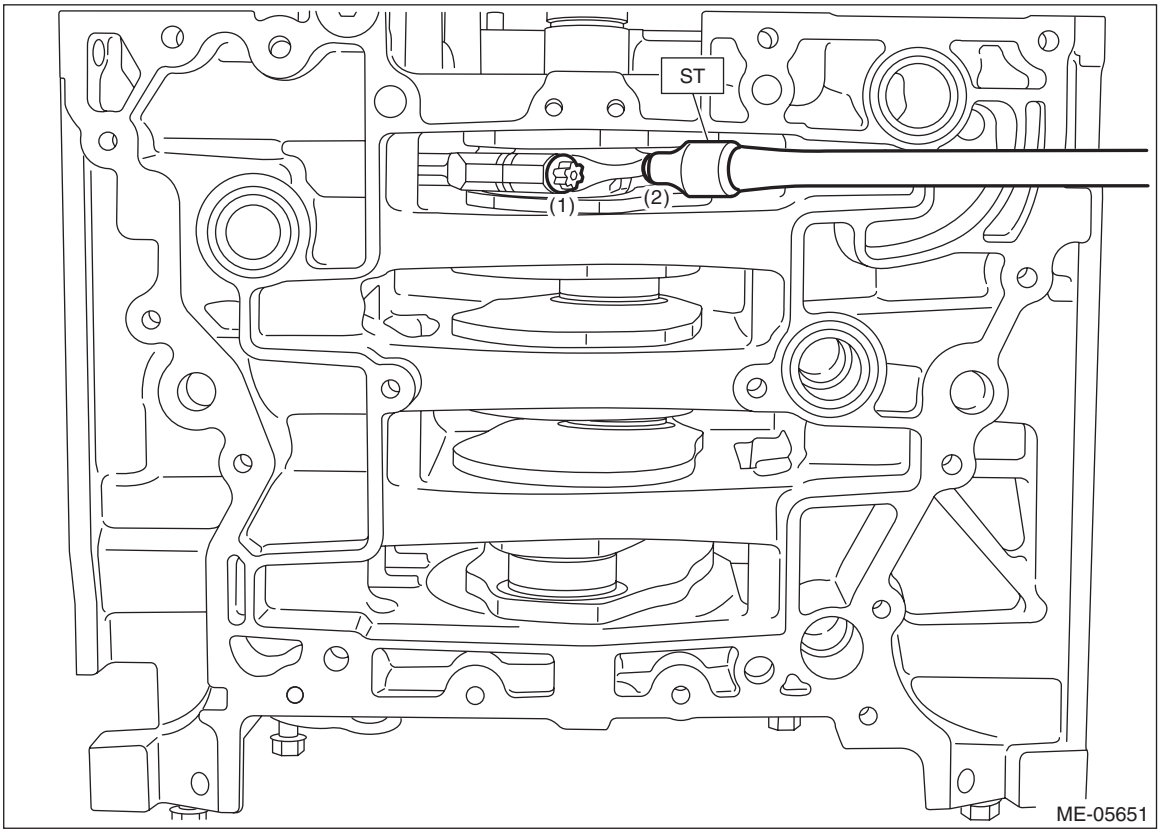
NOTE:
- Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching symbol.
- Use a new connecting rod cap bolt.
- Apply a coat of engine oil to the #1 connecting rod cap seat and the connecting rod cap bolt threads.

ST 18252AA000 CRANKSHAFT SOCKET



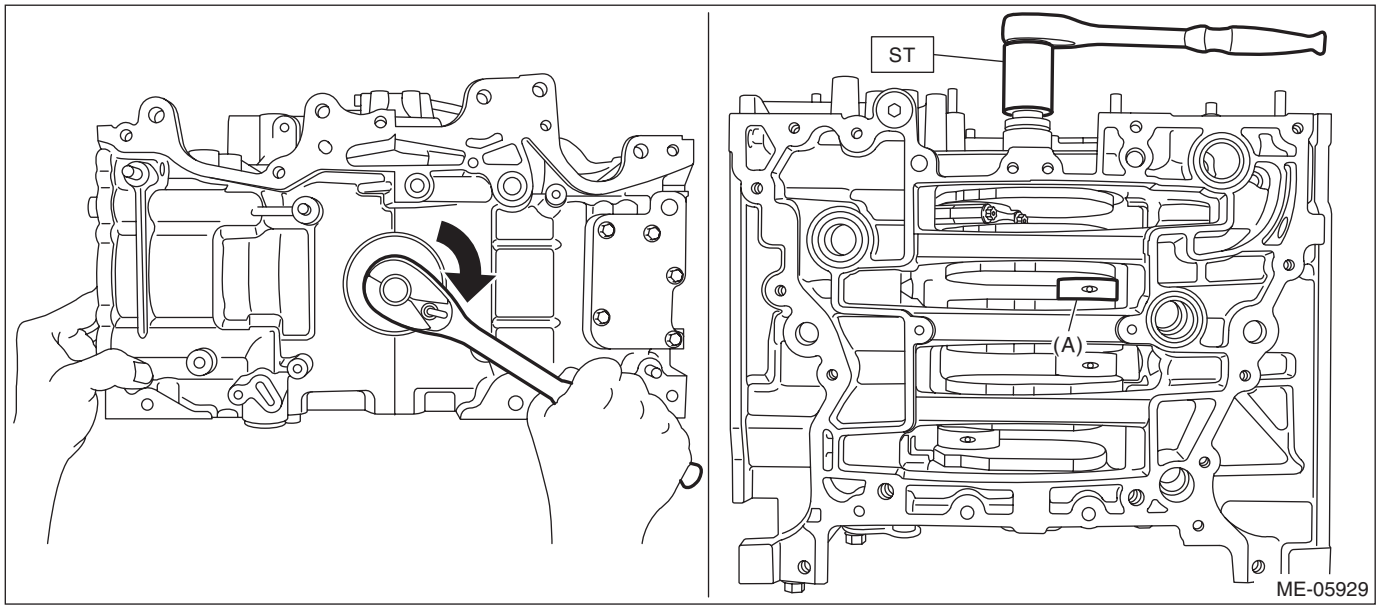
(5) Using ST, tighten the #1 connecting rod cap bolts to 10 N·m (1.0 kgf-m, 7.4 ft-lb) in numerical order as shown in the figure, then retighten the bolts to 22 N·m (2.2 kgf-m, 16.2 ft-lb) in numerical order as shown in the figure.

ST 18270AA020 SOCKET



(6) Turn the crankshaft clockwise so that the #2 pin (A) of crankshaft is positioned at TDC using ST.

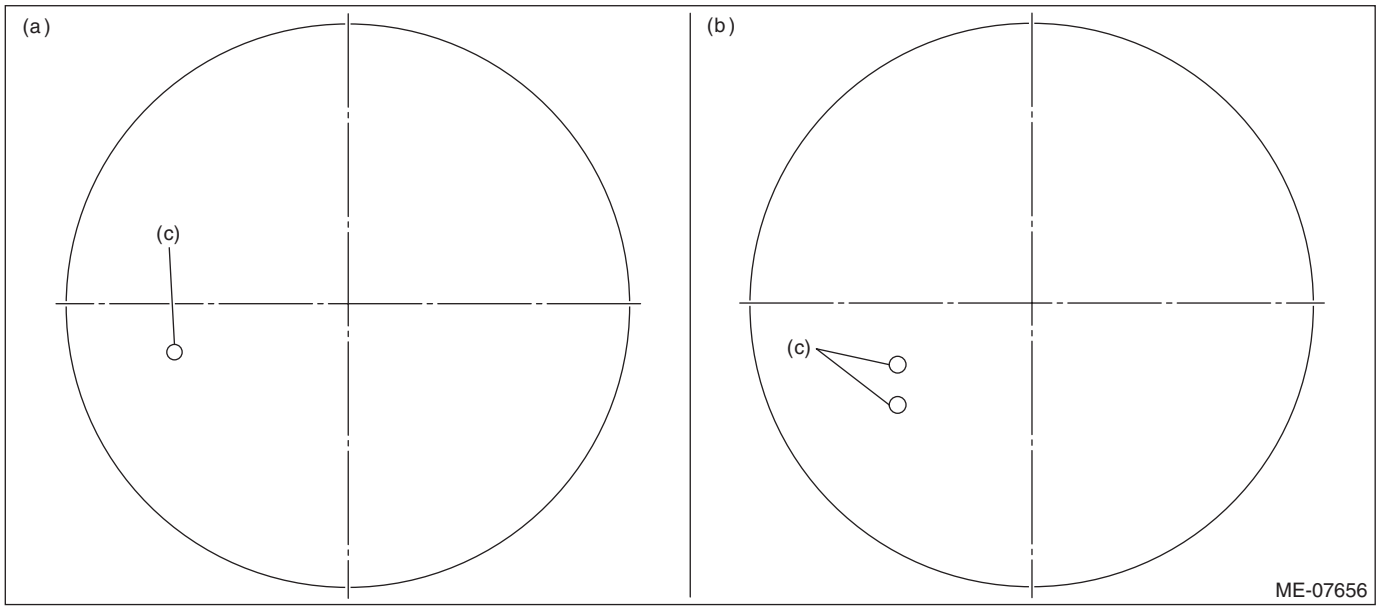
ST 18252AA000 CRANKSHAFT SOCKET



(7) Compress the piston ring using piston ring compressor, and insert the #2 connecting rod with #2 piston into cylinder block.

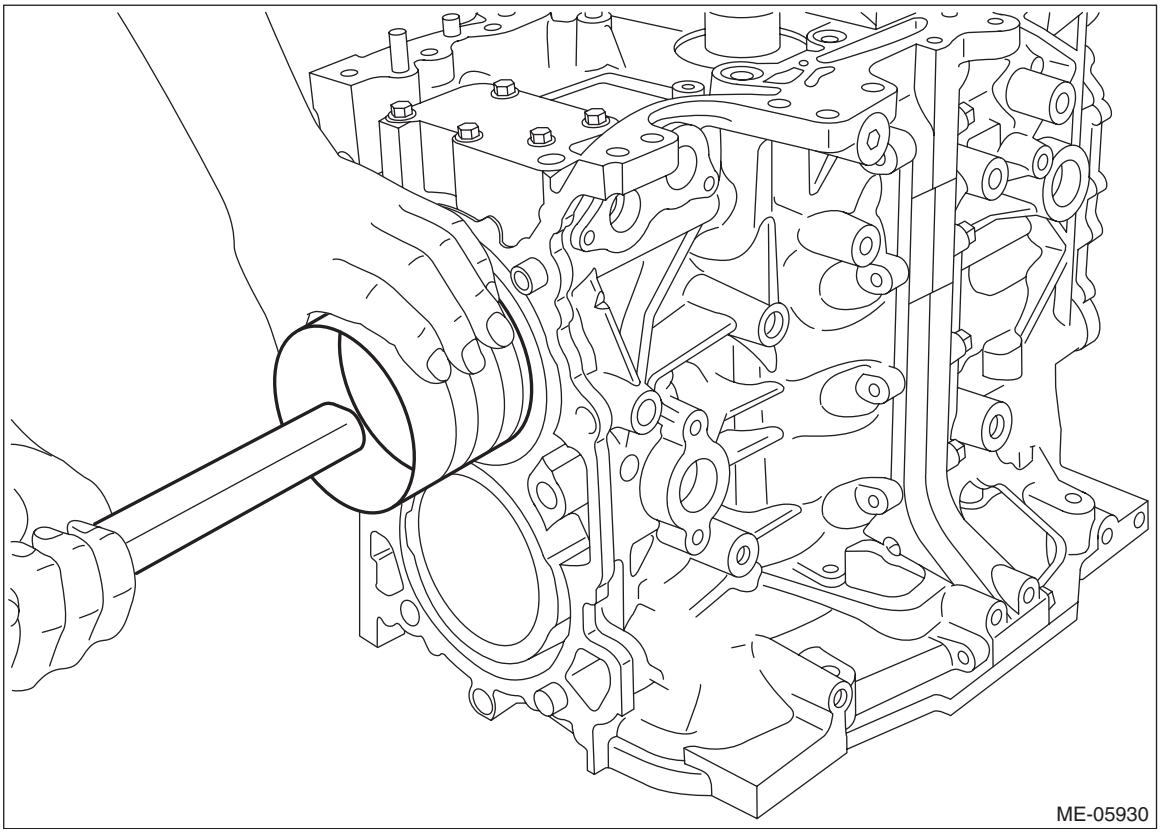
CAUTION:
- **Be careful not to damage the cylinder liner and #2 pin of crankshaft by the #2 connecting rod large end.**
- **Be careful not to apply strong impact when inserting to prevent connecting rod bearing from falling off.**

NOTE:
- Face the piston front mark (round mark) towards the front of the engine.



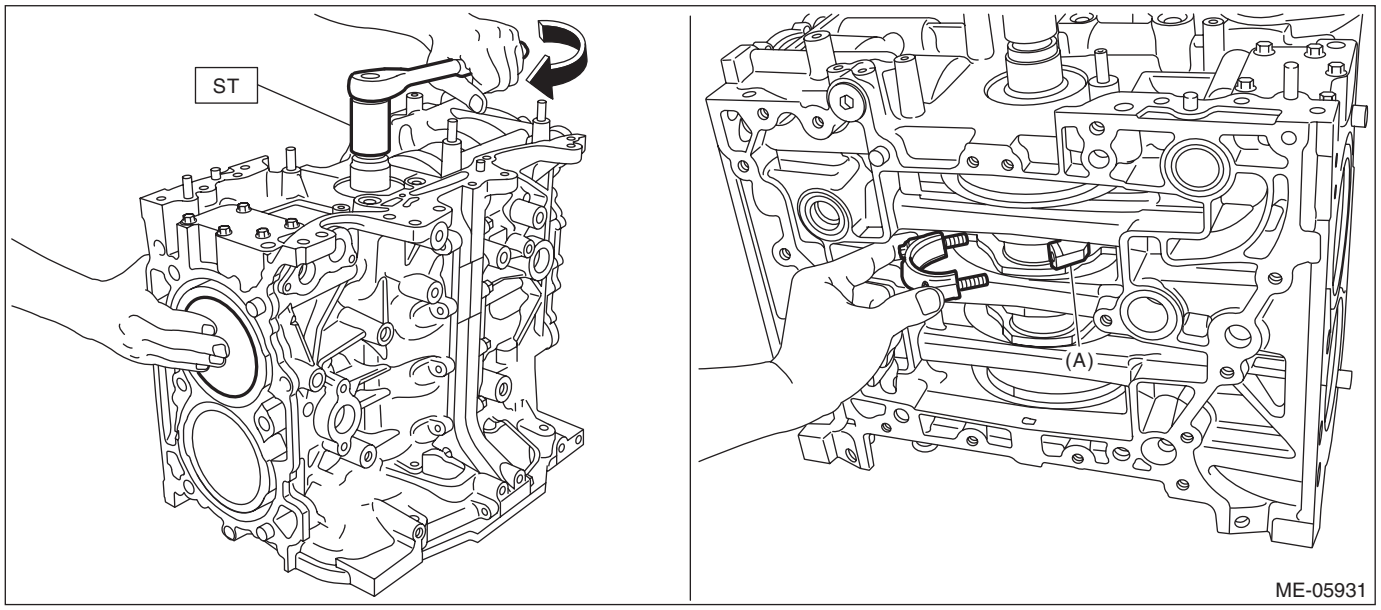
(a) Gasoline engine model (b) HEV model (c) Front mark

- Insert while lightly tapping the crown of the piston with the handle of a plastic hammer.



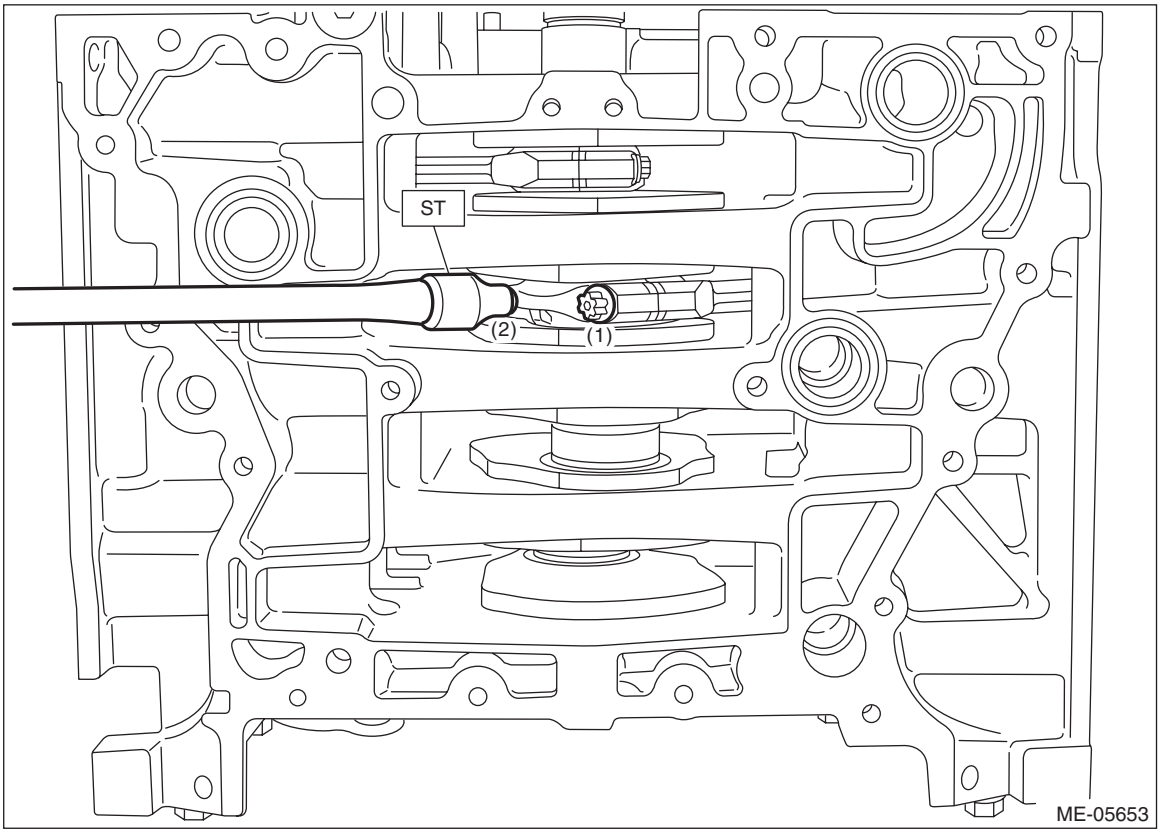
(8) Turn the crankshaft clockwise so that the #2 pin of crankshaft and the large end (A) of #2 connecting rod are positioned as shown in the figure using ST, while pressing the #2 piston crown, and then set the #2 connecting rod cap and #2 connecting rod cap bolt.

NOTE:
• Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching symbol.
• Use a new connecting rod cap bolt.
• Apply a coat of engine oil to the #2 connecting rod cap seat and the connecting rod cap bolt threads.
ST 18252AA000 CRANKSHAFT SOCKET



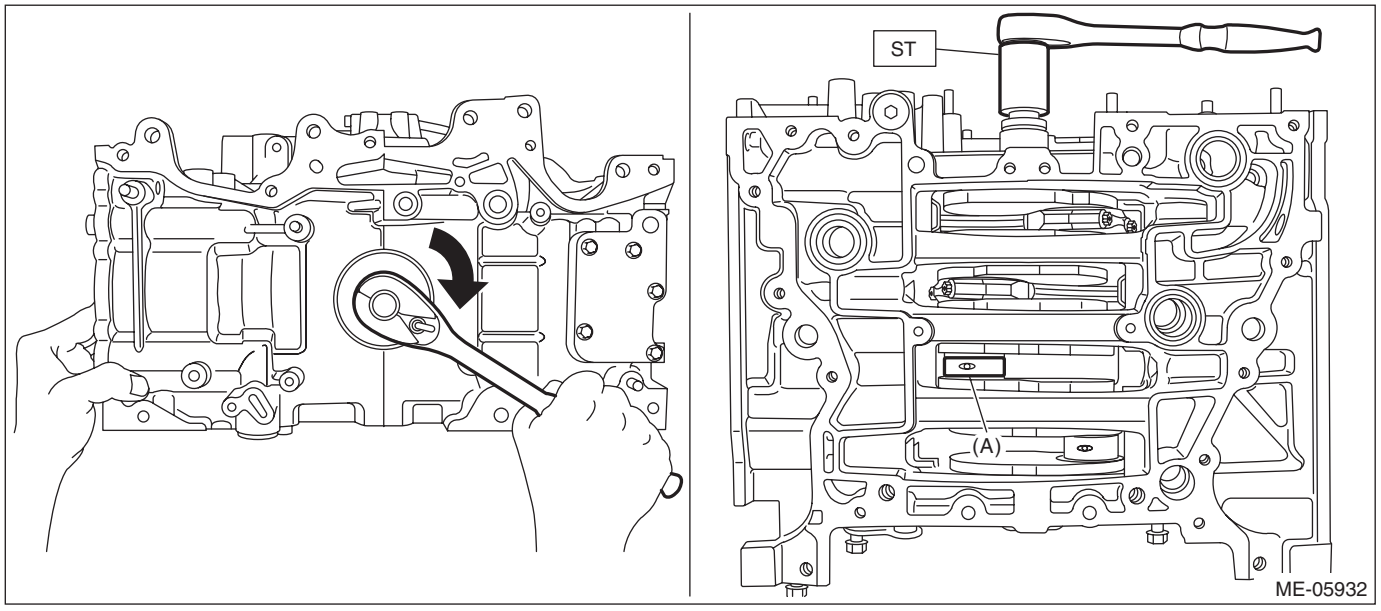
(9) Using ST, tighten the #2 connecting rod cap bolts to 10 N·m (1.0 kgf-m, 7.4 ft-lb) in numerical order as shown in the figure, then retighten the bolts to 22 N·m (2.2 kgf-m, 16.2 ft-lb) in numerical order as shown in the figure.

ST 18270AA020 SOCKET



(10) Turn the crankshaft clockwise so that the #3 pin (A) of crankshaft is positioned at TDC using ST.

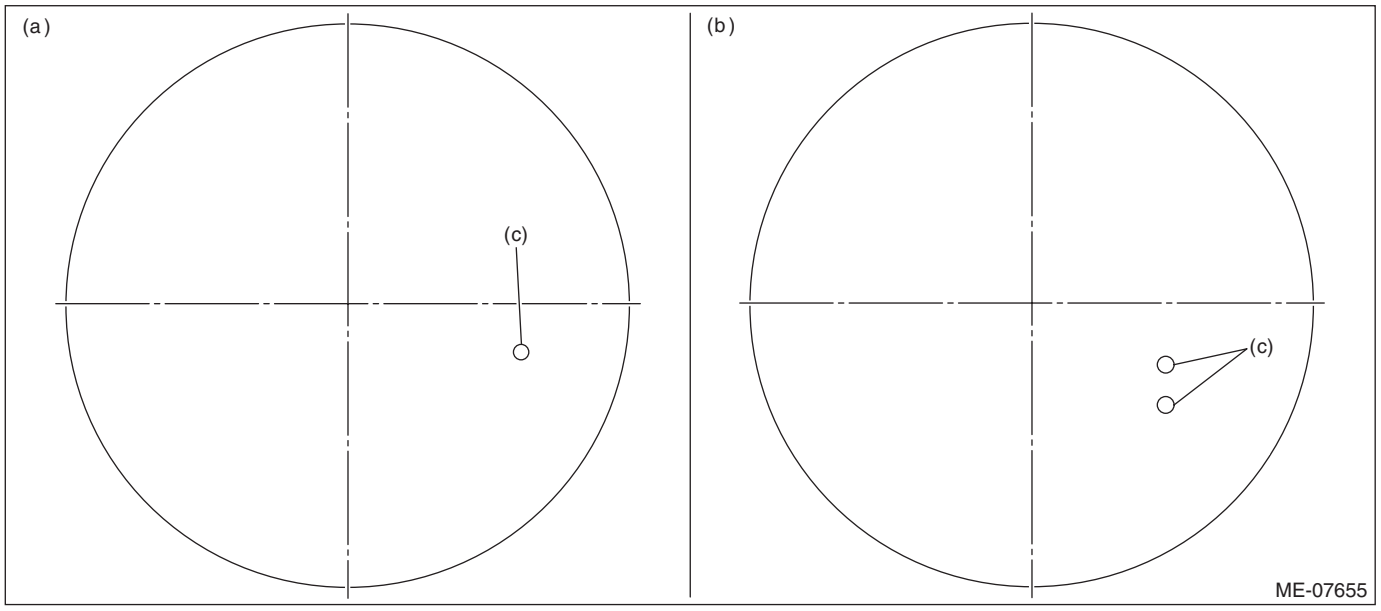
ST 18252AA000 CRANKSHAFT SOCKET



(11) Compress the piston ring using piston ring compressor, and insert the #3 connecting rod with #3 piston into cylinder block.

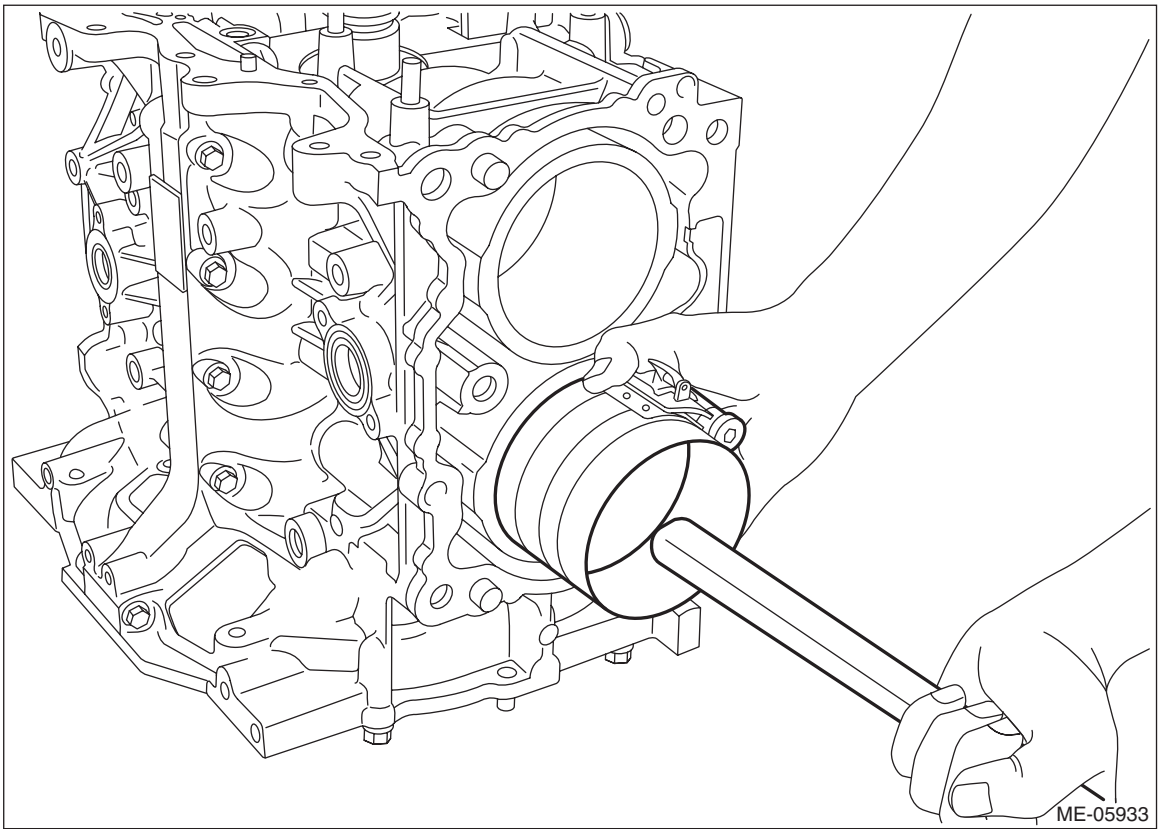
CAUTION:
- **Be careful not to damage the cylinder liner and #3 pin of crankshaft by the #3 connecting rod large end.**
- **Be careful not to apply strong impact when inserting to prevent connecting rod bearing from falling off.**

NOTE:
- Face the piston front mark (round mark) towards the front of the engine.



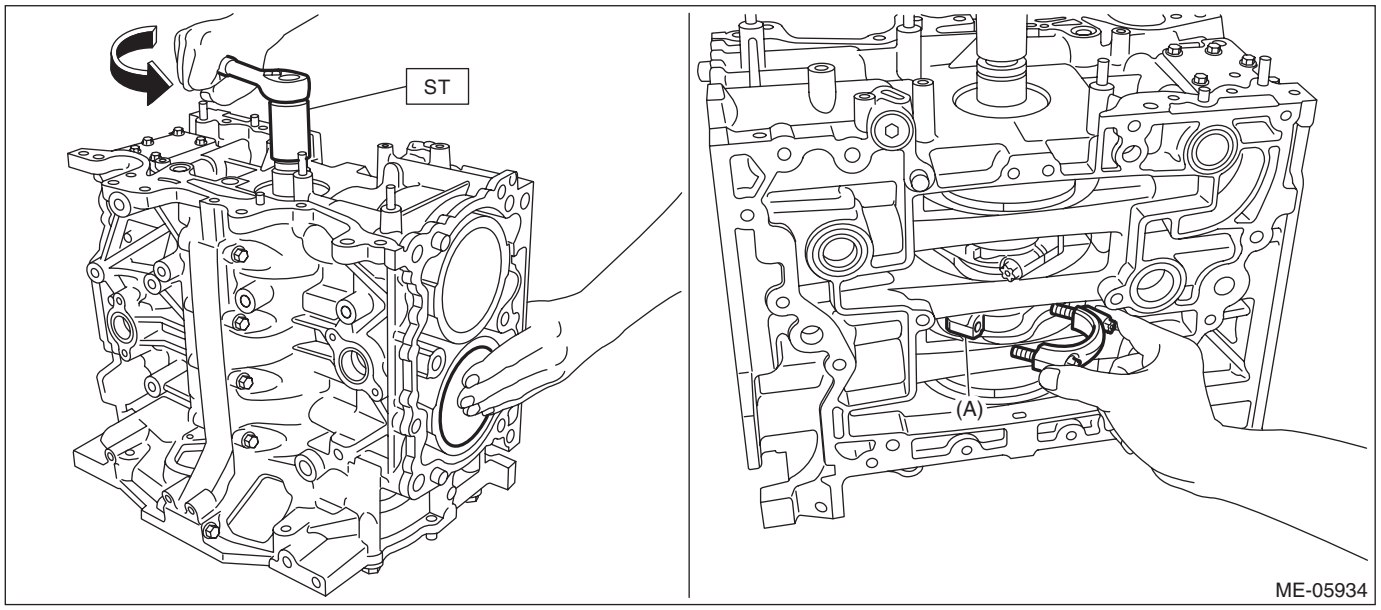
(a) Gasoline engine model (b) HEV model (c) Front mark

- Insert while lightly tapping the crown of the piston with the handle of a plastic hammer.



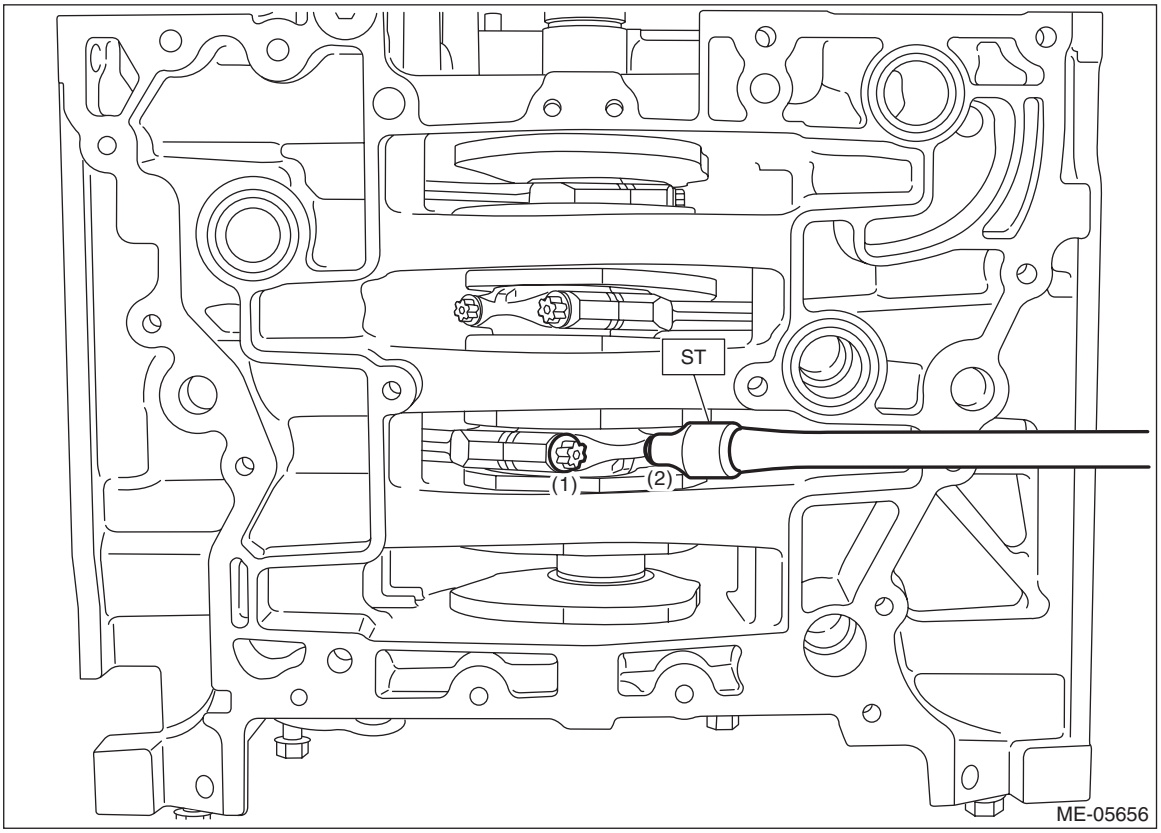
(12) Turn the crankshaft counterclockwise so that the #3 pin of crankshaft and the large end (A) of #3 connecting rod are positioned as shown in the figure using ST, while pressing the #3 piston crown, and then set the #3 connecting rod cap and #3 connecting rod cap bolt.

NOTE:
• Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching symbol.
• Use a new connecting rod cap bolt.
• Apply a coat of engine oil to the #3 connecting rod cap seat and the connecting rod cap bolt threads.
ST 18252AA000 CRANKSHAFT SOCKET



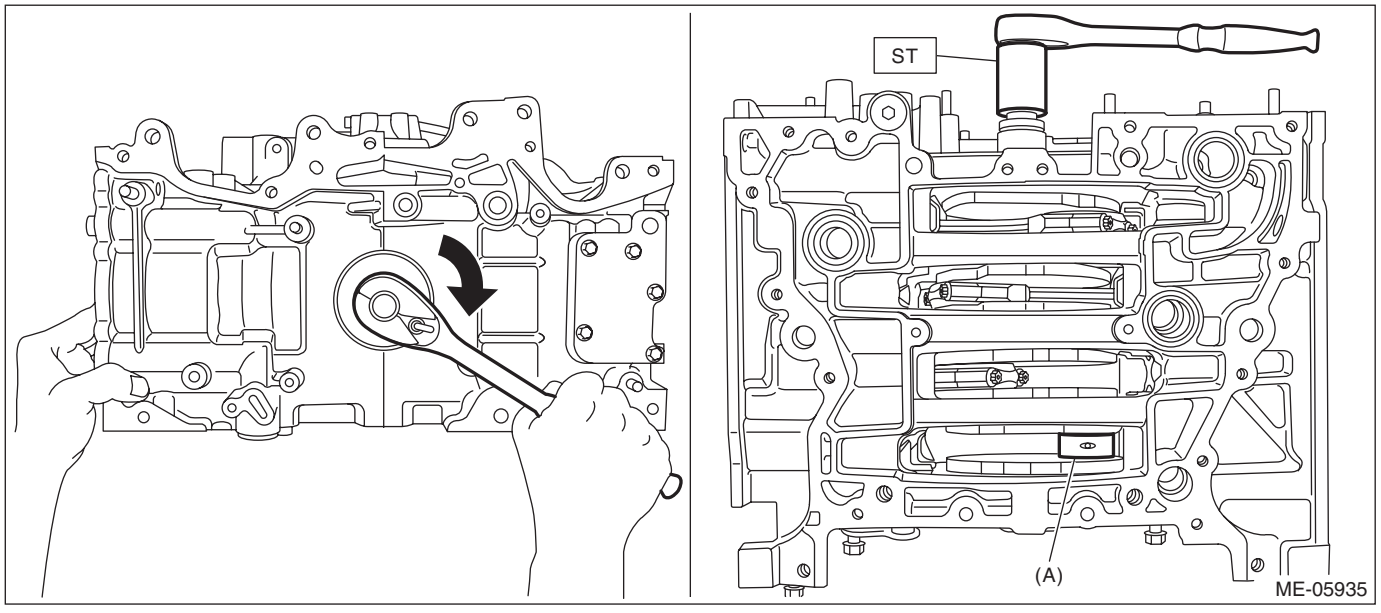
(13) Using ST, tighten the #3 connecting rod cap bolts to 10 N·m (1.0 kgf-m, 7.4 ft-lb) in numerical order as shown in the figure, then retighten the bolts to 22 N·m (2.2 kgf-m, 16.2 ft-lb) in numerical order as shown in the figure.

ST 18270AA020 SOCKET



(14) Turn the crankshaft clockwise so that the #4 pin (A) of crankshaft is positioned at TDC using ST.

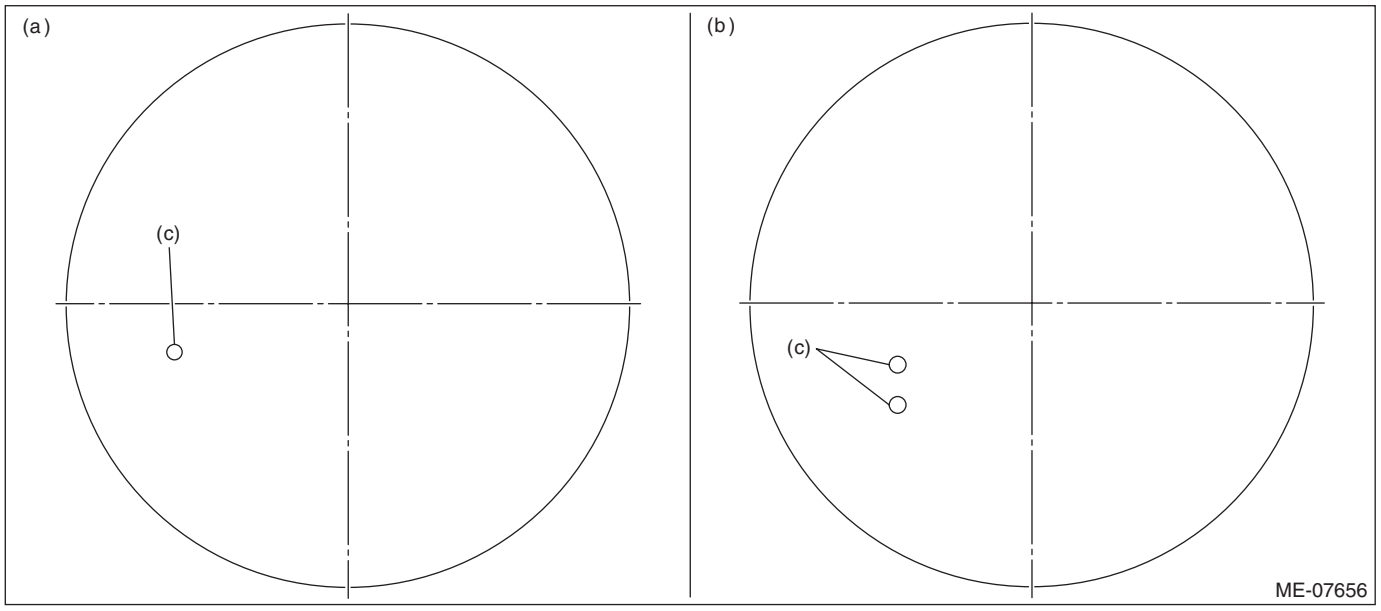
ST 18252AA000 CRANKSHAFT SOCKET



(15) Compress the piston ring using piston ring compressor, and insert the #4 connecting rod with #4 piston into cylinder block.

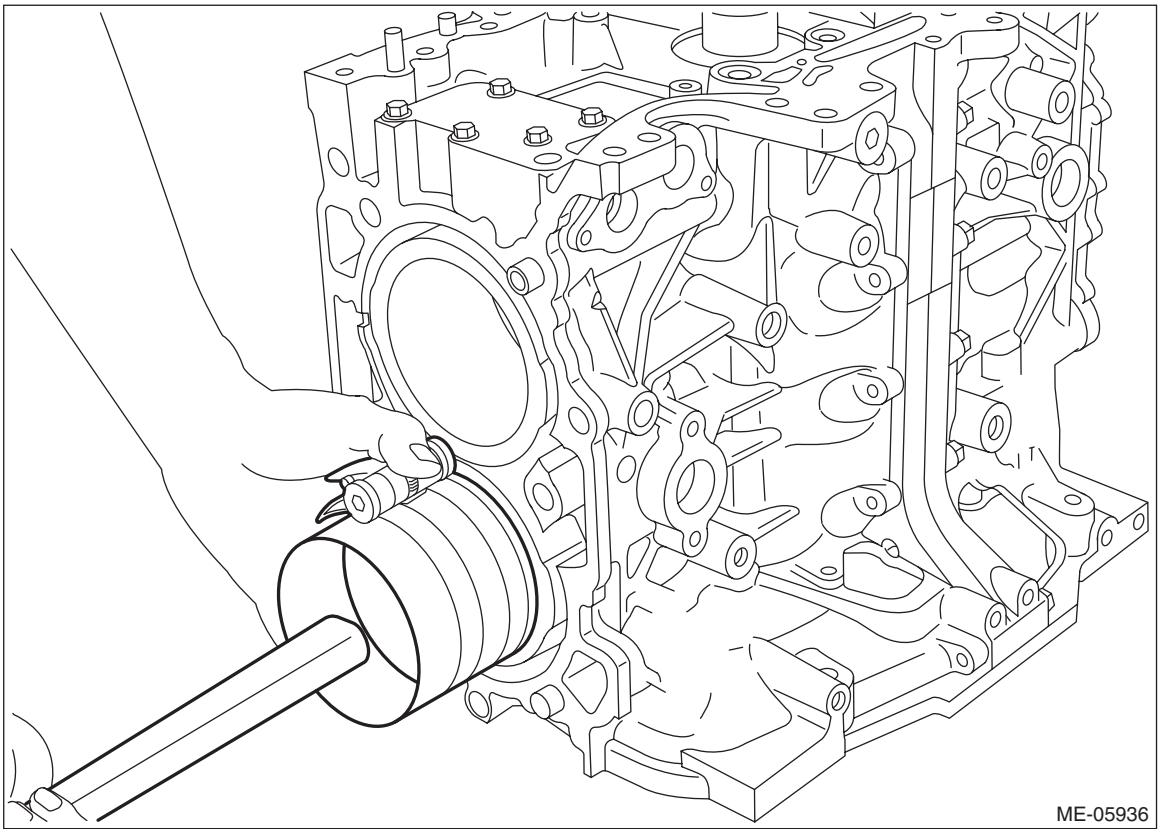
CAUTION:
- **Be careful not to damage the cylinder liner and #4 pin of crankshaft by the #4 connecting rod large end.**
- **Be careful not to apply strong impact when inserting to prevent connecting rod bearing from falling off.**

NOTE:
- Face the piston front mark (round mark) towards the front of the engine.



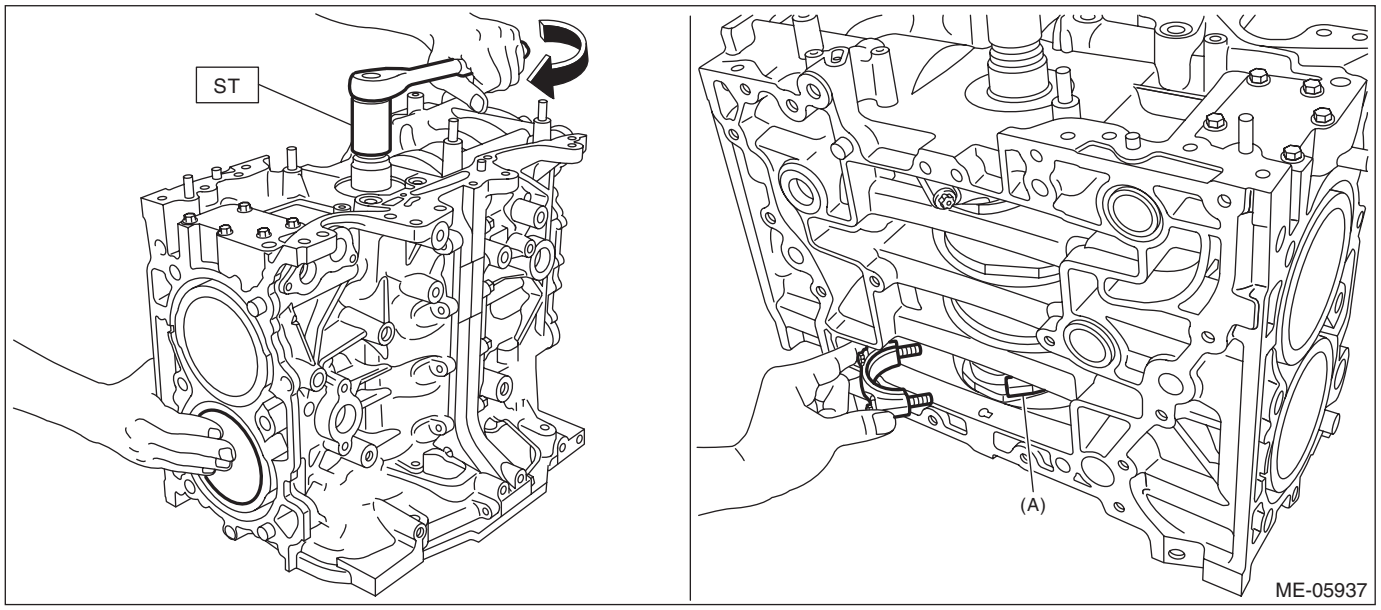
(a) Gasoline engine model (b) HEV model (c) Front mark

- Insert while lightly tapping the crown of the piston with the handle of a plastic hammer.



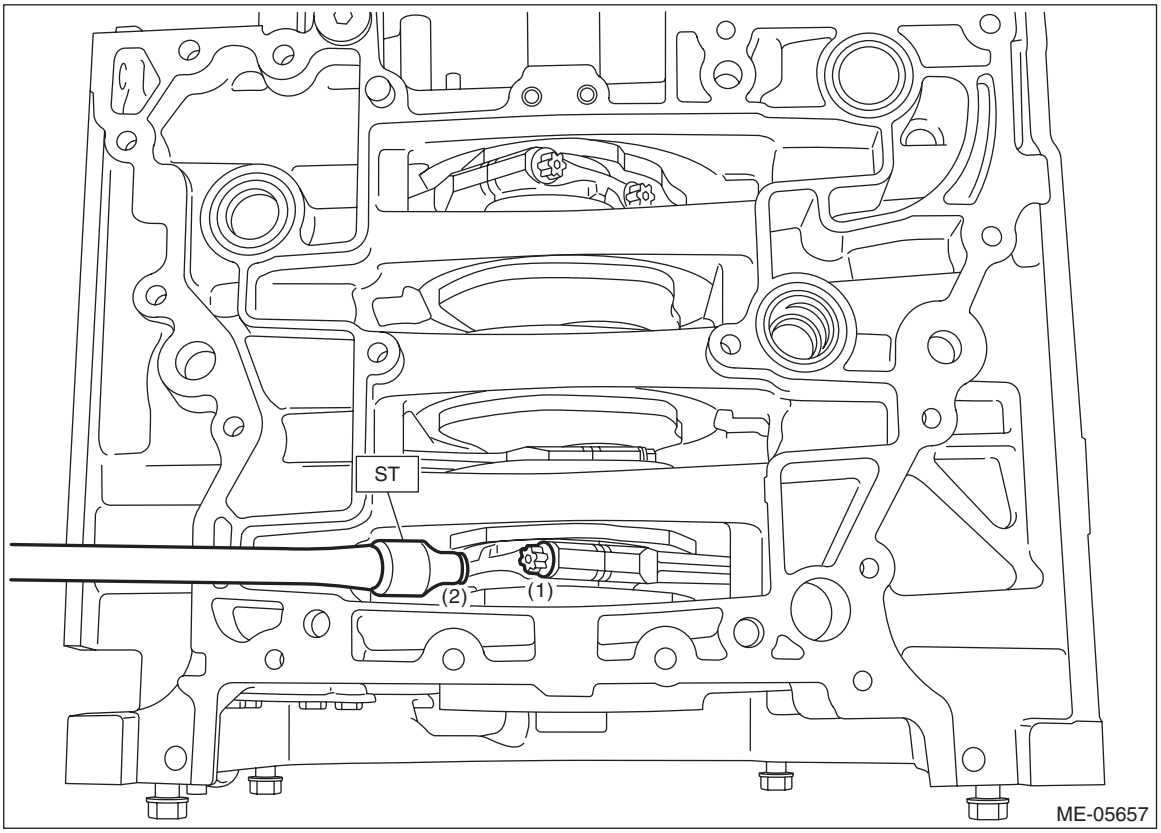
(16) Turn the crankshaft clockwise so that the #4 pin of crankshaft and the large end (A) of #4 connecting rod are positioned as shown in the figure using ST, while pressing the #4 piston crown, and then set the #4 connecting rod cap and #4 connecting rod cap bolt.

NOTE:
• Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching symbol.
• Use a new connecting rod cap bolt.
• Apply a coat of engine oil to the #4 connecting rod cap seat and the connecting rod cap bolt threads.
ST 18252AA000 CRANKSHAFT SOCKET



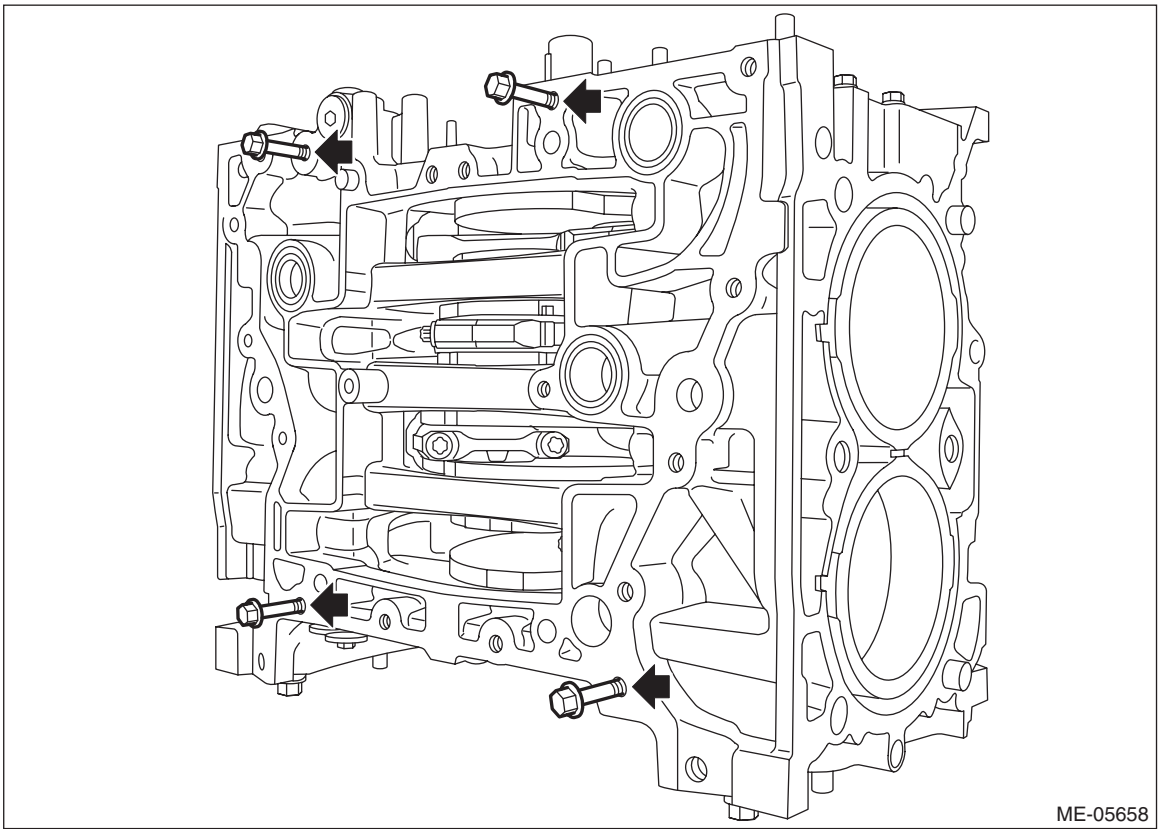
(17) Using ST, tighten the #4 connecting rod cap bolts to 10 N·m (1.0 kgf-m, 7.4 ft-lb) in numerical order as shown in the figure, then retighten the bolts to 22 N·m (2.2 kgf-m, 16.2 ft-lb) in numerical order as shown in the figure.

ST 18270AA020 SOCKET



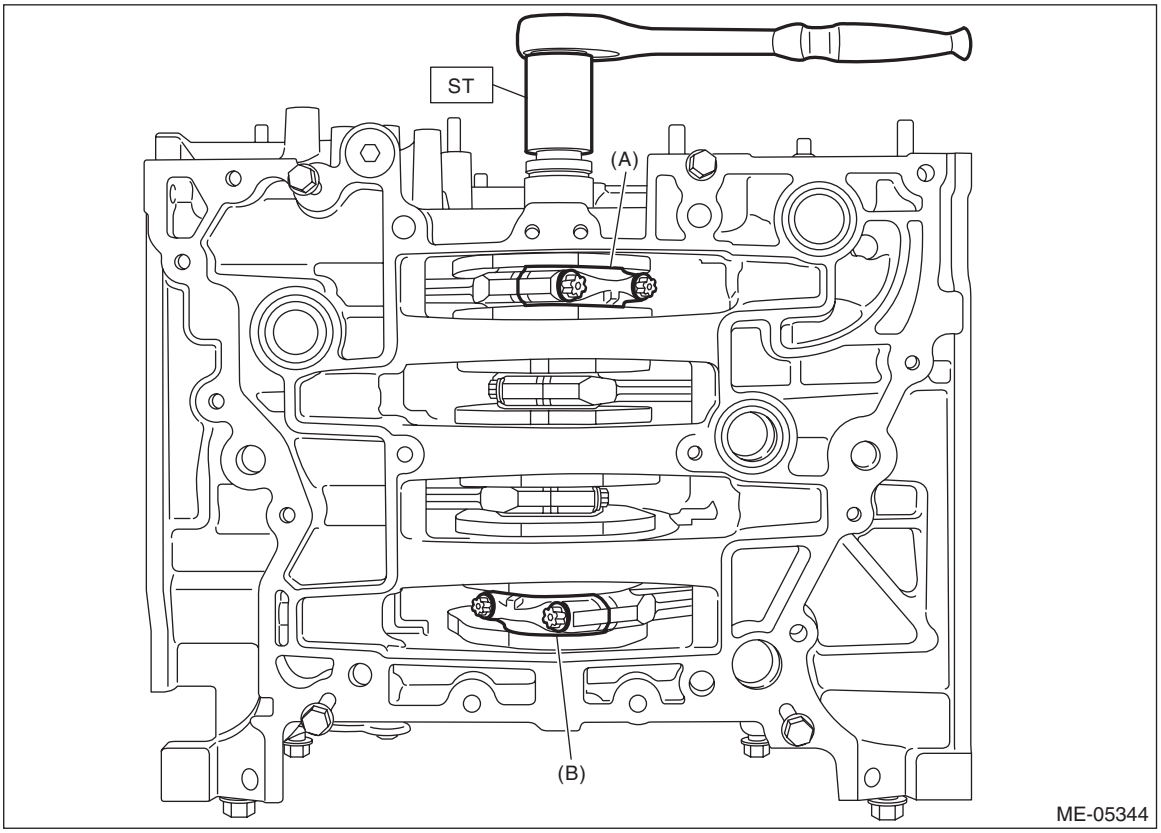
(18) Install the cam carrier mounting bolts at the locations shown in the figure.

NOTE:
This procedure is required to tighten the connecting rod cap bolts with specified angle using ST.



(19) Turn the crankshaft so that the #1 connecting rod cap (A) and #4 connecting rod cap (B) is located at the position shown in the figure using ST.

ST 18252AA000 CRANKSHAFT SOCKET

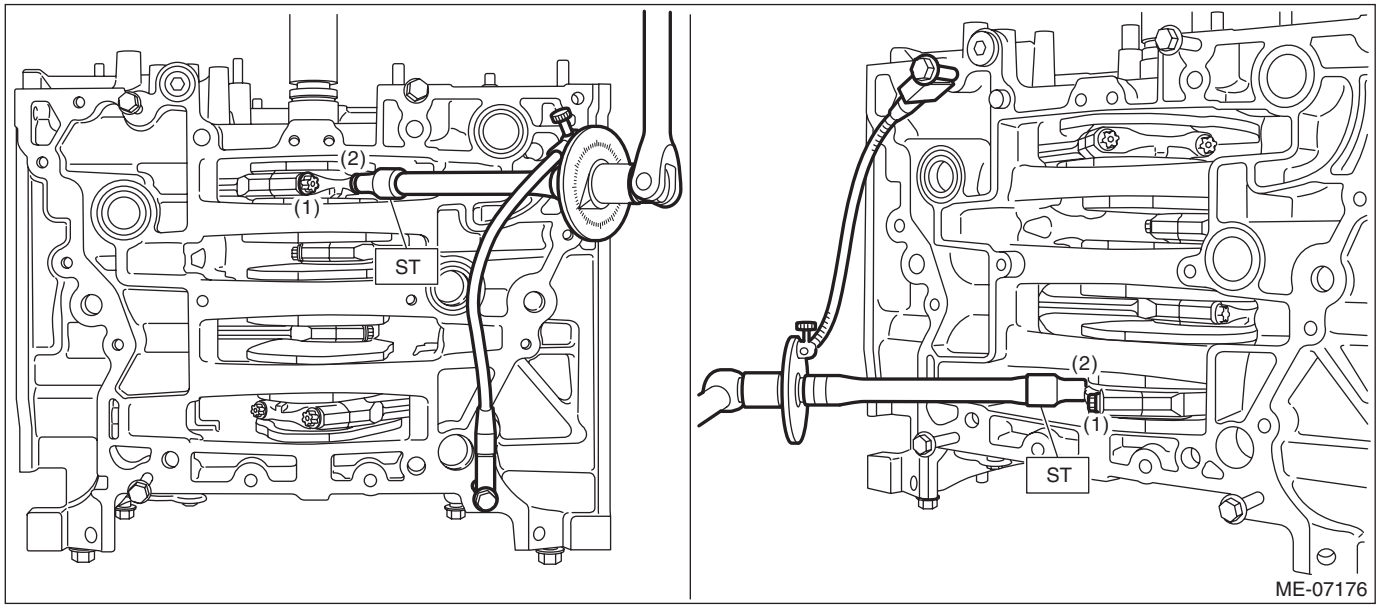


(20) Using ST and angle gauge, tighten the #1 connecting rod cap bolts and #4 connecting rod cap bolts with specified angle in numerical order as shown in the figure.

ST 18270AA020 SOCKET

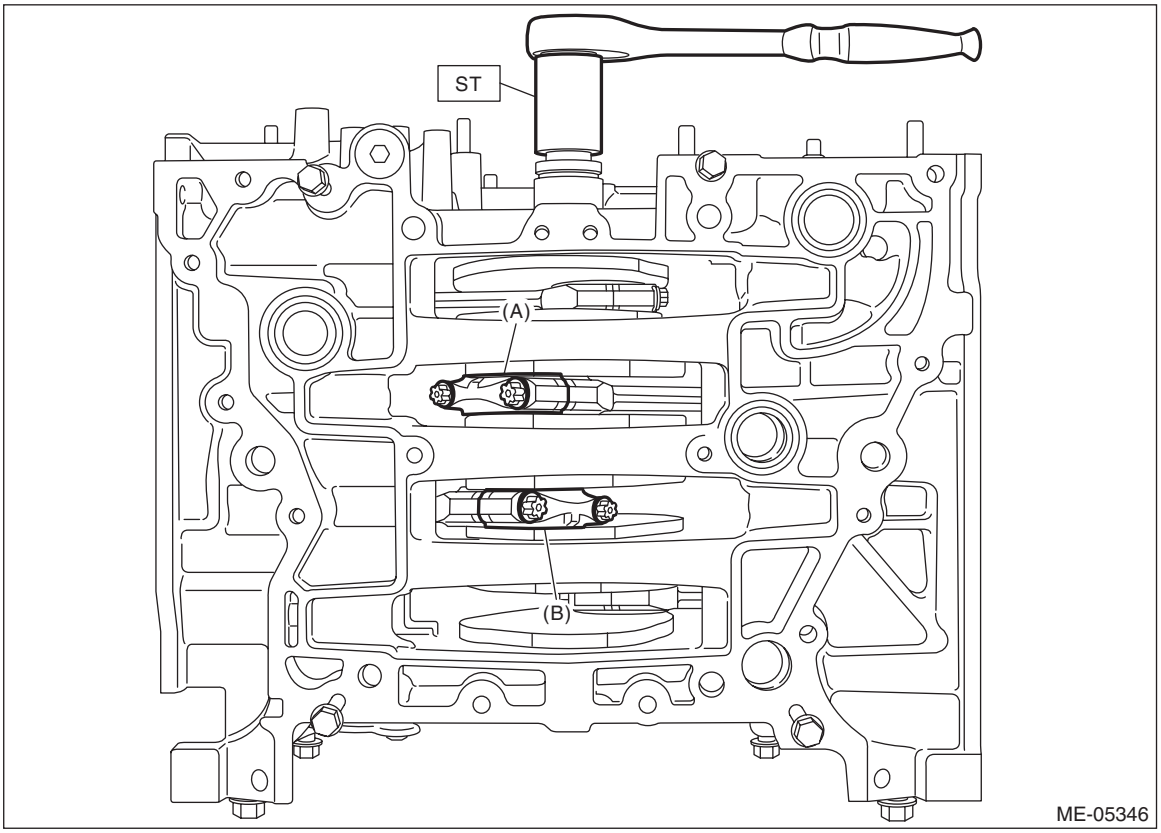
Tightening angle:

137°+3° –2°



(21) Turn the crankshaft so that the #2 connecting rod cap (A) and #3 connecting rod cap (B) is located at the position shown in the figure using ST.

ST 18252AA000 CRANKSHAFT SOCKET

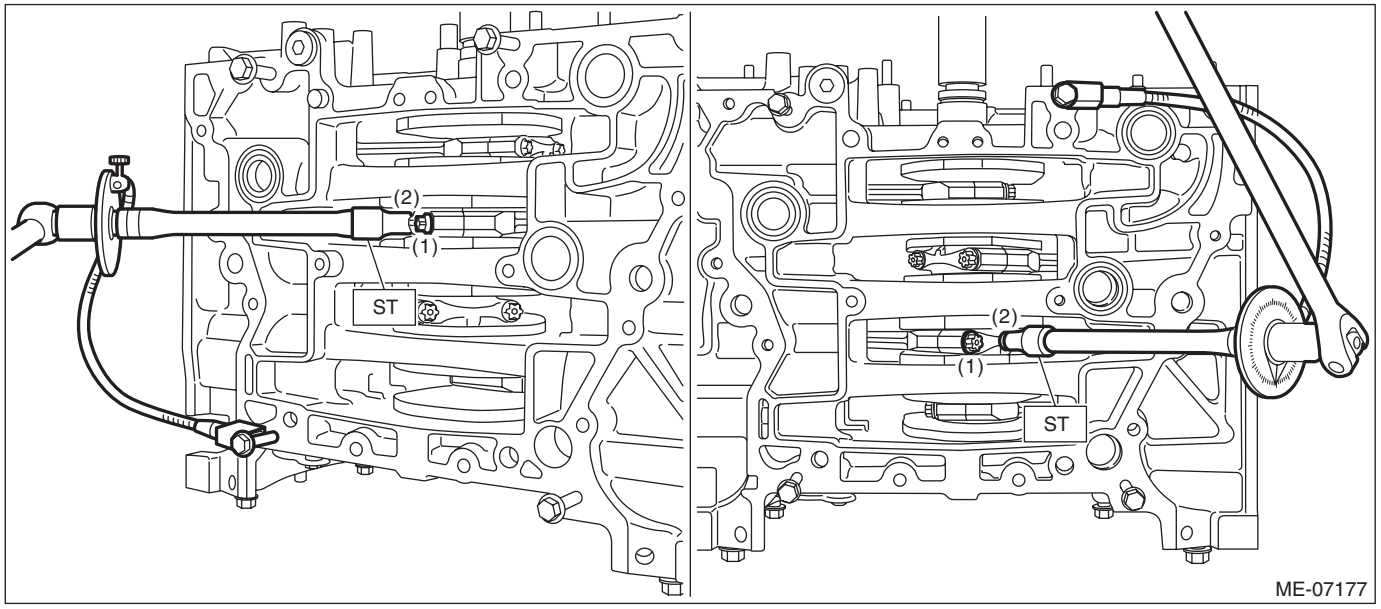


(22) Using ST and angle gauge, tighten the #2 connecting rod cap bolts and #3 connecting rod cap bolts with specified angle in numerical order as shown in the figure.

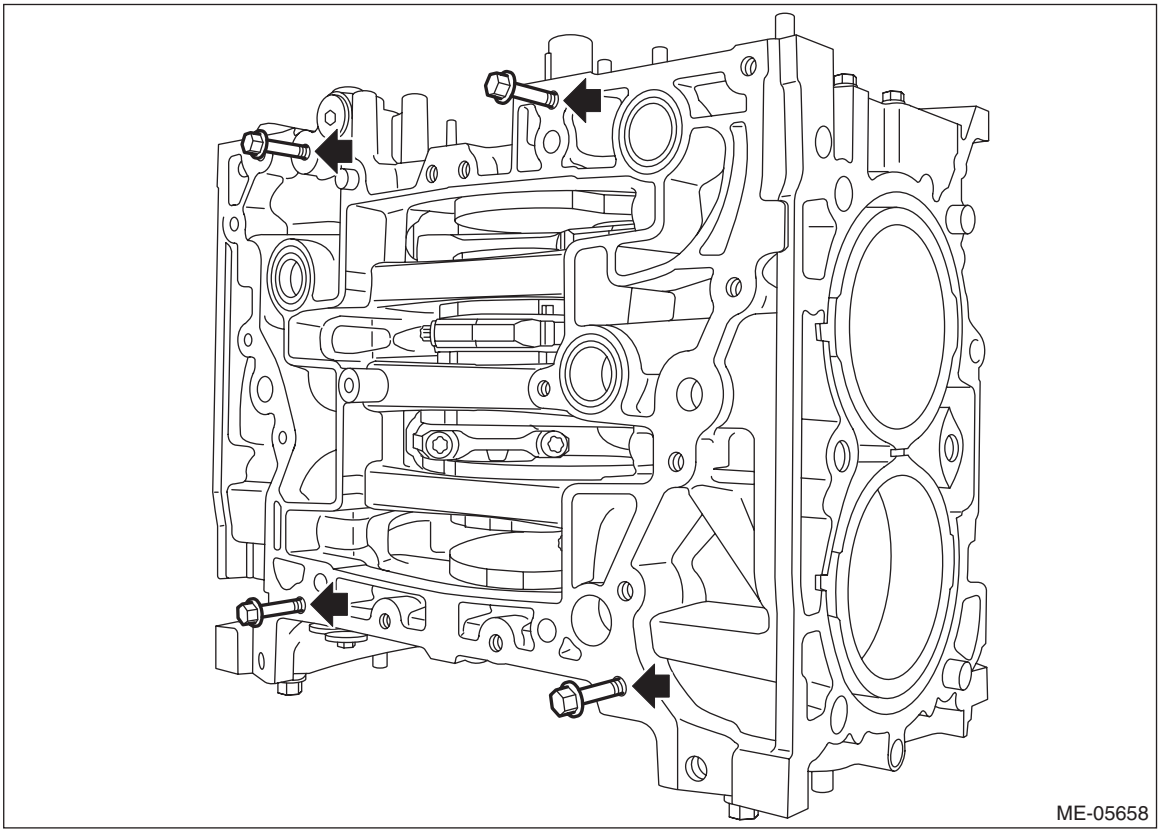
ST 18270AA020 SOCKET

Tightening angle:

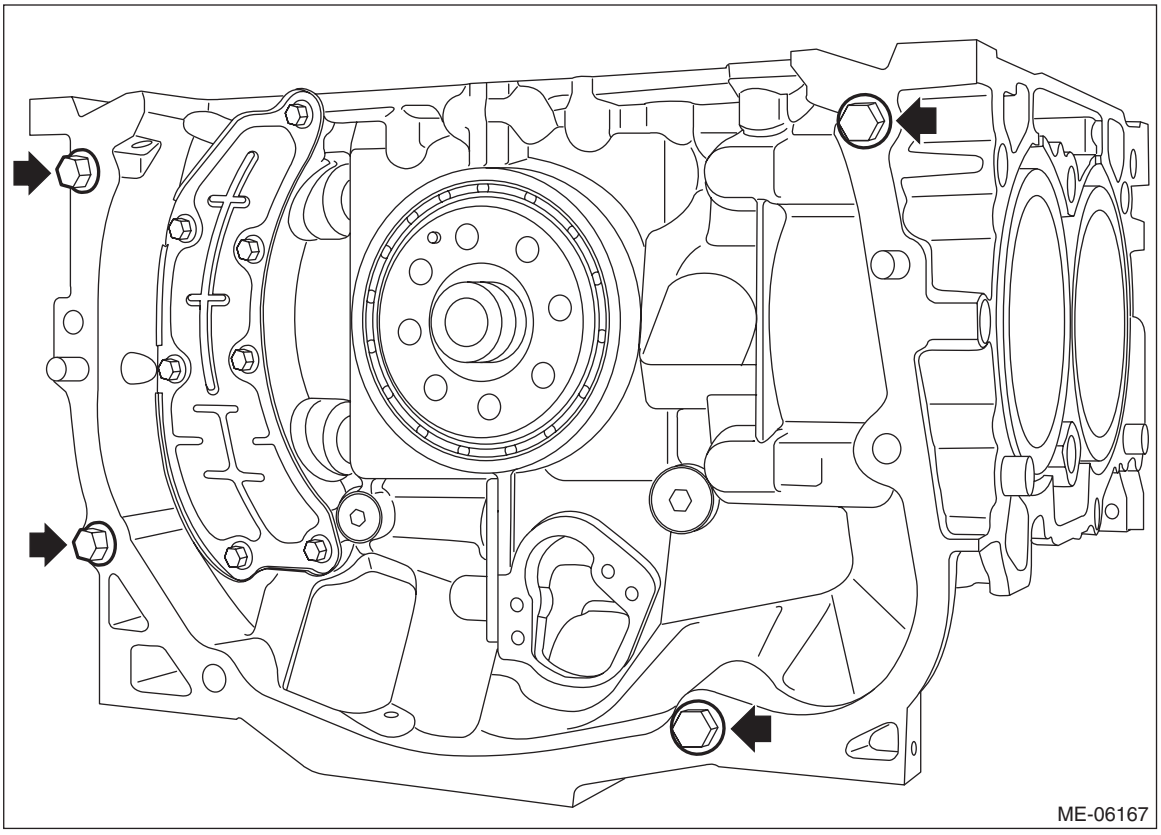
137°+3° –2°



(23) Remove the cam carrier mounting bolts attached at the locations shown in the figure.



13) Set the cylinder block so that the oil pan side faces upward, and remove the mounting bolts attached to the locations shown in the figure.

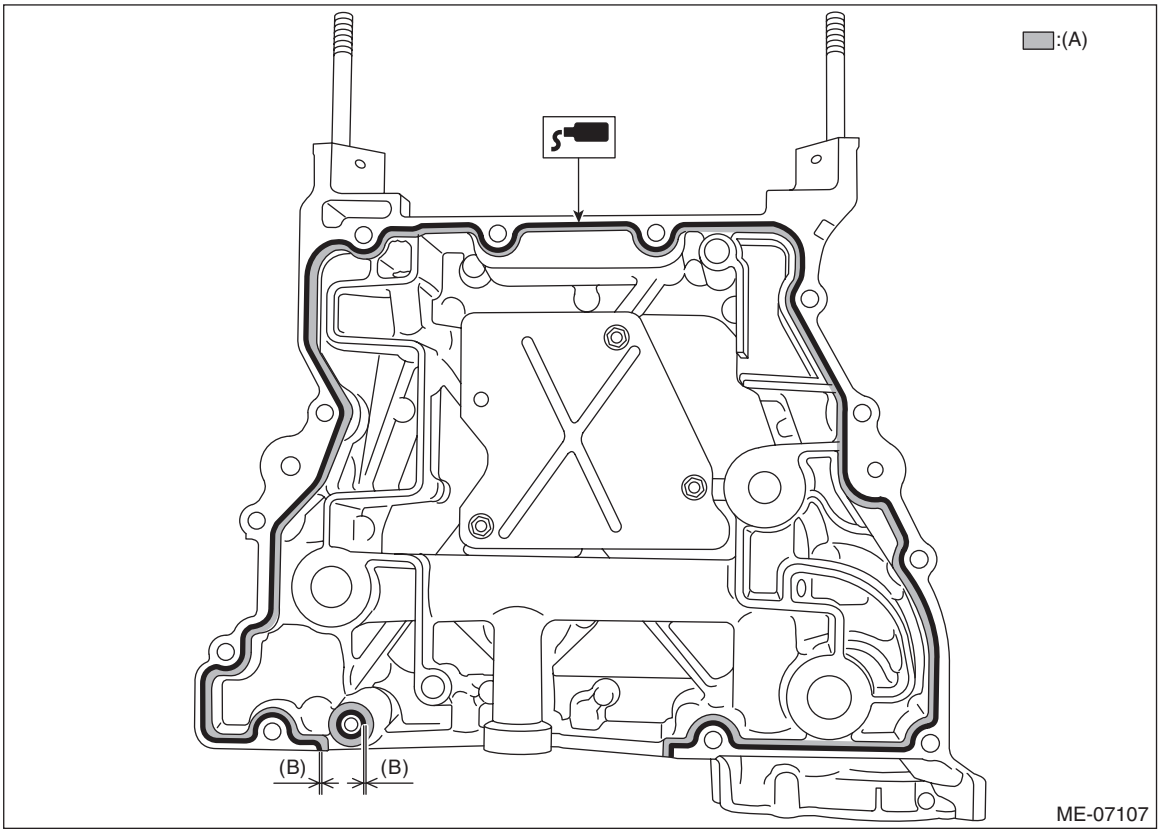


14) Install the oil pan upper with oil pan to the cylinder block.
(1) Apply liquid gasket to the mating surface of oil pan upper as shown in the figure.

NOTE:
• Before applying liquid gasket, degrease the old liquid gasket seal surface of the cylinder block and the oil pan upper.
• Install within 5 min. after applying liquid gasket.
• Apply liquid gasket 1.5 mm (0.0591 in) outside from the chamfer surface. However, application of liquid gasket on the chamfer surface around the bolt hole is allowed.

Liquid gasket:
THREE BOND 1217G (Part No. 0877Y0100), THREE BOND 1217H or equivalent

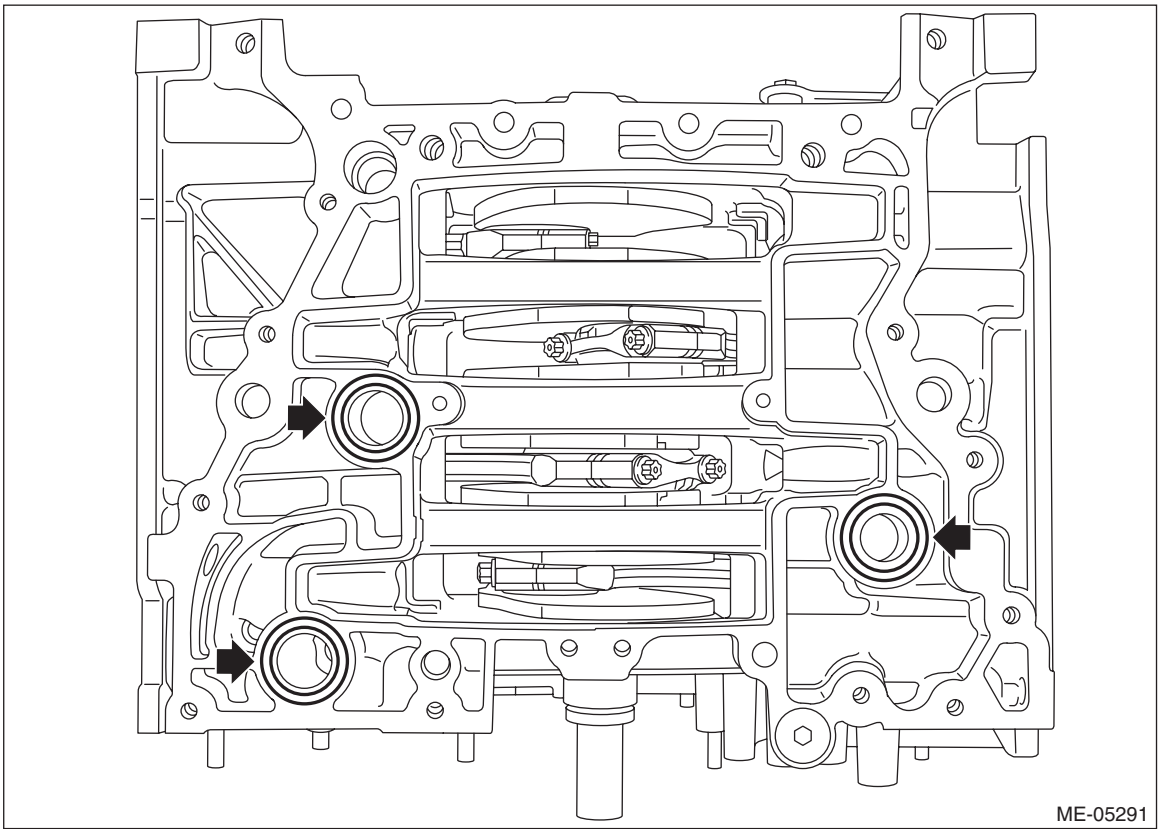
Liquid gasket applying diameter:
5±1 mm (0.1969±0.0394 in)



(A) Chamfer surface (B) 1.5 mm (0.0591 in)

(2) Install the O-ring to the cylinder block.

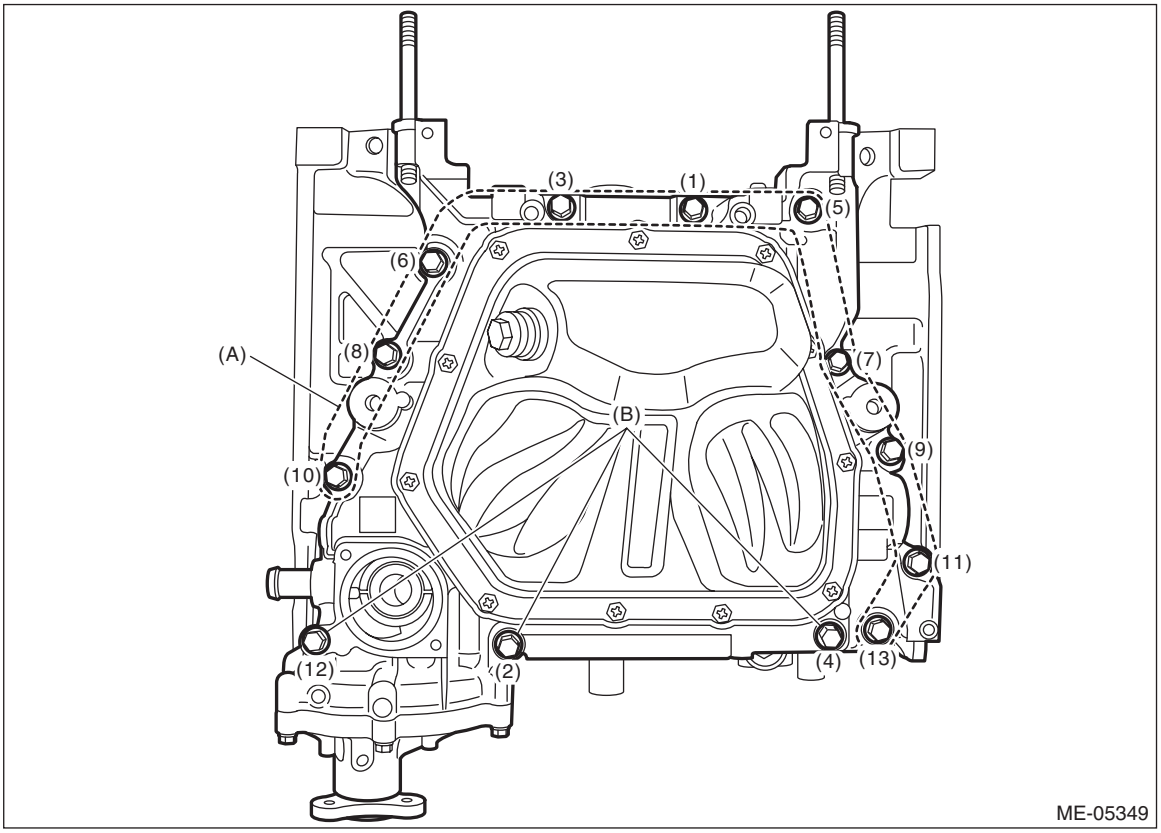
NOTE:
Use new O-rings.



(3) Set the oil pan with oil pan upper to the cylinder block, and tighten the bolts in numerical order as shown in the figure.

NOTE:
After tightening, if the liquid gasket is squeezed out onto the seal surface of the chain cover, completely remove any squeezed-out liquid gasket.

Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)

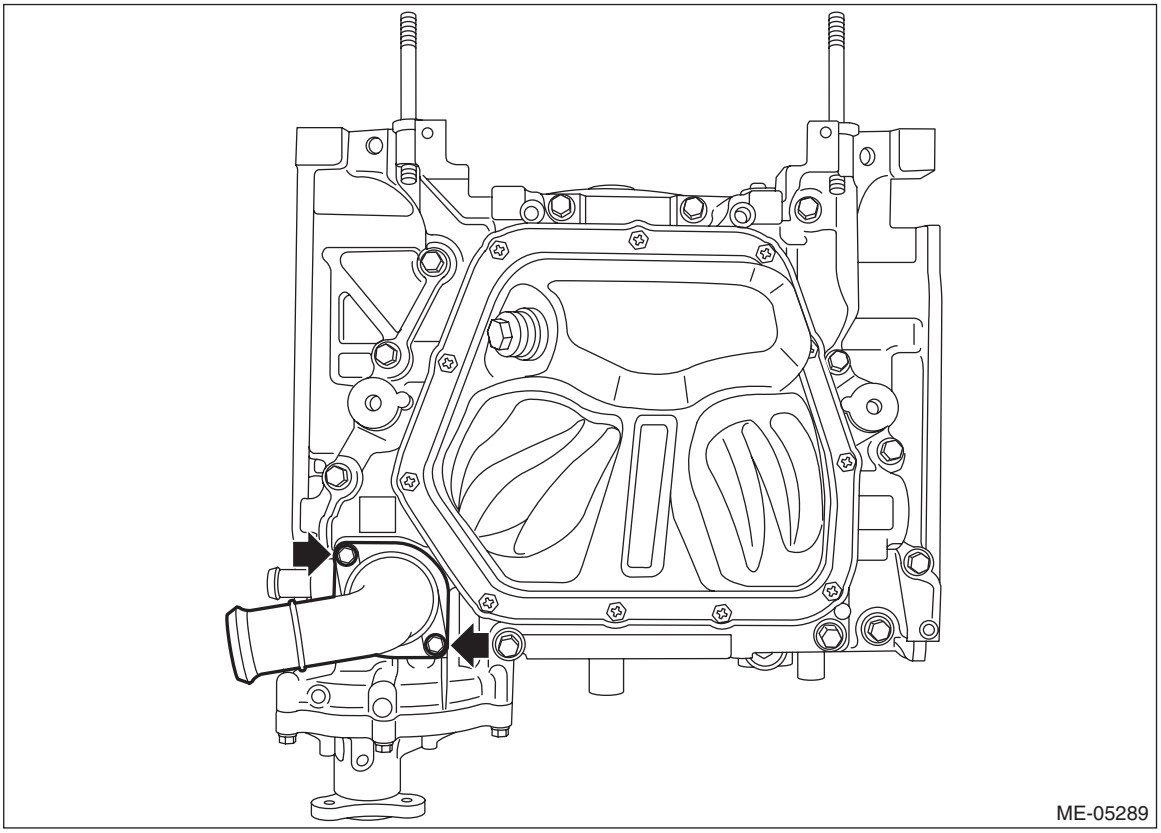


(A) M8 × 25 (B) M8 × 75

15) Set the thermostat to the oil pan upper, and install the thermostat cover.

NOTE:
Use a new gasket.

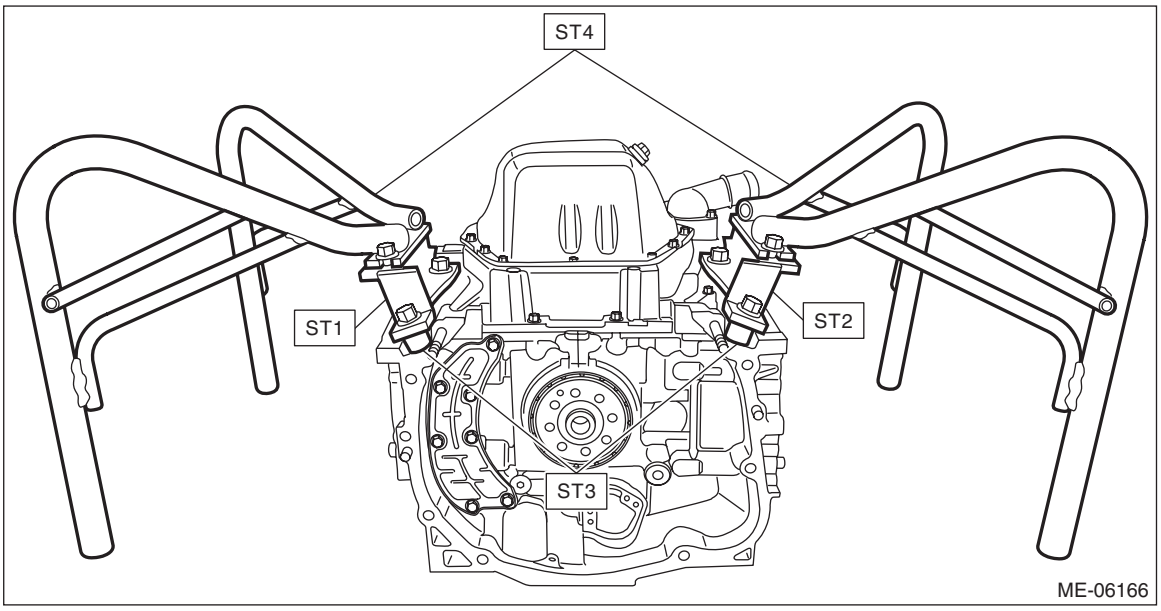
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



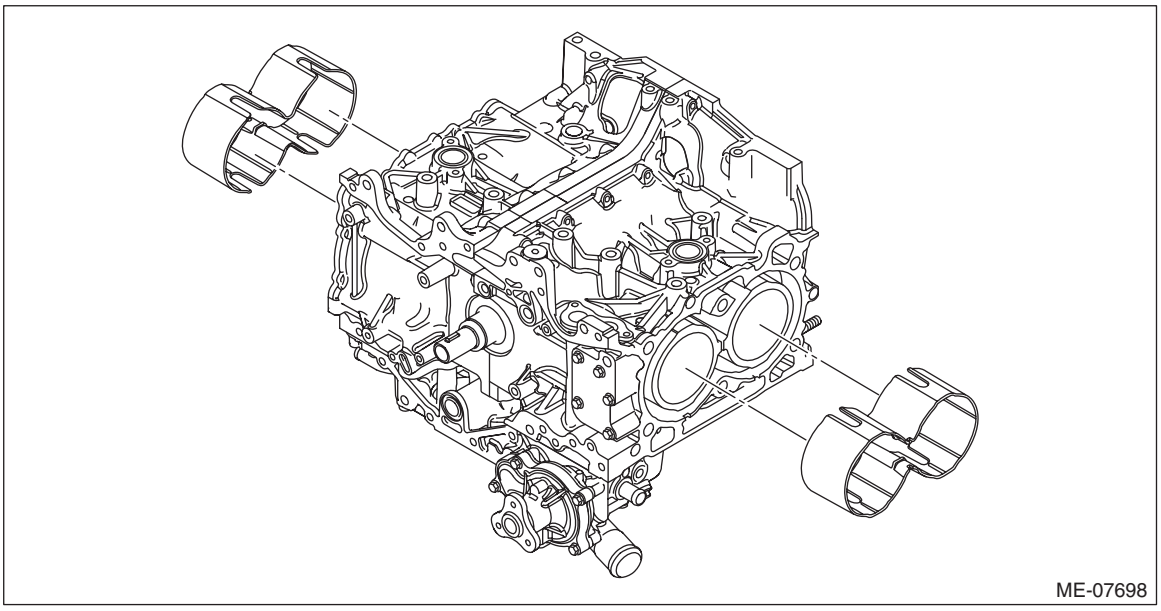
16) Install the ST1, ST2, ST3 and ST4 to the cylinder block and oil pan upper.

ST1	498457000	ENGINE STAND ADAPTER RH
ST2	498457100	ENGINE STAND ADAPTER LH
ST3	18362AA020	ADAPTER
ST4	499817100	ENGINE STAND

Tightening torque:
35 N·m (3.6 kgf-m, 25.8 ft-lb)

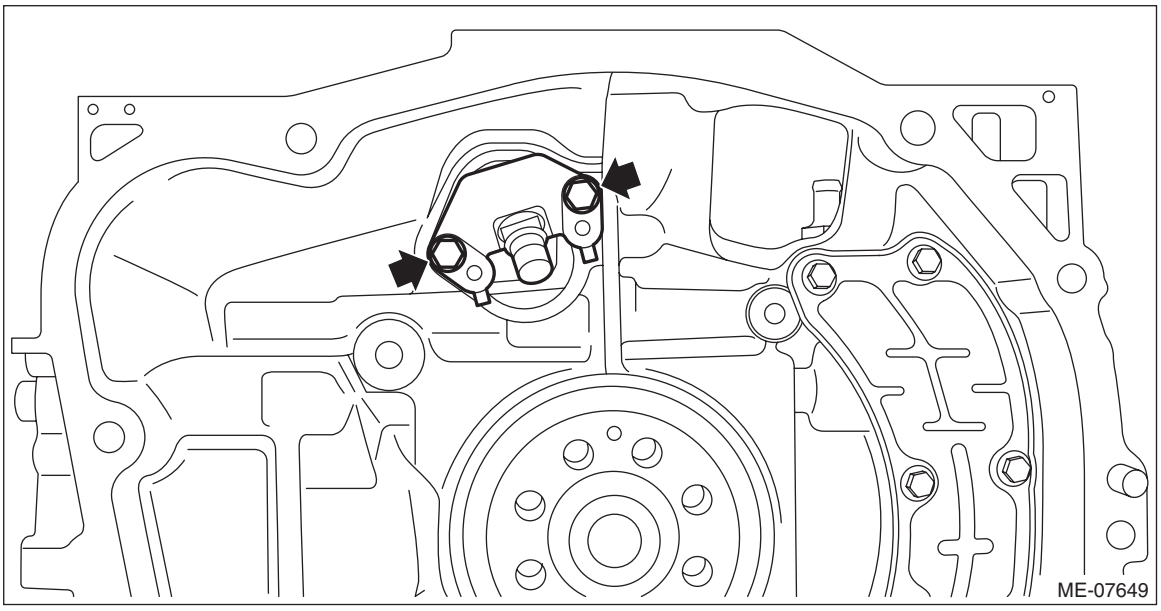


17) Install the water jacket spacer to the cylinder block RH and cylinder block LH.



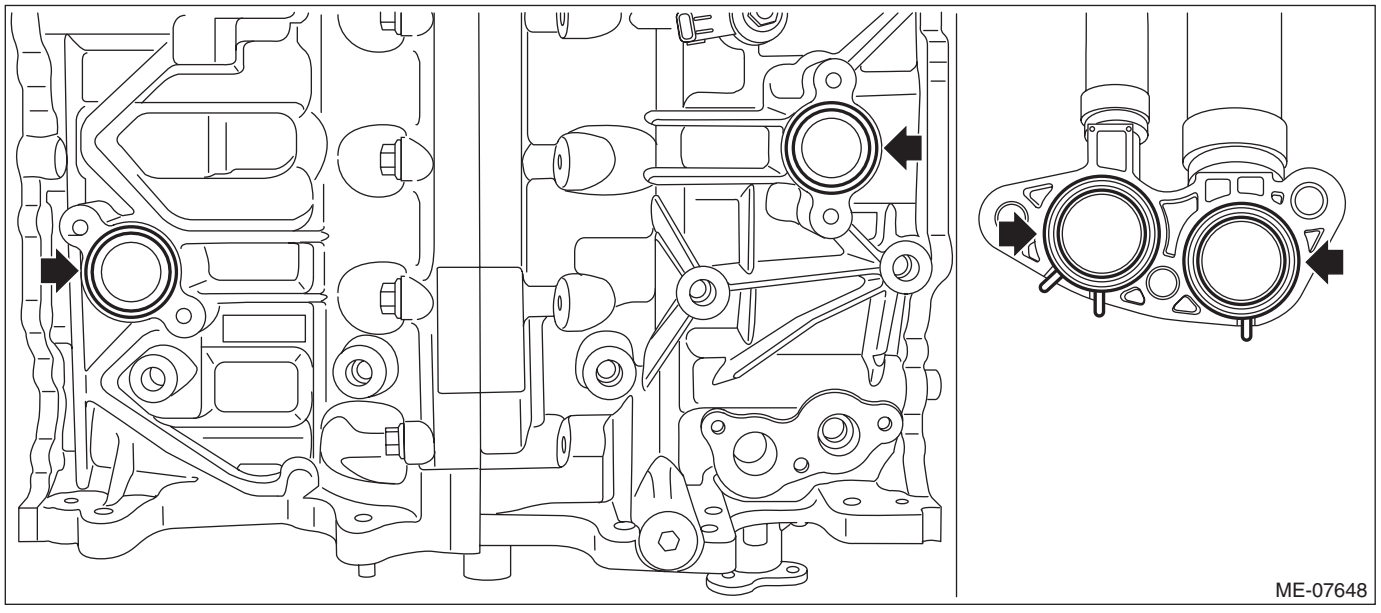
18) Install the crankshaft position sensor with crankshaft position sensor holder to the cylinder block LH.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



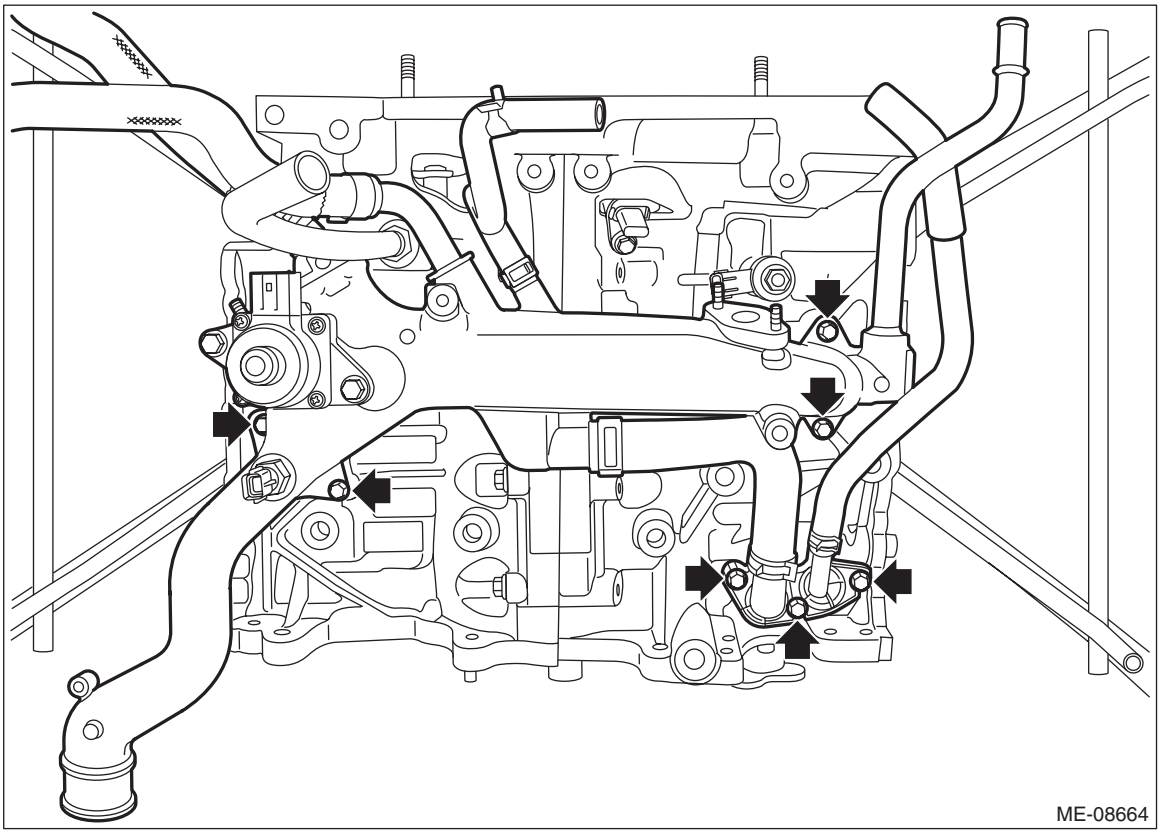
19) Install the crankshaft position sensor plate with drive plate. (CVT model) <Ref. to CVT(TR580)-163, INSTALLATION, Drive Plate.> <Ref. to CVT(TH58A)-176, INSTALLATION, Drive Plate.>
20) Install the crankshaft position sensor plate with flywheel. (MT model) <Ref. to CL-11, INSTALLATION, Flywheel.>
21) Install the clutch disc and cover. (MT model) <Ref. to CL-9, INSTALLATION, Clutch Disc and Cover.>
22) Install the PCV valve. <Ref. to EC(H4DO(w/o HEV))-66, INSTALLATION, PCV Valve.> <Ref. to EC(H4DO(HEV))-54, INSTALLATION, PCV Valve.>
23) Install the knock sensor. <Ref. to FU(H4DO(w/o HEV))-70, INSTALLATION, Knock Sensor.> <Ref. to FU(H4DO(HEV))-60, INSTALLATION, Knock Sensor.>
24) Install the O-ring to the cylinder block and PCV connector.

NOTE:
Use new O-rings.

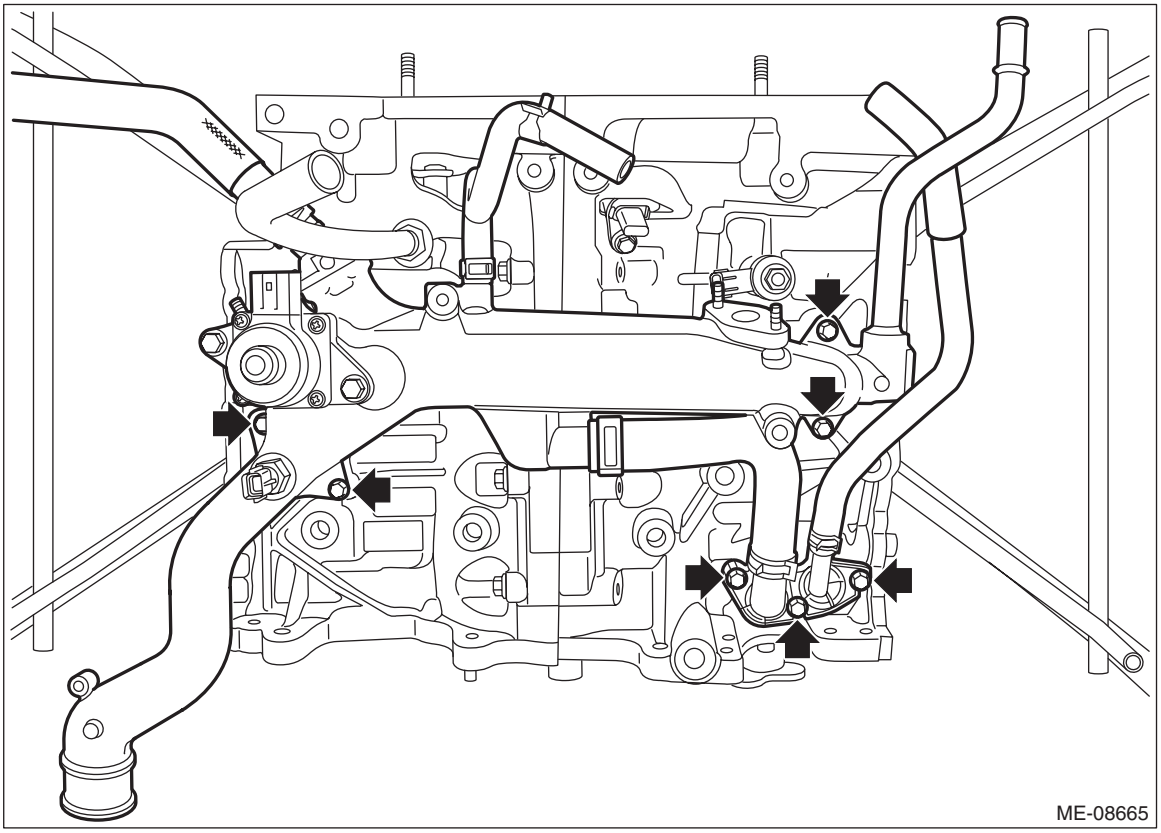


25) Set the water pipe assembly, PCV connector and brake vacuum pipe (HEV model) to the cylinder block, and install the bolts which secure the water pipe assembly and PCV connector to the cylinder block.

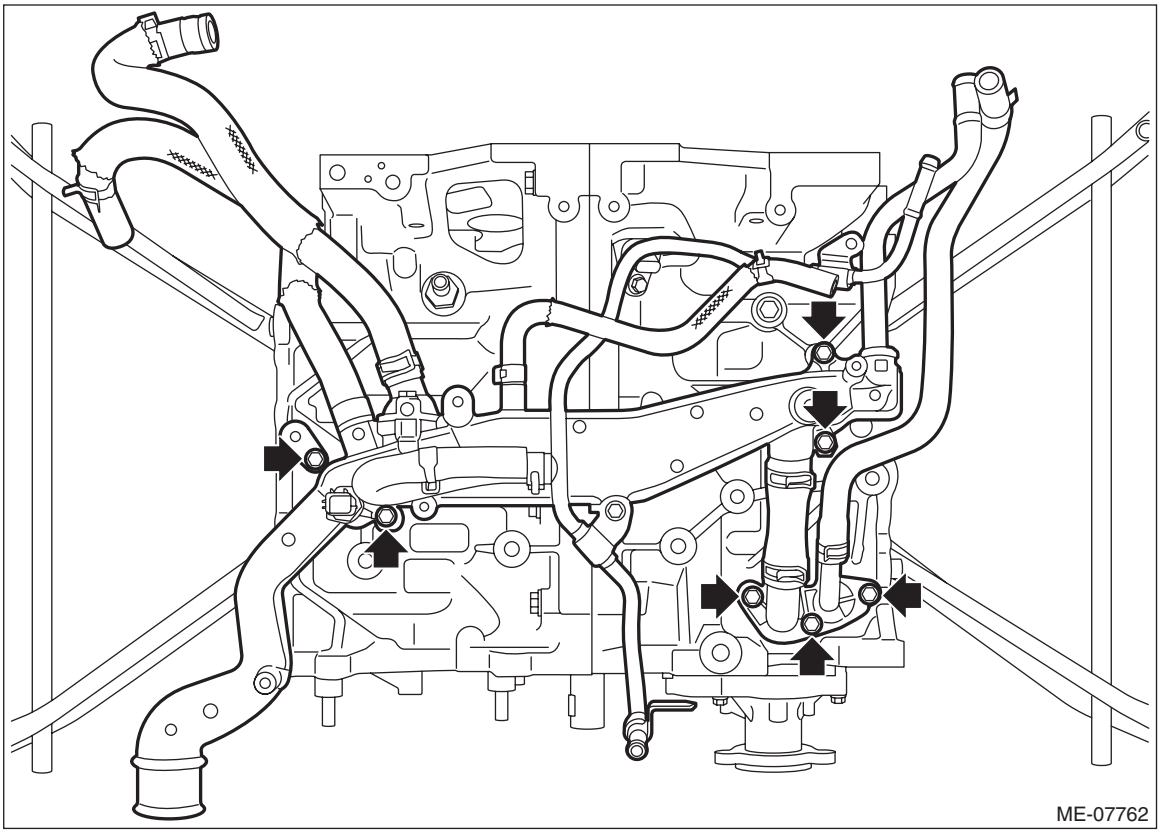
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
- Gasoline engine CVT model



- Gasoline engine MT model

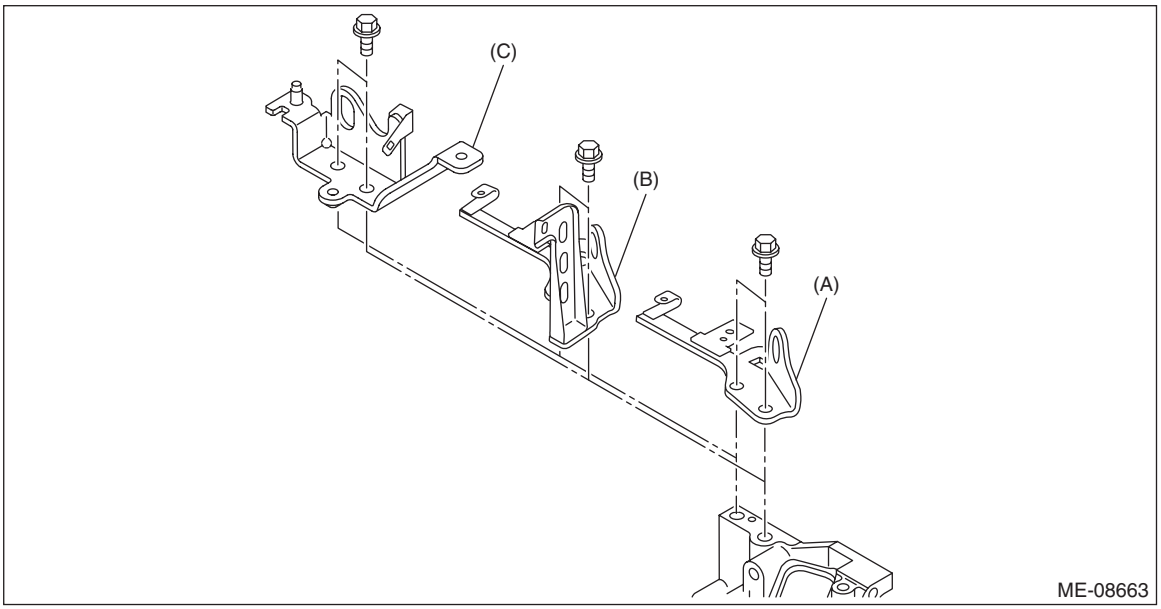


- HEV model



26) Install the engine rear hanger to the cylinder block RH.

Tightening torque:
21 N·m (2.1 kgf-m, 15.5 ft-lb)



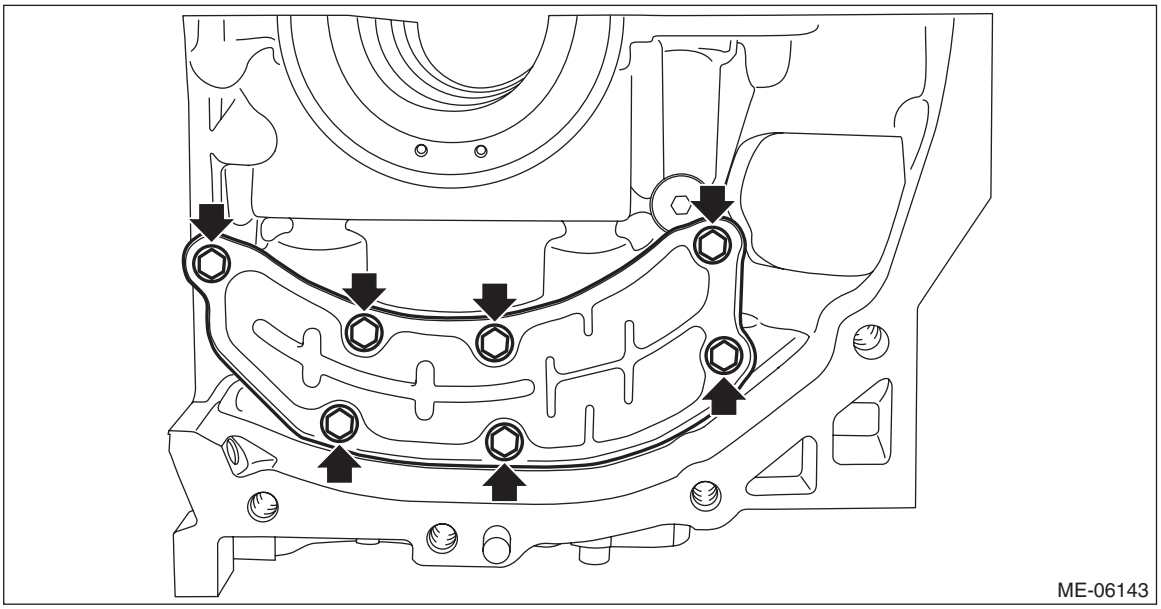
(A) Gasoline engine CVT model (B) Gasoline engine MT model (C) HEV model

27) Install the crank sprocket. <Ref. to ME(H4DO(w/o HEV))-201, INSTALLATION, Crank Sprocket.>
28) Install the cylinder head. <Ref. to ME(H4DO(w/o HEV))-265, INSTALLATION, Cylinder Head.>
29) Install the cam carrier. <Ref. to ME(H4DO(w/o HEV))-230, INSTALLATION, Cam Carrier.>
30) Install the rocker cover. <Ref. to ME(H4DO(w/o HEV))-210, INSTALLATION, Rocker Cover.>
31) Install the chain cover. <Ref. to ME(H4DO(w/o HEV))-156, INSTALLATION, Chain Cover.>
32) Install the tumble generator valve assembly. <Ref. to FU(H4DO(w/o HEV))-86, INSTALLATION, Tumble Generator Valve Assembly.> <Ref. to FU(H4DO(HEV))-74, INSTALLATION, Tumble Generator Valve Assembly.>
33) Install the engine wiring harness. <Ref. to FU(H4DO(w/o HEV))-47, INSTALLATION, Engine Wiring Harness.> <Ref. to FU(H4DO(HEV))-38, INSTALLATION, Engine Wiring Harness.>
34) Install the intake manifold. <Ref. to FU(H4DO(w/o HEV))-29, INSTALLATION, Intake Manifold.> <Ref. to FU(H4DO(HEV))-25, INSTALLATION, Intake Manifold.>
35) Install the engine to the vehicle. <Ref. to ME(H4DO(w/o HEV))-88, INSTALLATION, Engine Assembly.>

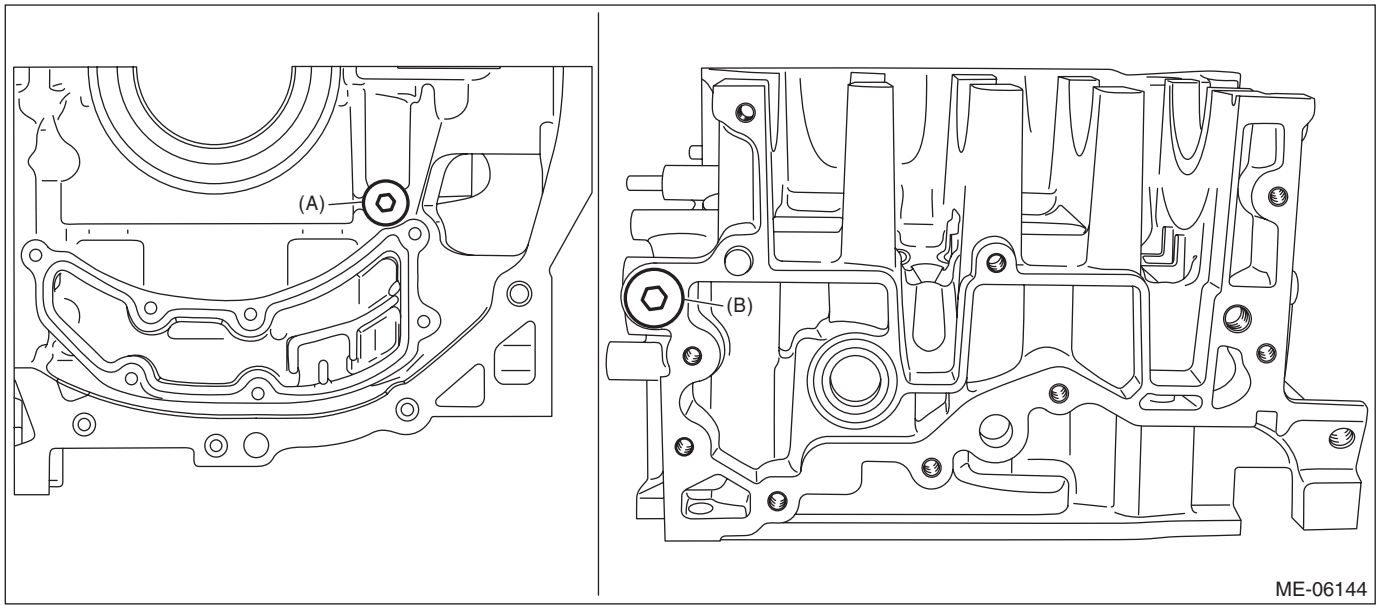
C: DISASSEMBLY

1. CYLINDER BLOCK

1) Remove the oil separator cover from cylinder block RH.

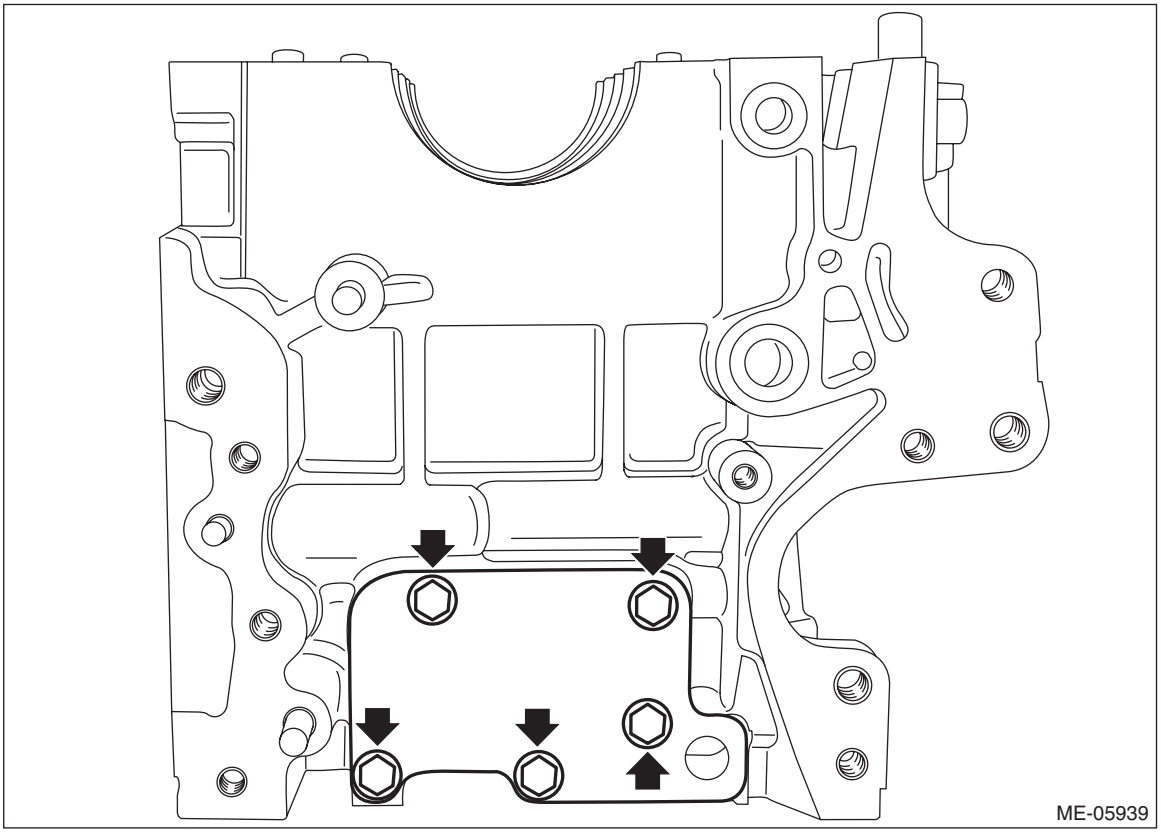


2) Remove the liquid gasket from cylinder block RH.
3) Remove the cylinder block plug (A) and the main gallery plug (B) from cylinder block RH.

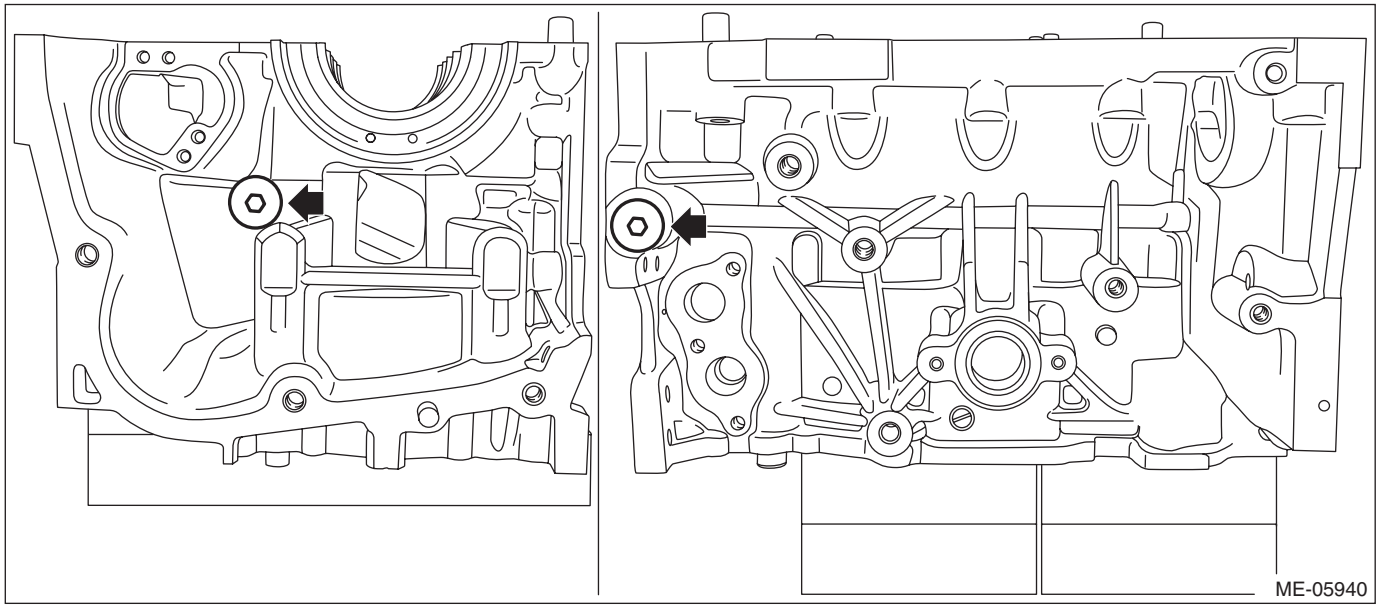


4) Remove the liquid gasket from the thread holes of the cylinder block RH, and from the threaded portions of cylinder block plug and main gallery plug.

5) Remove the cylinder block plate from cylinder block LH.

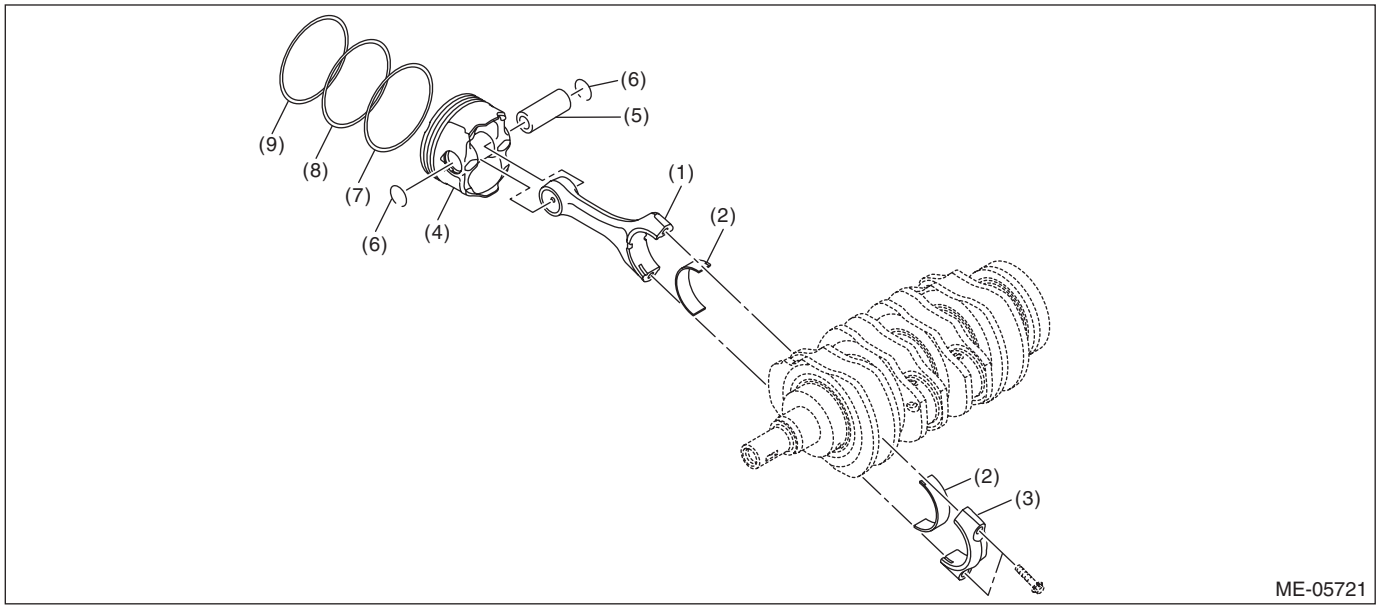


6) Remove the main gallery plug from cylinder block LH.



7) Remove the liquid gasket from the thread holes of the cylinder block LH and main gallery plug.

2. PISTON AND CONNECTING ROD



(1)	Connecting rod	(4)	Piston	(7)	Oil ring
(2)	Connecting rod bearing	(5)	Piston pin	(8)	Second ring
(3)	Connecting rod cap	(6)	Circlip	(9)	Top ring

NOTE:
To prevent confusion of various parts, mark each part.
1) Remove the connecting rod bearing from connecting rod and connecting rod cap.
2) Remove the piston rings from the piston.

NOTE:
Arrange the piston rings in order so that they can be installed in their original positions without confusion.
(1) Remove the compression rings in the order of top ring and second ring, using piston ring expander.
(2) Remove the oil rings in the order of upper rail, lower rail and expander by hand.
3) Remove the circlip on one end from the piston using a flat tip screwdriver.

NOTE:
Be careful not damage the piston and piston pin, by wrapping the tip of flat tip screwdriver with tape.
4) Remove the piston pin from piston, and remove the connecting rod from piston.
5) Remove the circlip on other end from the piston using a flat tip screwdriver.

NOTE:
Be careful not damage the piston and piston pin, by wrapping the tip of flat tip screwdriver with tape.

D: ASSEMBLY

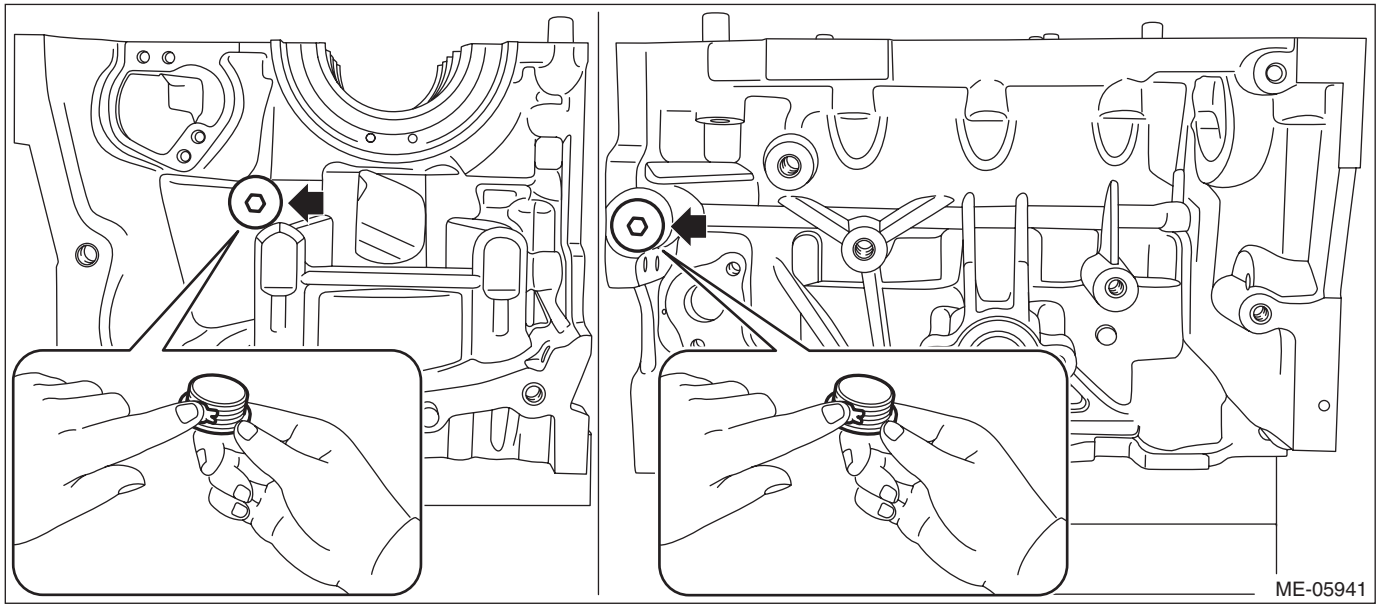
1. CYLINDER BLOCK

1) Apply liquid gasket to the threaded portion of the main gallery plug, and install the main gallery plug to the cylinder block LH.

NOTE:
Before applying liquid gasket, degrease the thread holes of the cylinder block LH and main gallery plug.

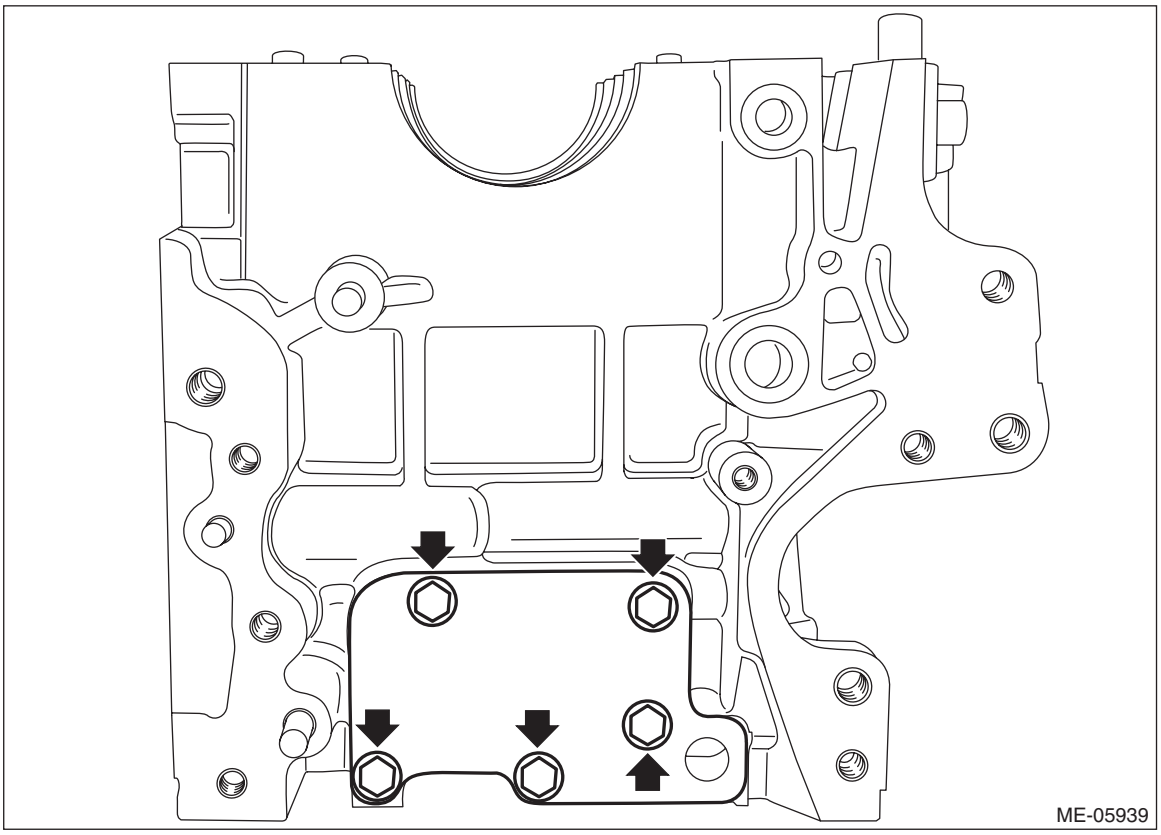
Liquid gasket:
THREE BOND 1105 (Part No. 004403010) or equivalent

Tightening torque:
37 N·m (3.8 kgf-m, 27.3 ft-lb)



2) Install the cylinder block plate onto cylinder block LH.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

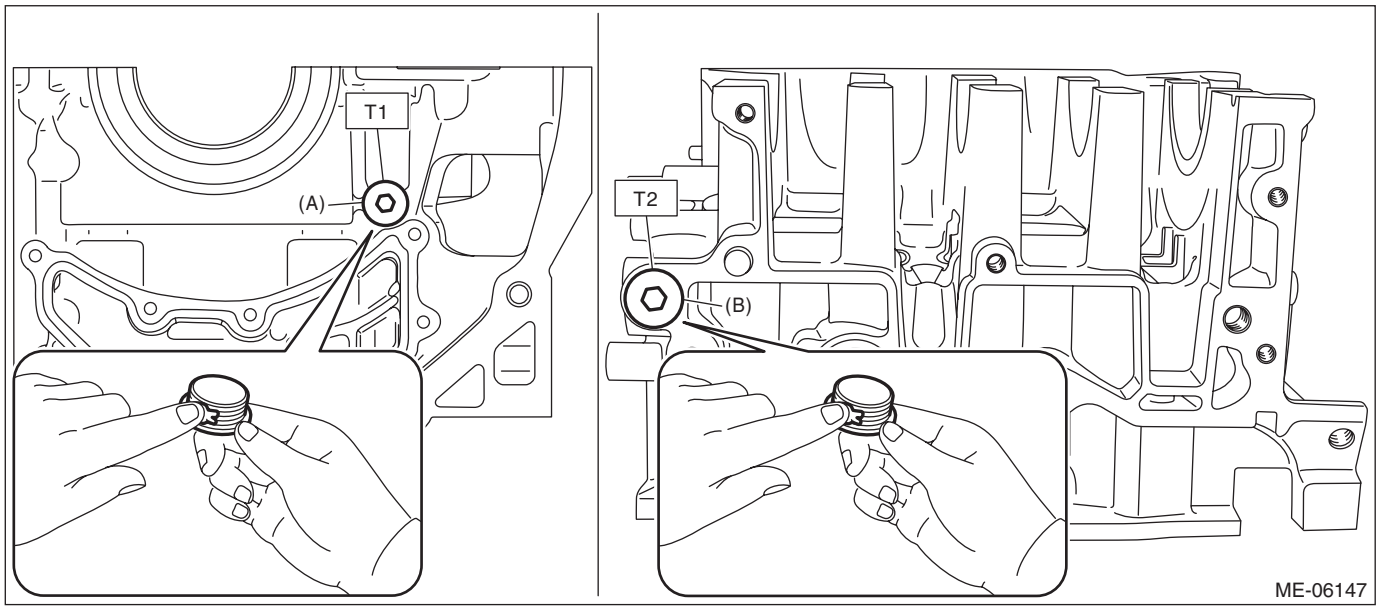


3) Apply liquid gasket to the threaded portions of cylinder block plug and main gallery plug, and install the cylinder block plug (A) and main gallery plug (B) to cylinder block RH.

NOTE:
Before applying liquid gasket, degrease the thread holes of the cylinder block RH, and the threaded portions of cylinder block plug and main gallery plug.

Liquid gasket:
THREE BOND 1105 (Part No. 004403010) or equivalent

Tightening torque:
T1: 16 N·m (1.6 kgf-m, 11.8 ft-lb)
T2: 37 N·m (3.8 kgf-m, 27.3 ft-lb)

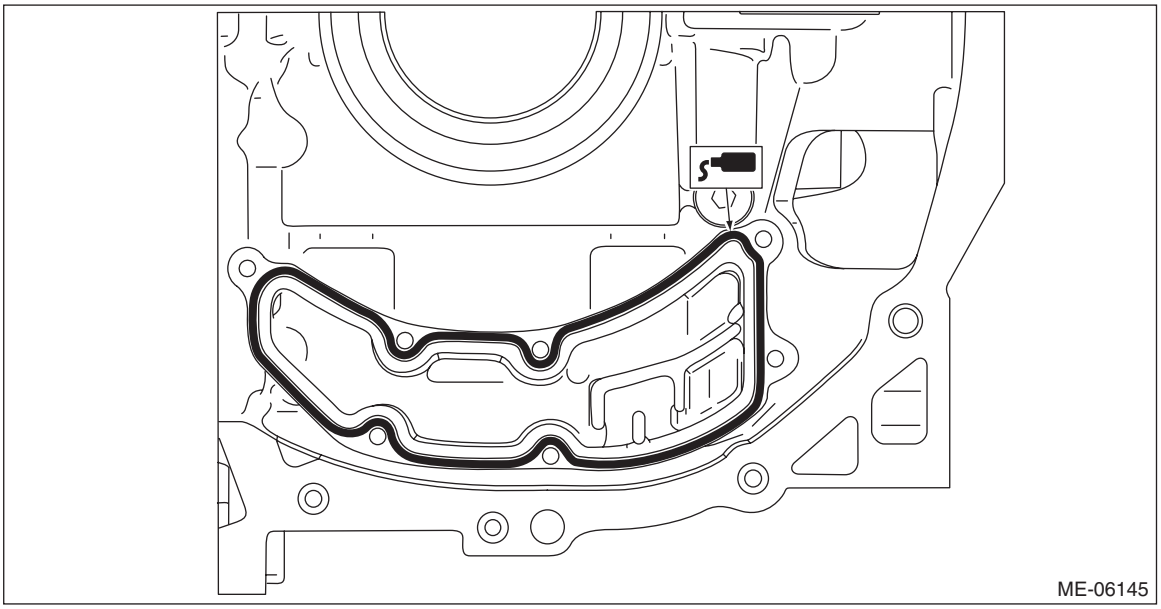


4) Install the oil separator cover to the cylinder block RH.
(1) Apply liquid gasket to the mating surfaces of oil separator cover.

NOTE:
- Use new oil separator cover.
- Before applying liquid gasket, degrease the old liquid gasket seal surface of cylinder block RH.
- Install within 5 min. after applying liquid gasket.

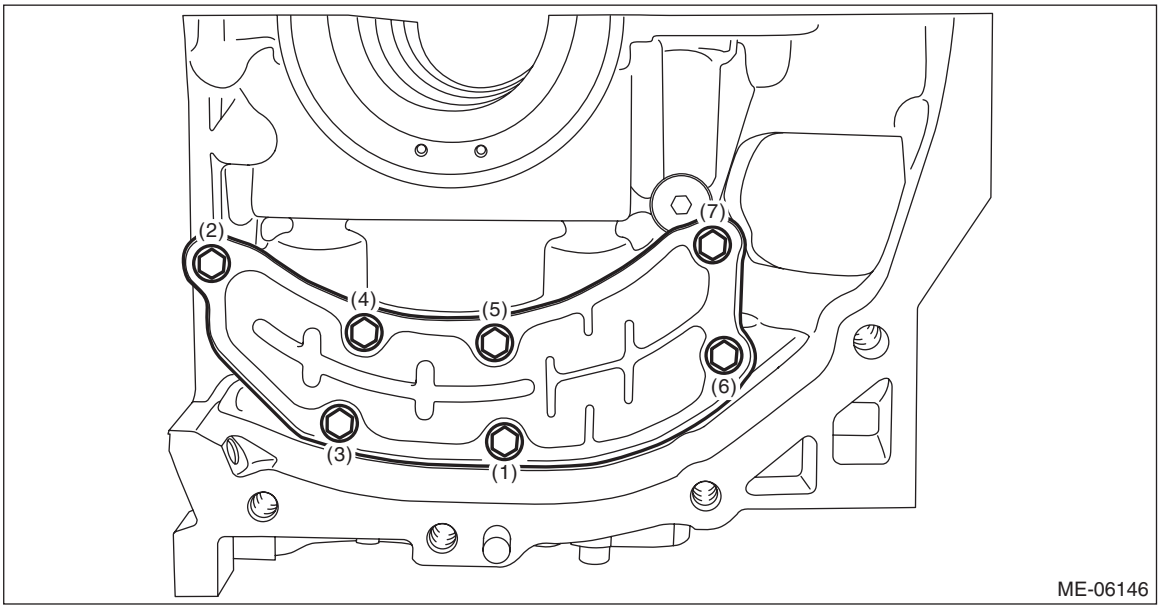
Liquid gasket:
Mating surface
THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:
4±1 mm (0.1772±0.0197 in)

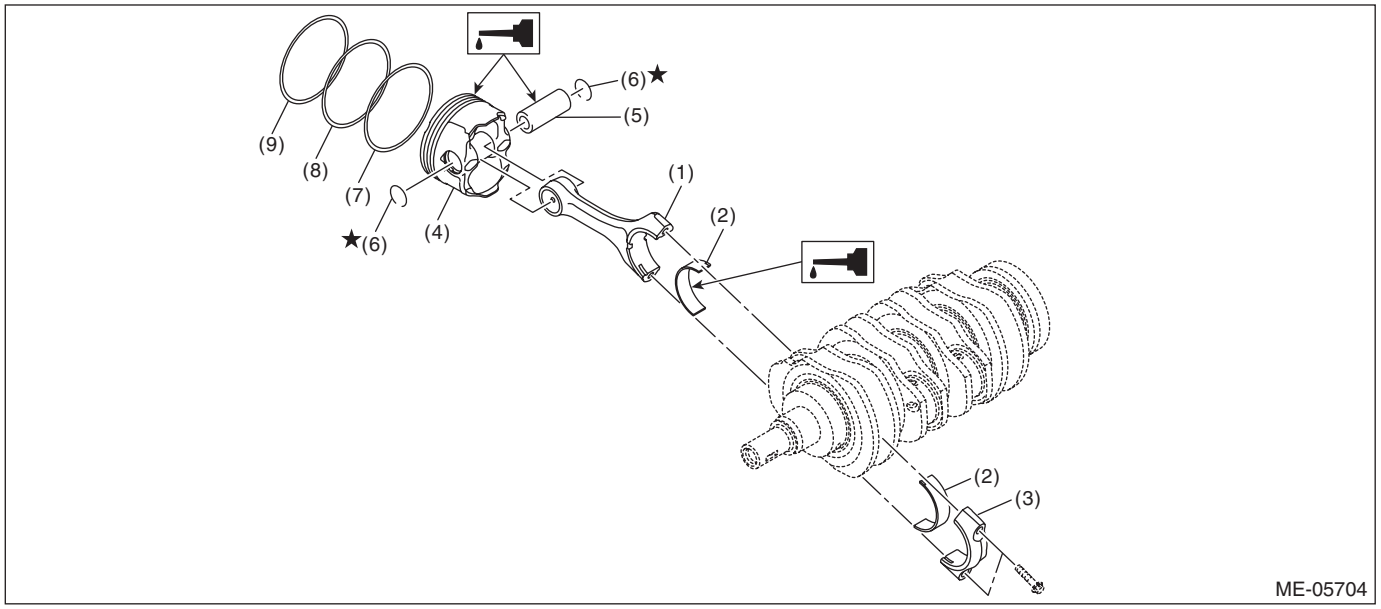


(2) Install the oil separator cover to the cylinder block RH, and tighten the oil separator cover bolts in numerical order as shown in the figure.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



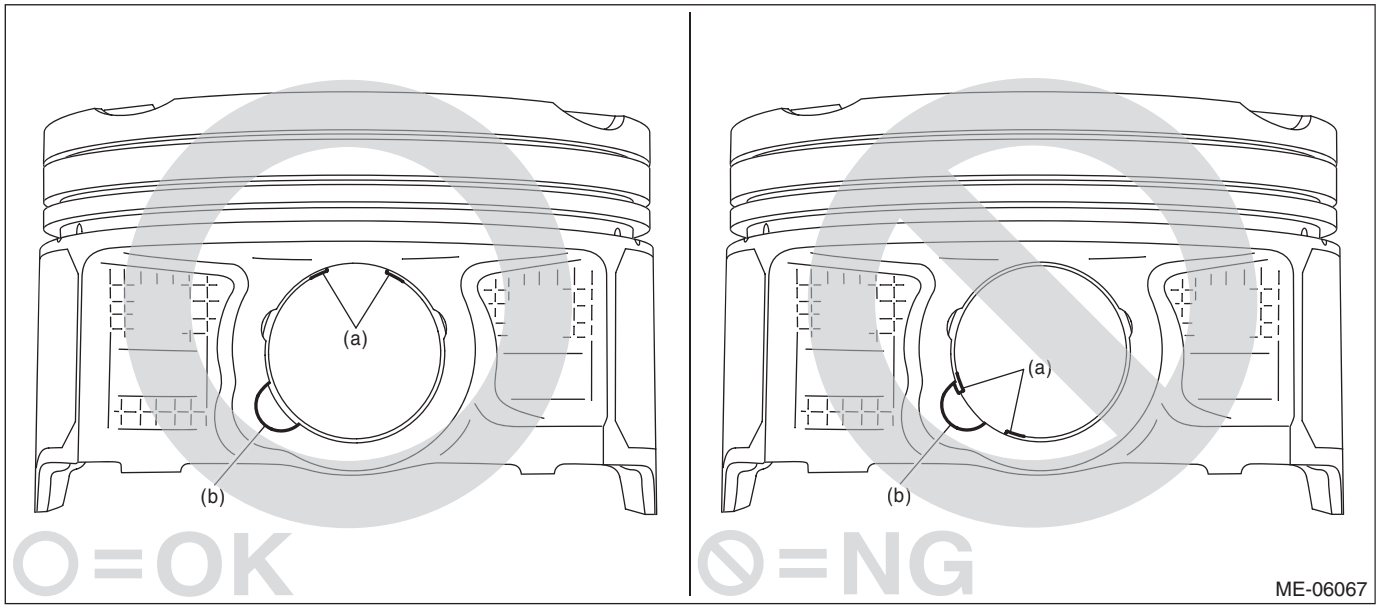
2. PISTON AND CONNECTING ROD



(1)	Connecting rod	(4)	Piston	(7)	Oil ring
(2)	Connecting rod bearing	(5)	Piston pin	(8)	Second ring
(3)	Connecting rod cap	(6)	Circlip	(9)	Top ring

1) Install the connecting rod bearing to the connecting rod and connecting rod cap.
2) Install the circlip on one end of the piston using a flat tip screwdriver.

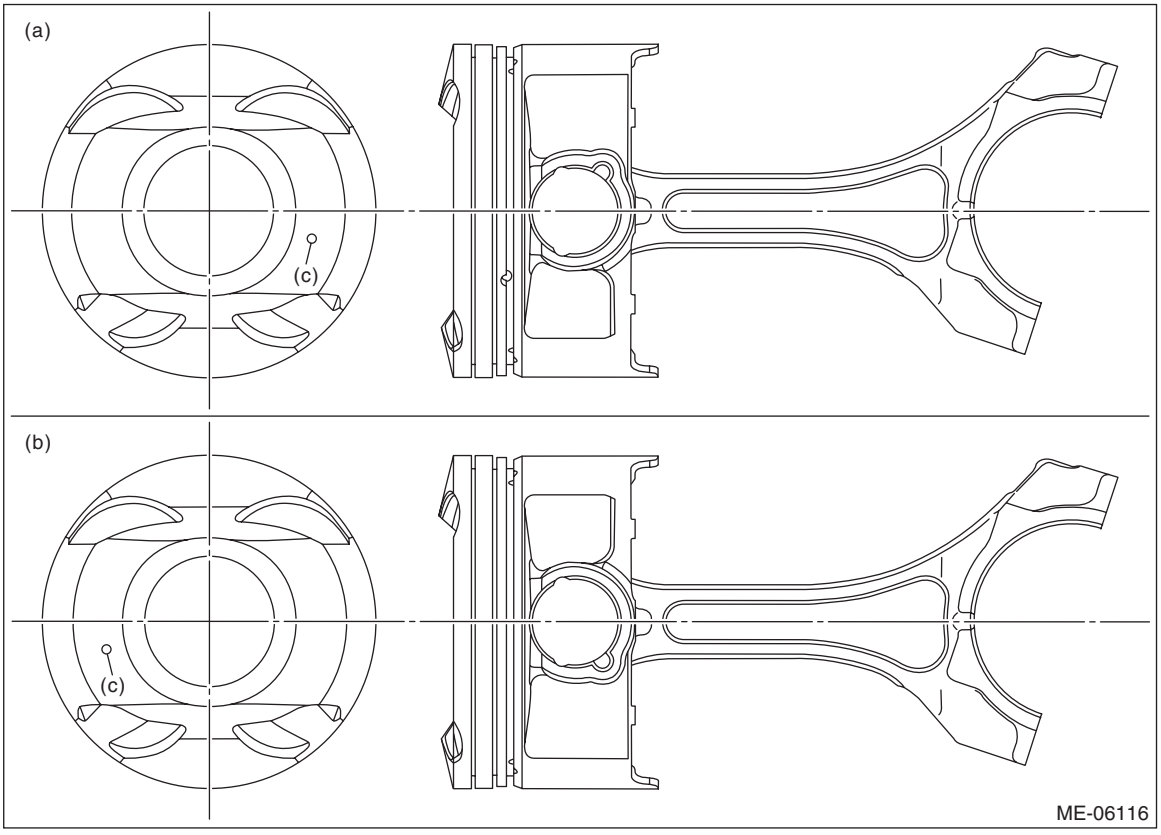
NOTE:
- Be careful not damage the piston, by wrapping the tip of flat tip screwdriver with tape.
- Make sure the circlip is firmly inserted into the circlip groove.
- After installing the circlip, rotate the circlip so that its end part (a) and the cutout portion of circlip groove (b) do not match.



3) Set the piston to the connecting rod.

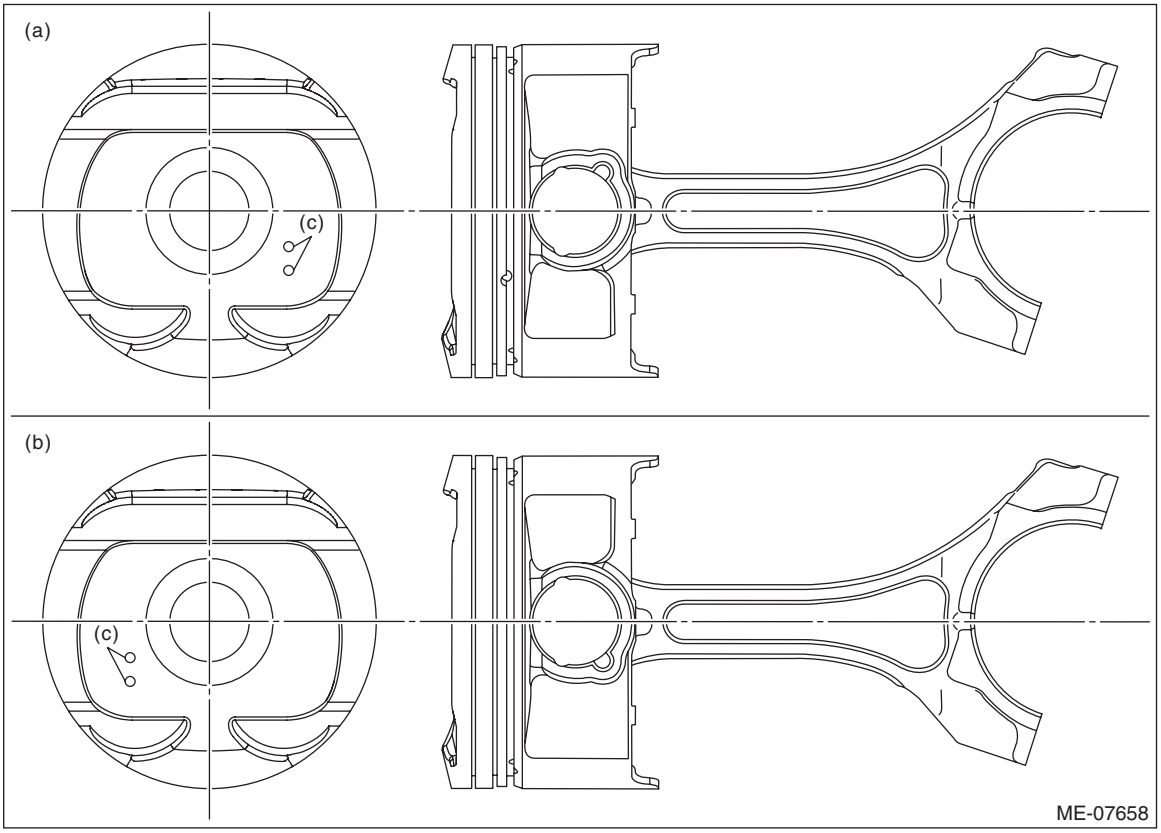
NOTE:
Align the front mark of piston and the connecting rod direction correctly as shown in the figure.

- Gasoline engine model



(a) RH side (#1 and #3) (b) LH side (#2 and #4) (c) Front mark

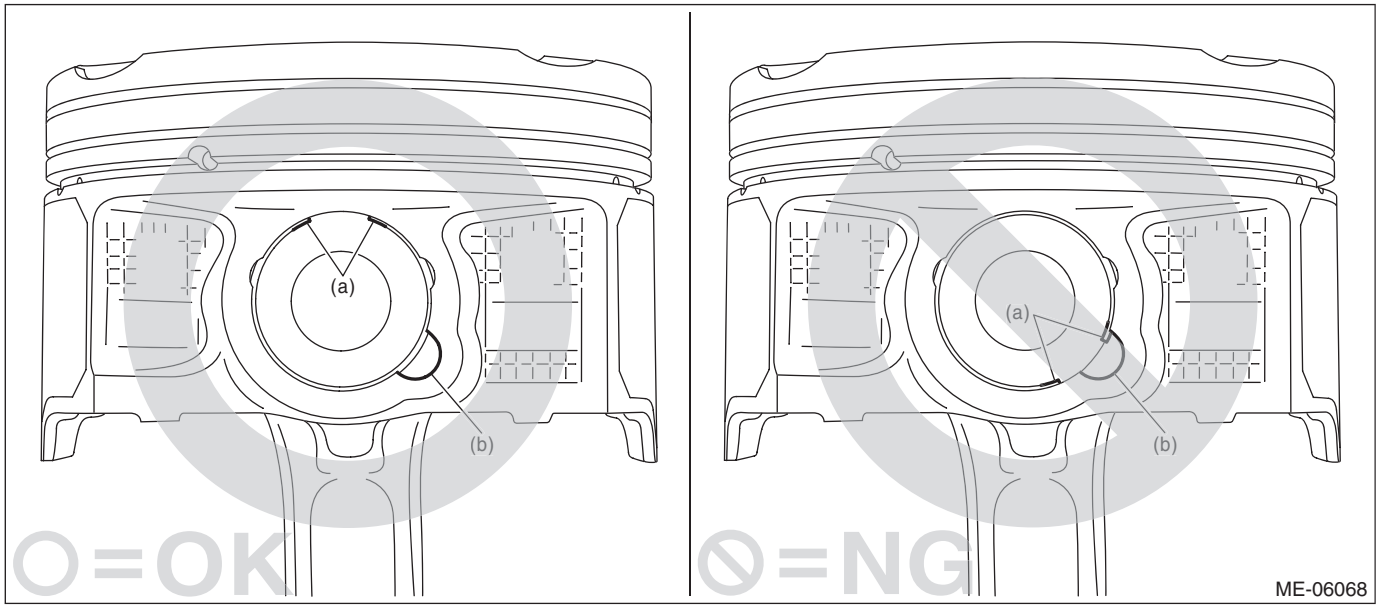
- HEV model



(a) RH side (#1 and #3) (b) LH side (#2 and #4) (c) Front mark

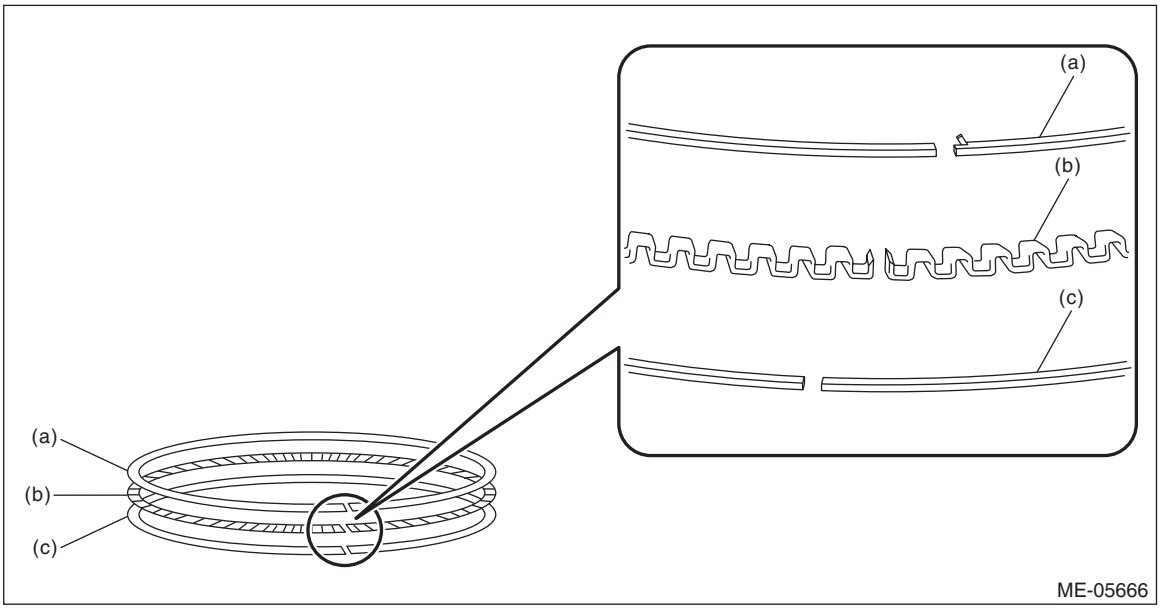
4) Apply engine oil to the piston pin, and attach the piston pin.
5) Install the circlip on the piston using a flat tip screwdriver.

NOTE:
- Be careful not damage the piston and piston pin, by wrapping the tip of flat tip screwdriver with tape.
- Make sure the circlip is firmly inserted into the circlip groove.
- After installing the circlip, rotate the circlip so that its end part (a) and the cutout portion of circlip groove (b) do not match.



6) Install the piston rings onto the piston.
(1) Install the oil rings in the order of expander, lower rail and upper rail by hand.

NOTE:
Oil ring consists of the upper rail, expander and lower rail.



(a) Upper rail (b) Expander (c) Lower rail

(2) Install the compression rings in the order of second ring and top ring, using piston ring expander.

NOTE:
Install so that the compression ring mark faces the top side of the piston.

E: INSPECTION

1. CYLINDER BLOCK & PISTON

1) Visually inspect to make sure that there are no cracks, scratches or other damage.
2) Use liquid penetrant tester on the important sections to check for fissures.
3) Check that there are no traces of gas leaking or water leaking on the gasket attachment surface.
4) Check the oil passages for clogging.
5) Check for warpage of mating surfaces of the cylinder block that contacts cylinder head using a straight edge and thickness gauge. If it exceeds the limit, correct the surface by grinding it with a surface grinder or replace the cylinder block.

NOTE:
Measurement should be performed at a temperature of 20°C (68°F).

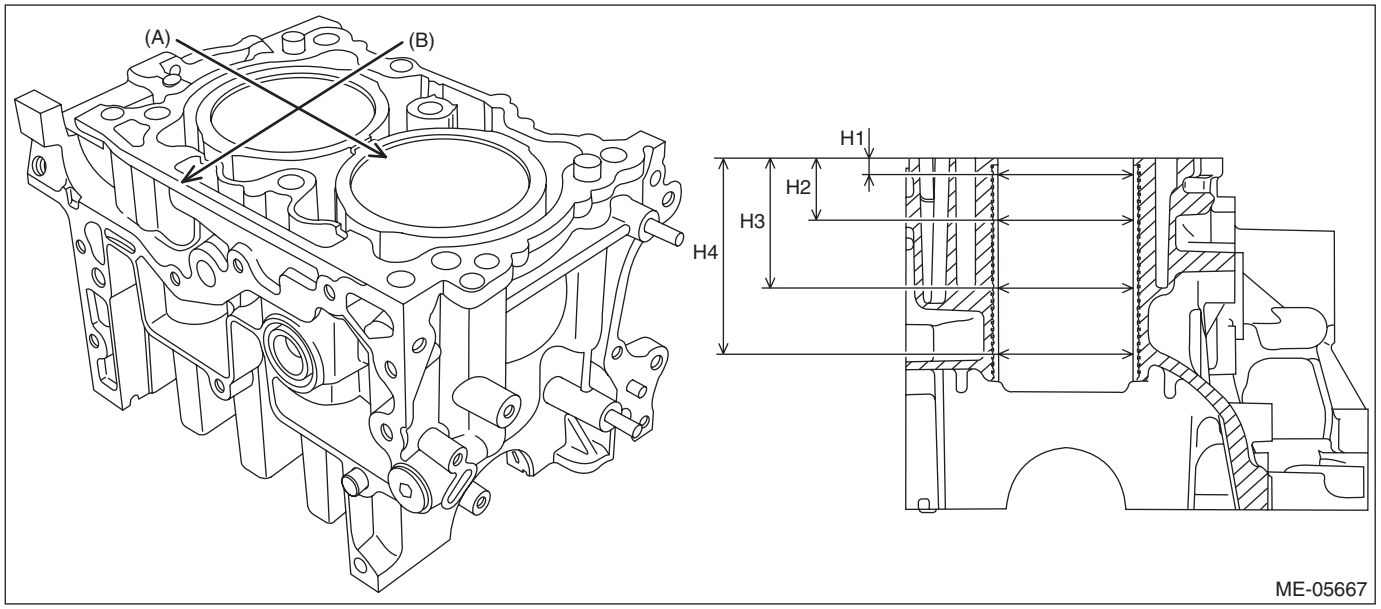
Cylinder block warpage:
Limit
0.025 mm (0.00098 in)

Grinding limit of cylinder block :
To 204.9 mm (8.067 in)

Height of cylinder block:
Standard
205.0 mm (8.071 in)

6) Using a cylinder bore gauge, check the cylindricality and out-of-roundness of cylinder liner. If it is not within the standard, perform reboring (including honing), or replace the cylinder block and piston as a set. For reboring and honing procedure, refer to step 8).

NOTE:
- Measure the cylinder liner with cylinder blocks separated (into cylinder block RH and cylinder block LH).
- Measurement should be performed at a temperature of 20°C (68°F).
- Write down all measurement values as the values are used in the next procedure.
- Measure the inner diameter of each cylinder liner in both the thrust and piston pin directions at the heights as shown in the figure.



(A) Piston pin direction (B) Thrust direction

H1: 10 mm (0.3937 in) H2: 45 mm (1.7717 in) H3: 80 mm (3.1496 in)
H4: 105 mm (4.1339 in)

- Calculate the cylindricality of cylinder liner by using the following formula.

Calculation formula
C = The larger value between the calculation values C' and C'' C' = (D (a)–D (b))/2 C'' = (D (c)–D (d))/2
C: Cylindricality of cylinder liner D (a): The largest value of all the values obtained by measuring the cylinder liner inner diameter in the direction of the piston pin D (b): The smallest value of all the values obtained by measuring the cylinder liner inner diameter in the direction of the piston pin D (c): The largest value of all the values obtained by measuring the cylinder liner inner diameter in the thrust direction D (d): The smallest value of all the values obtained by measuring the cylinder liner inner diameter in the thrust direction

- Calculate the out-of-roundness of cylinder liner at each measurement height by using the following formula.

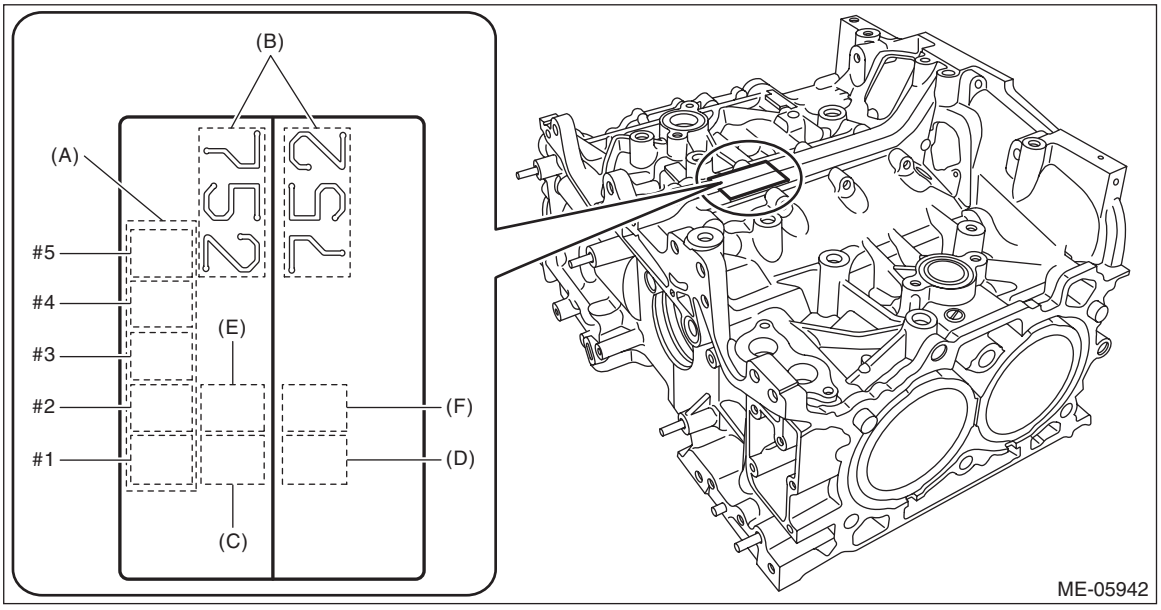
Calculation formula
R = (D(e)–D(f))/2
R: Out-of-roundness of cylinder liner D(e): The larger value between the measurement values in the piston pin direction and in the thrust direction of cylinder liner inner diameter D(f): The smaller value between the measurement values in the piston pin direction and in the thrust direction of cylinder liner inner diameter

Cylindricality of cylinder liner:
Limit
0.030 mm (0.0012 in)

Out-of-roundness of cylinder liner:
Limit
0.030 mm (0.0012 in)

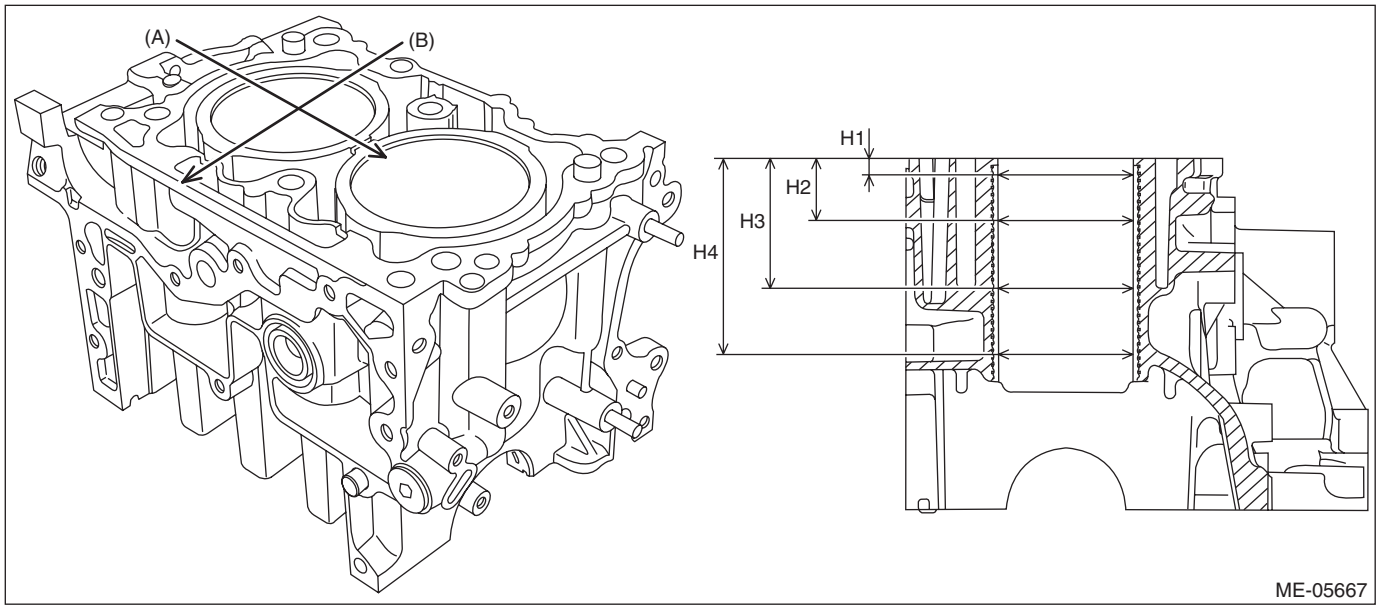
7) Check the clearance between cylinder liner and piston. Check the clearance between cylinder liner and piston by measuring the inner diameter of cylinder liner and the outer diameter of piston respectively.
(1) Measure the inner diameter of cylinder liner. If it is not within the standard, perform reboring (including honing), or replace the cylinder block and piston as a set. For reboring and honing procedure, refer to step 8).

NOTE:
- Measure the cylinder liner with cylinder blocks separated (into cylinder block RH and cylinder block LH).
- Measurement should be performed at a temperature of 20°C (68°F).
- The cylinder bore size mark is stamped on the upper face of the cylinder block.



(A) Main journal size mark
(B) Cylinder block (RH) – (LH) combination mark
(C) #1 cylinder bore size mark
(D) #2 cylinder bore size mark
(E) #3 cylinder bore size mark
(F) #4 cylinder bore size mark

• Measure the inner diameter of each cylinder liner in both the thrust and piston pin directions at the heights as shown in the figure and read the value of the most worn location.



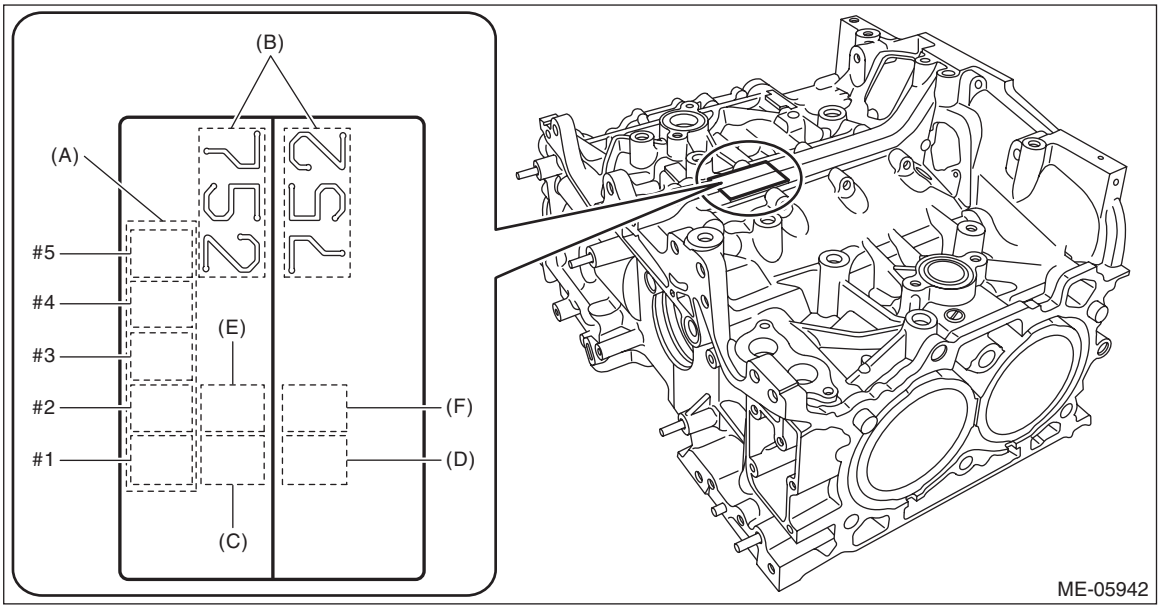
(A) Piston pin direction (B) Thrust direction

H1: 10 mm (0.3937 in) H2: 45 mm (1.7717 in) H3: 80 mm (3.1496 in)
H4: 105 mm (4.1339 in)

Inner diameter of cylinder liner:
Cylinder bore size mark A
Standard
84.005 — 84.015 mm (3.3073 — 3.3077 in)
Cylinder bore size mark B
Standard
83.995 — 84.005 mm (3.3069 — 3.3073 in)

(2) Check the outer diameter of piston with a micrometer. If it is not within the standard, replace the piston.

NOTE:
- Measurement should be performed at a temperature of 20°C (68°F).
- Measure the outer diameter of each piston in thrust direction at the height as shown in the figure.
- Standard sized pistons are classified into two grades, “A” and “B”. These grades should be used as guide lines in selecting a standard piston.
- The grade can be judged by the stamp of cylinder bore size mark on the upper face of the cylinder block.

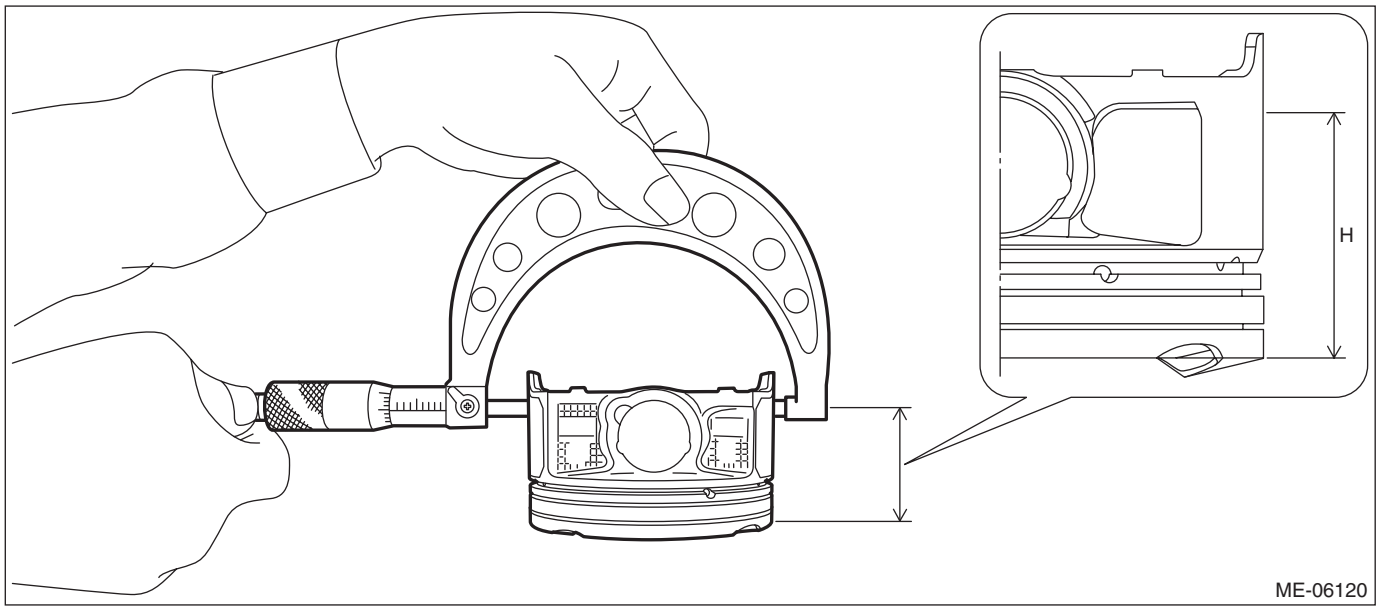


(A) Main journal size mark
(B) Cylinder block (RH) – (LH) combination mark
(C) #1 cylinder bore size mark
(D) #2 cylinder bore size mark
(E) #3 cylinder bore size mark
(F) #4 cylinder bore size mark

• If the piston is replaced, check the clearance between cylinder liner and piston in the step (3), and select a suitable sized piston.

Piston grade point H:
38.0 mm (1.50 in)

Piston outer diameter:
Standard size (grade A = cylinder bore size mark A)
Standard
83.975 — 83.985 mm (3.3061 — 3.3065 in)
Standard size (grade B = cylinder bore size mark B)
Standard
83.965 — 83.975 mm (3.3057 — 3.3061 in)



(3) Calculate the clearance between cylinder liner and piston. If it is not within the standard, perform reboring (including honing), or replace the cylinder block and piston as a set. For reboring and honing procedure, refer to step 8).

NOTE:
The clearance between cylinder liner and piston is decided by matching the cylinder block bore size mark and the grade of piston outer diameter (grade A or B).

Clearance between cylinder liner and piston:
Standard
0.020 — 0.040 mm (0.00079 — 0.00158 in)

8) Reboring and honing
(1) If any of the cylindricality, out-of-roundness, inner diameter or clearance between cylinder liner and piston is out of standard or if there is any damage on the cylinder liner, perform reboring (including honing).

CAUTION:
When any of the cylinder liner needs reboring, all other cylinder liners must be rebored at the same time, and replaced with proper size pistons.

Oversize piston outer diameter:
0.25 mm (0.0098 in) oversize
Standard
84.215 — 84.235 mm (3.3155 — 3.3163 in)
0.50 mm (0.0197 in) oversize
Standard
84.465 — 84.485 mm (3.3254 — 3.3262 in)
(2) If the inner diameter of cylinder liner exceeds the limit after reboring (including honing), replace the cylinder block and piston as a set.

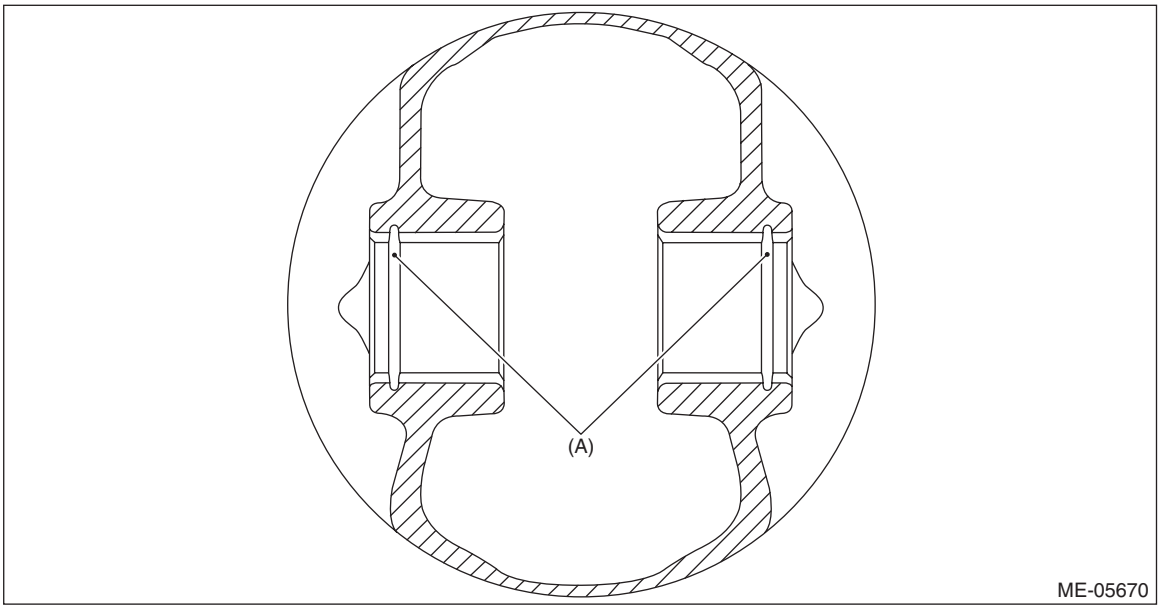
NOTE:
• Immediately after reboring (including honing), the inner diameter of cylinder liner may differ from its real diameter due to temperature rise. Thus, when measuring the inner diameter of cylinder liner, wait until the temperature has cooled to 20°C (68°F).
• For the measurement of the inner diameter of cylinder liner, refer to step 7).

Inner diameter of cylinder liner boring limit (diameter):
To 84.505 mm (3.3270 in)

2. PISTON AND PISTON PIN

1) Check the piston and piston pin for wear or crack.
2) Check the snap ring for distortion or wear.
3) Check the piston ring groove for damage.
4) Check the circlip groove (A) for burr.

NOTE:
If the burr is found, remove the burr from groove.

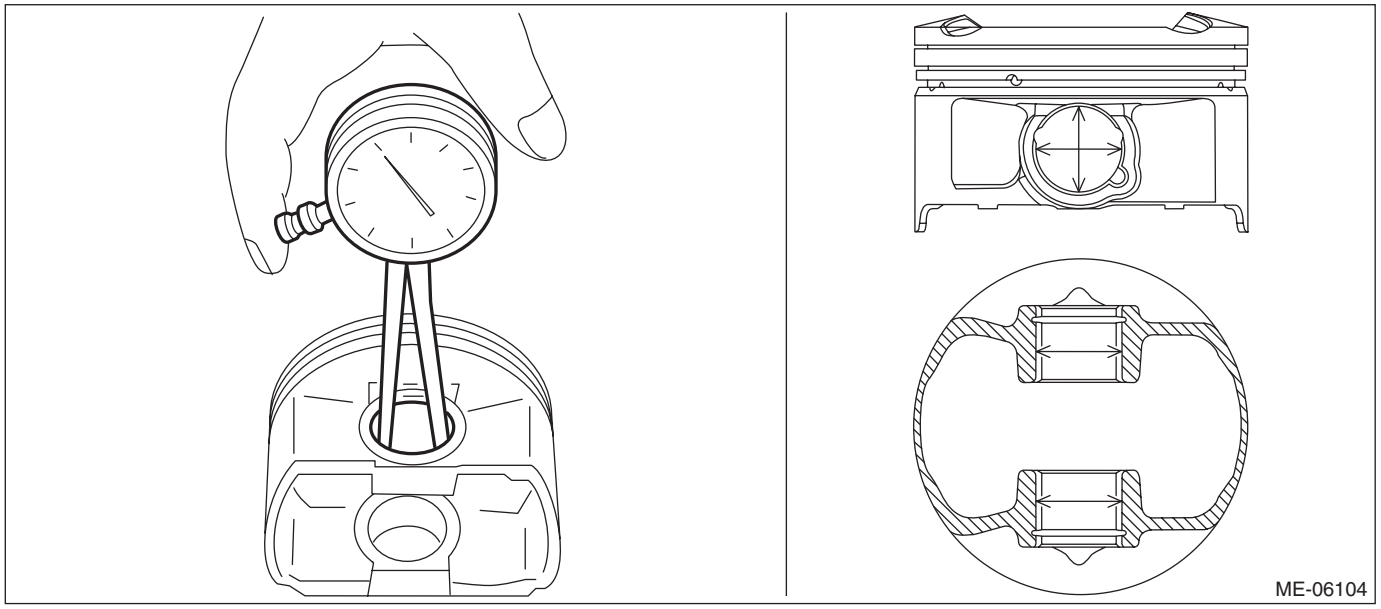


5) Check that the piston pin can be inserted into the piston with a thumb at 20°C (68°F).

6) Check the clearance between piston and piston pin. Check the clearance between piston and piston pin by measuring the inner diameter of piston pin hole and the outer diameter of piston pin respectively.

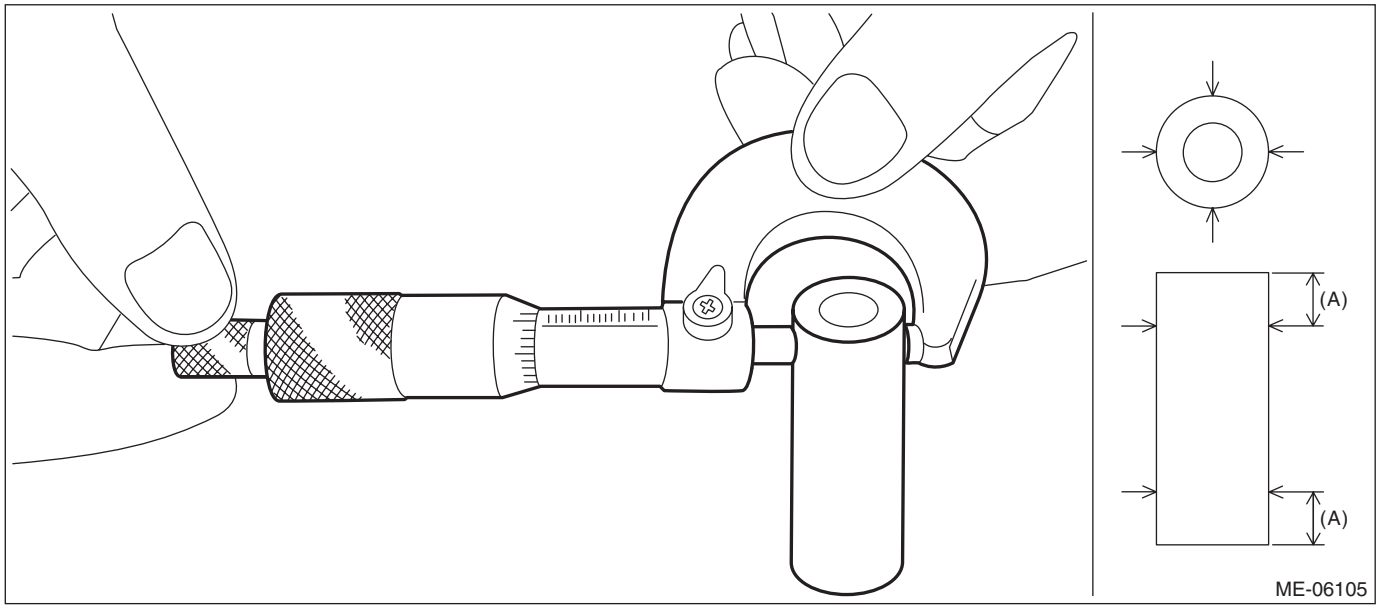
(1) Using a caliper gauge, measure the inner diameter of piston pin hole.

NOTE:
- Measurement should be performed at a temperature of 20°C (68°F).
- Measure the inner diameter of the piston pin hole at the four locations as shown in the figure, and read the value of most worn location.
- Record the measured value.



(2) Measure the outer diameter of piston pin with a micrometer.

NOTE:
- Measurement should be performed at a temperature of 20°C (68°F).
- Measure the outer diameter of the piston pin at the four locations as shown in the figure, and read the value of most worn location.
- Record the measured value.



(A) 10 mm (0.394 in)

(3) Calculate the clearance between piston and piston pin. If it is not within the standard, replace the piston and piston pin as a set.

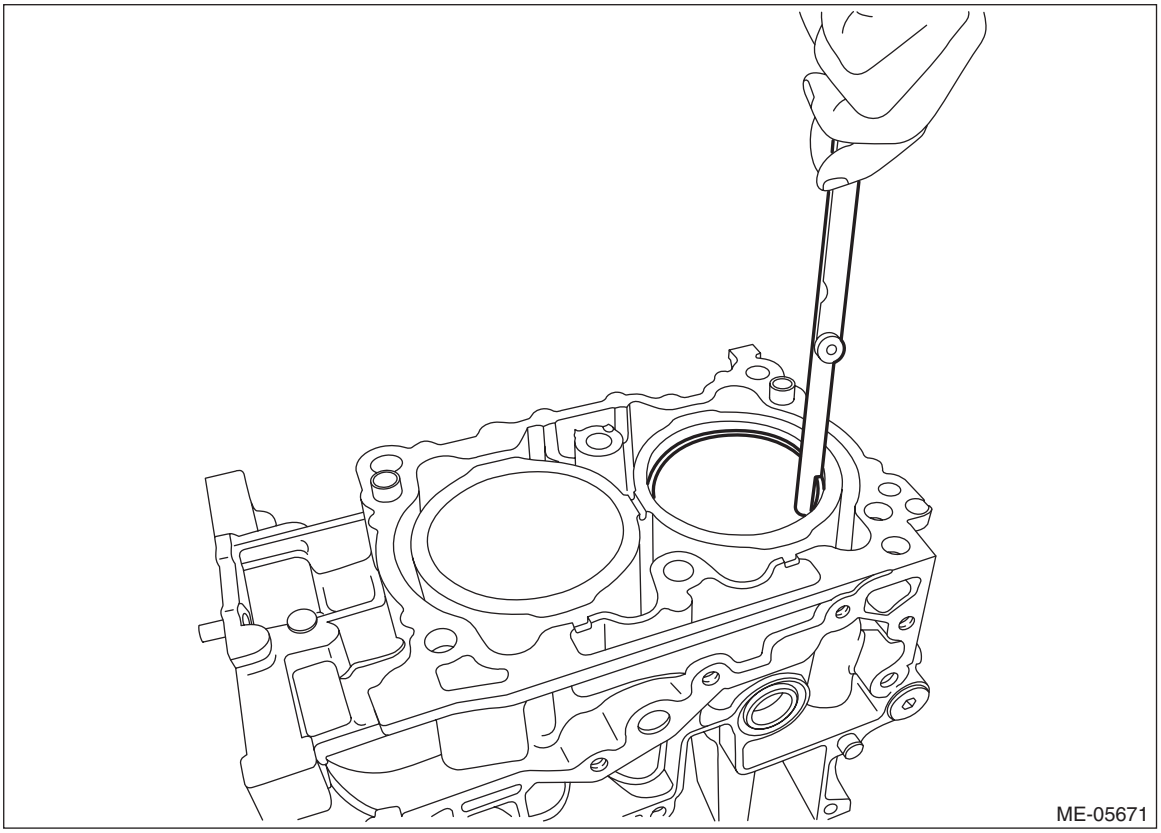
Clearance between piston and piston pin:
Standard
0.004 — 0.008 mm (0.0002 — 0.0003 in)

3. PISTON RING

1) Make sure the piston ring is not broken or damaged.
2) Using a cylindrical guide, insert the piston ring into the cylinder liner so that they are perpendicular to the cylinder wall, and check the piston ring gap using a thickness gauge. If it is not within the standard, replace the piston ring.

NOTE:
- Measurement should be performed at a temperature of 20°C (68°F).
- Use piston ring with same size as piston when replacing piston ring.

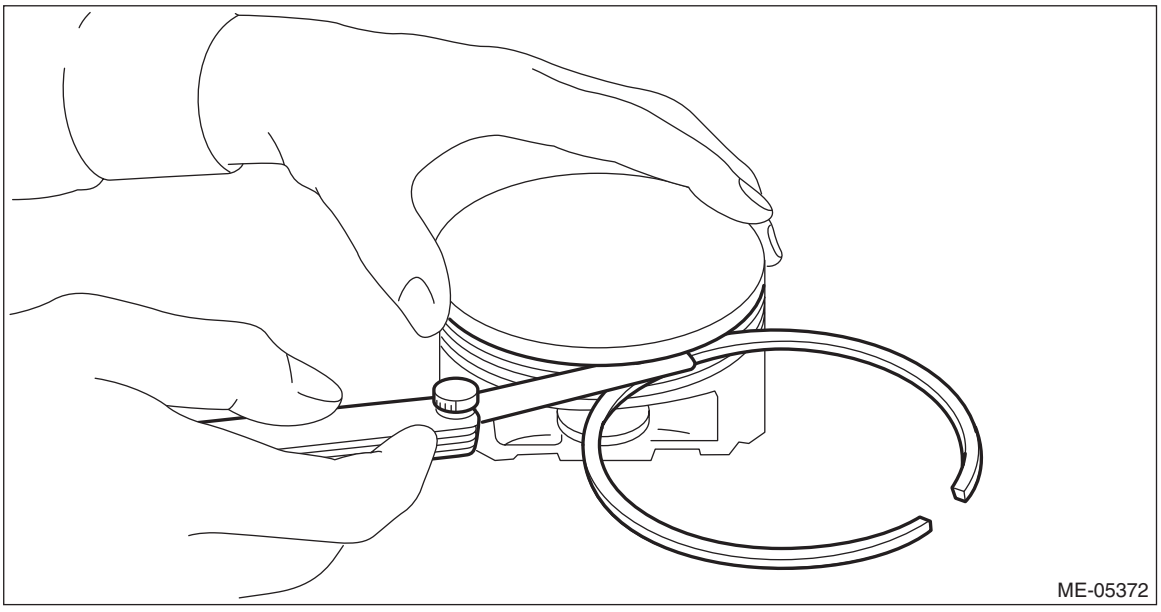
Piston ring gap:
Compression ring (top ring)
Standard
0.20 — 0.35 mm (0.0079 — 0.0138 in)
Compression ring (second ring)
Standard
0.40 — 0.50 mm (0.0157 — 0.0197 in)
Oil ring (upper rail and lower rail)
Standard
0.10 — 0.35 mm (0.0039 — 0.0138 in)



3) Fit the compression ring straight into the piston ring groove, then check the clearance between compression ring and piston with a thickness gauge. If it is not within the standard, replace the compression ring.

NOTE:
- Measurement should be performed at a temperature of 20°C (68°F).
- Before inspecting the clearance, clean the piston ring groove and compression ring.
- Use compression ring with same size as piston when replacing compression ring.

Clearance between compression ring and piston:
Top ring
Standard
0.040 — 0.080 mm (0.0016 — 0.0031 in)
Second ring
Standard
0.030 — 0.070 mm (0.0012 — 0.0028 in)

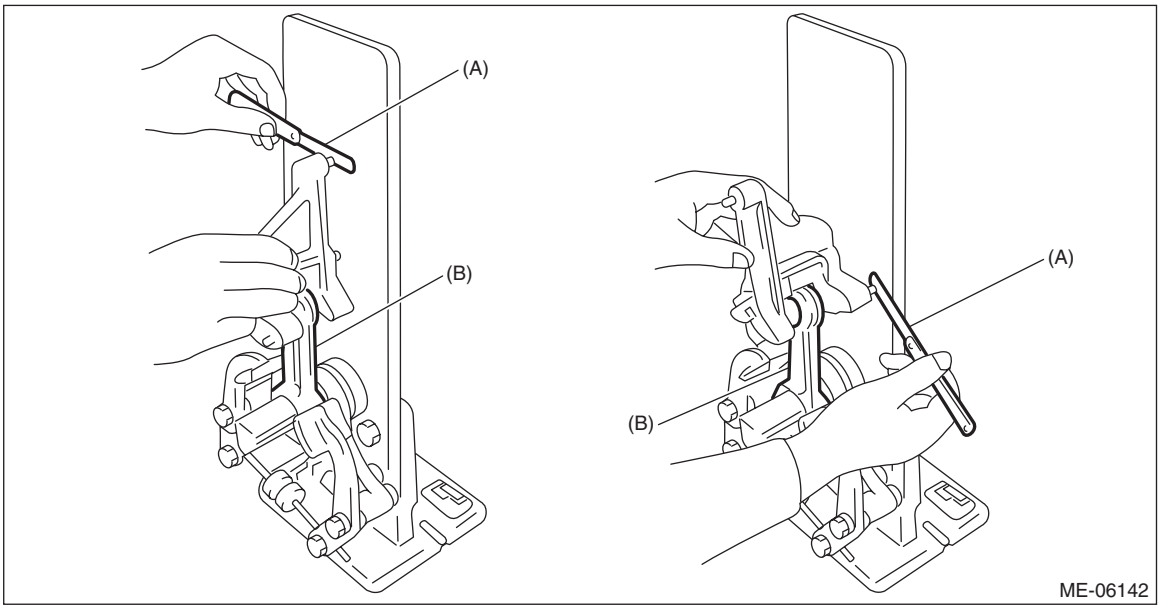


4. CONNECTING ROD AND CONNECTING ROD BEARING

1) Check for bend or twist using a connecting rod aligner. If it exceeds the limit, replace the connecting rod.

NOTE:
Measurement should be performed at a temperature of 20°C (68°F).

Bend or twist per 100 mm (3.94 in) in length:
Limit
0.10 mm (0.0039 in)



(A) Thickness gauge (B) Connecting rod

2) Check that the large or small end thrust surface of each connecting rod is not damaged.
3) Check each connecting rod bearing for scar, peeling, seizure, melting or wear, etc.

4) Check the thrust clearance of each connecting rod using a thickness gauge.

NOTE:
Measurement should be performed at a temperature of 20°C (68°F).

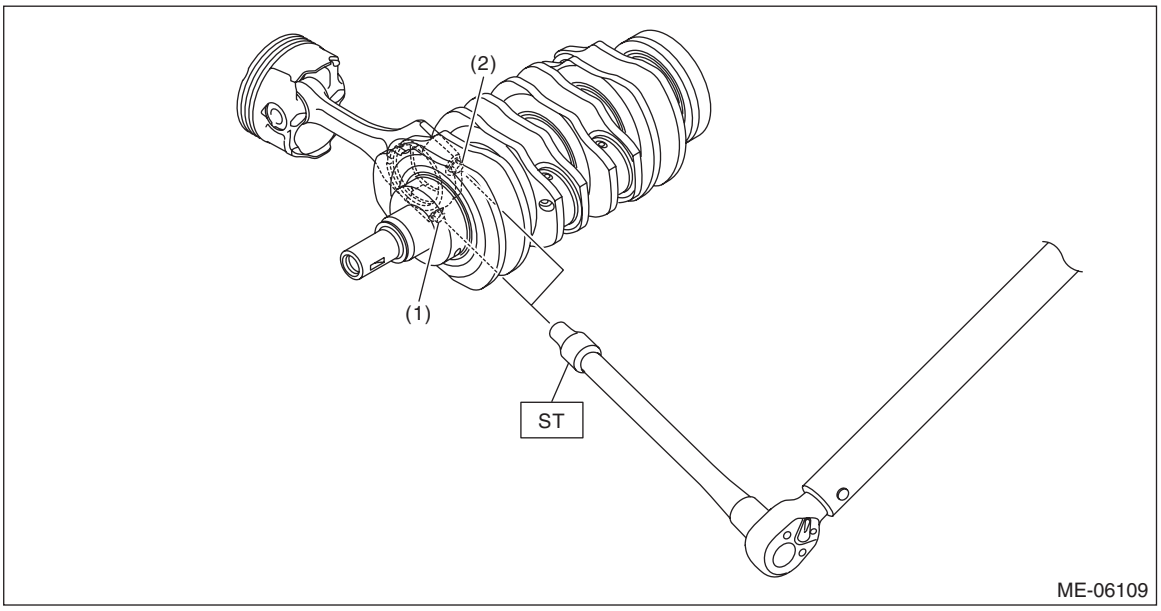
(1) Clean the #1 connecting rod bearing and the #1 pin of crankshaft, and apply engine oil to the #1 pin of crankshaft.
(2) Set the #1 connecting rod bearing to the #1 connecting rod and #1 connecting rod cap.
(3) Set the #1 connecting rod, #1 connecting rod cap and #1 connecting rod cap bolt to the #1 pin of crankshaft.

NOTE:
• Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching symbol.
• Use a new connecting rod cap bolt.
• Apply a coat of engine oil to the #1 connecting rod cap bolt thread.

(4) Using ST, tighten the #1 connecting rod cap bolts to 10 N·m (1.0 kgf-m, 7.4 ft-lb) in numerical order as shown in the figure, then retighten the bolts to 22 N·m (2.2 kgf-m, 16.2 ft-lb) in numerical order as shown in the figure.

CAUTION:
- **Make sure to hold the crankshaft securely during work.**
- **When holding the crankshaft, be careful not to damage the crankshaft.**

ST 18270AA020 SOCKET

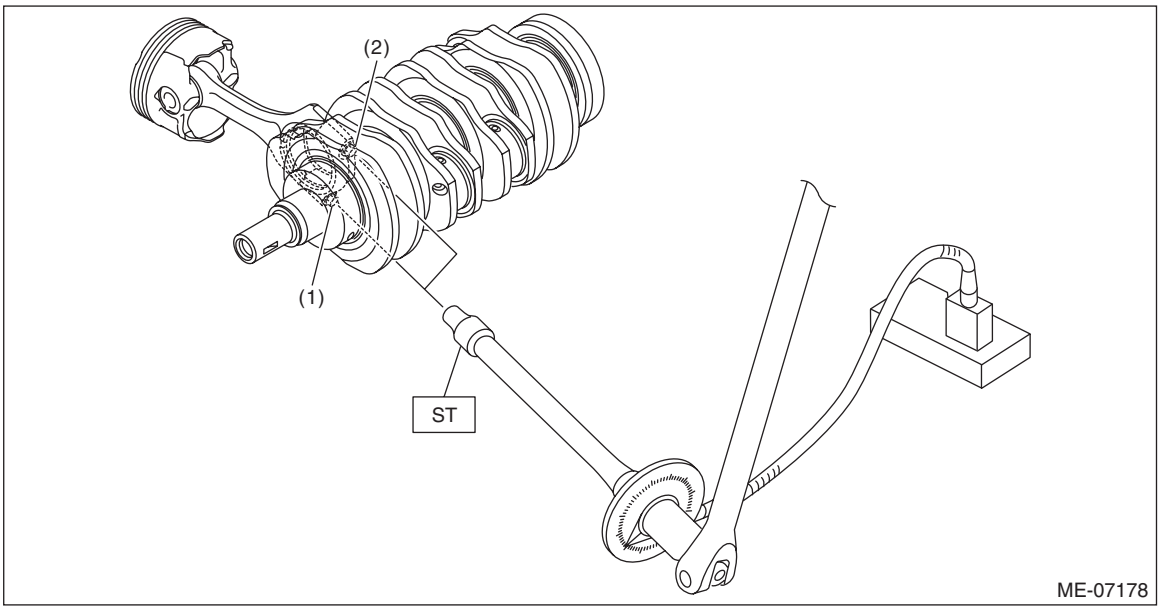


(5) Using ST and angle gauge, tighten the #1 connecting rod cap bolts with specified angle in numerical order as shown in the figure.

CAUTION:
- **Make sure to hold the crankshaft securely during work.**
- **When holding the crankshaft, be careful not to damage the crankshaft.**

ST 18270AA020 SOCKET

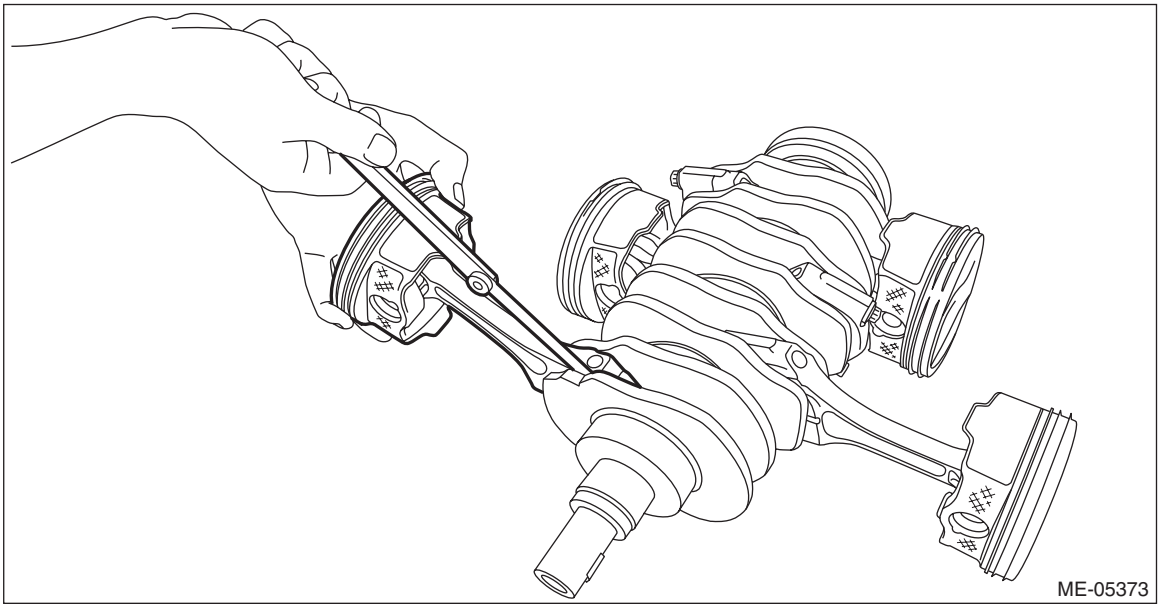
Tightening angle:
137°+3° –2°



(6) In the same manner, install the #2, #3 and #4 connecting rods.
(7) Check the thrust clearance of each connecting rod using a thickness gauge. If it is not within the standard, replace the connecting rod.

NOTE:
Measure the thrust clearance of each connecting rod at several points, and replace the connecting rod if there is uneven wear.

Connecting rod thrust clearance:
Standard
0.070 — 0.330 mm (0.0028 — 0.0130 in)



5) Check the oil clearance on each connecting rod bearing using plastigauge.

NOTE:
Measurement should be performed at a temperature of 20°C (68°F).

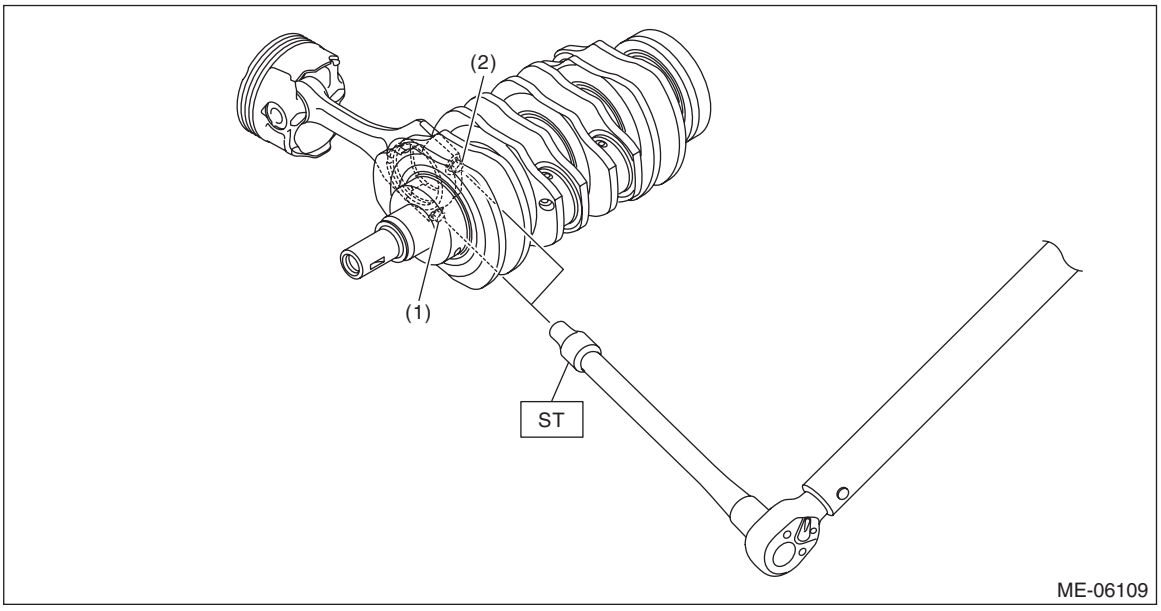
(1) Clean the #1 connecting rod bearing and the #1 pin of crankshaft.
(2) Set the #1 connecting rod bearing to the #1 connecting rod and #1 connecting rod cap.
(3) Place a plastigauge across the #1 pin of crankshaft, and set the #1 connecting rod, #1 connecting rod cap and #1 connecting rod cap bolt to the #1 pin of crankshaft.

NOTE:
• Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching symbol.
• Use a new connecting rod cap bolt.
• Apply a coat of engine oil to the #1 connecting rod cap bolt thread.

(4) Using ST, tighten the #1 connecting rod cap bolts to 10 N·m (1.0 kgf-m, 7.4 ft-lb) in numerical order as shown in the figure, then retighten the bolts to 22 N·m (2.2 kgf-m, 16.2 ft-lb) in numerical order as shown in the figure.

CAUTION:
- **Make sure to hold the crankshaft securely during work.**
- **When holding the crankshaft, be careful not to damage the crankshaft.**
- **During tightening, be careful not to move the #1 connecting rod and the #1 connecting rod cap.**

ST 18270AA020 SOCKET

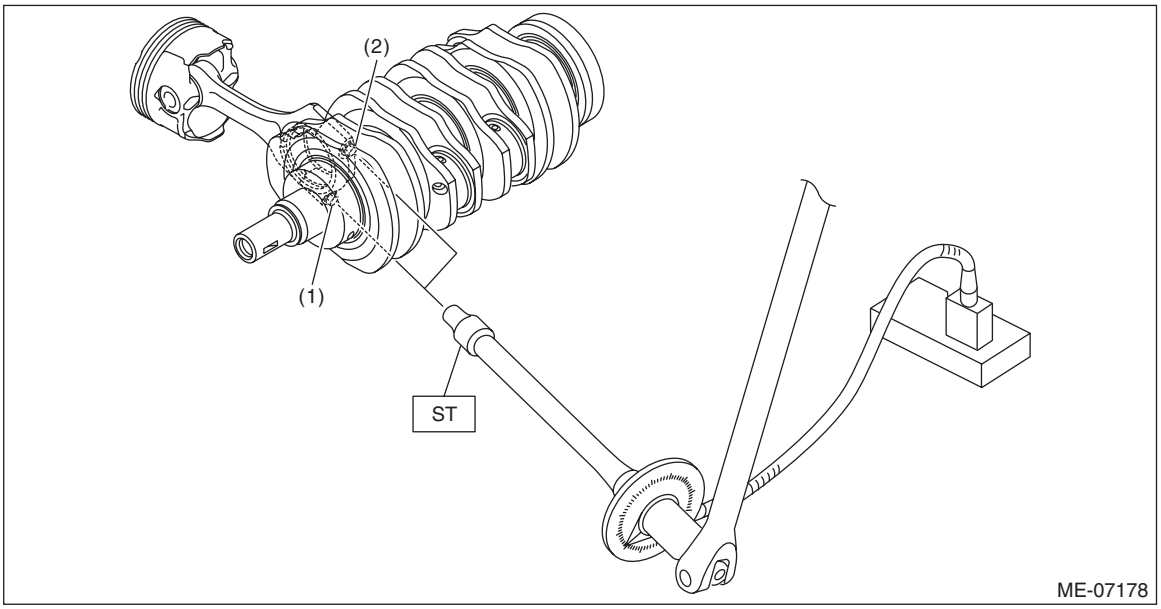


(5) Using ST and angle gauge, tighten the #1 connecting rod cap bolts with specified angle in numerical order as shown in the figure.

CAUTION:
- **Make sure to hold the crankshaft securely during work.**
- **When holding the crankshaft, be careful not to damage the crankshaft.**
- **During tightening, be careful not to move the #1 connecting rod and the #1 connecting rod cap.**

ST 18270AA020 SOCKET

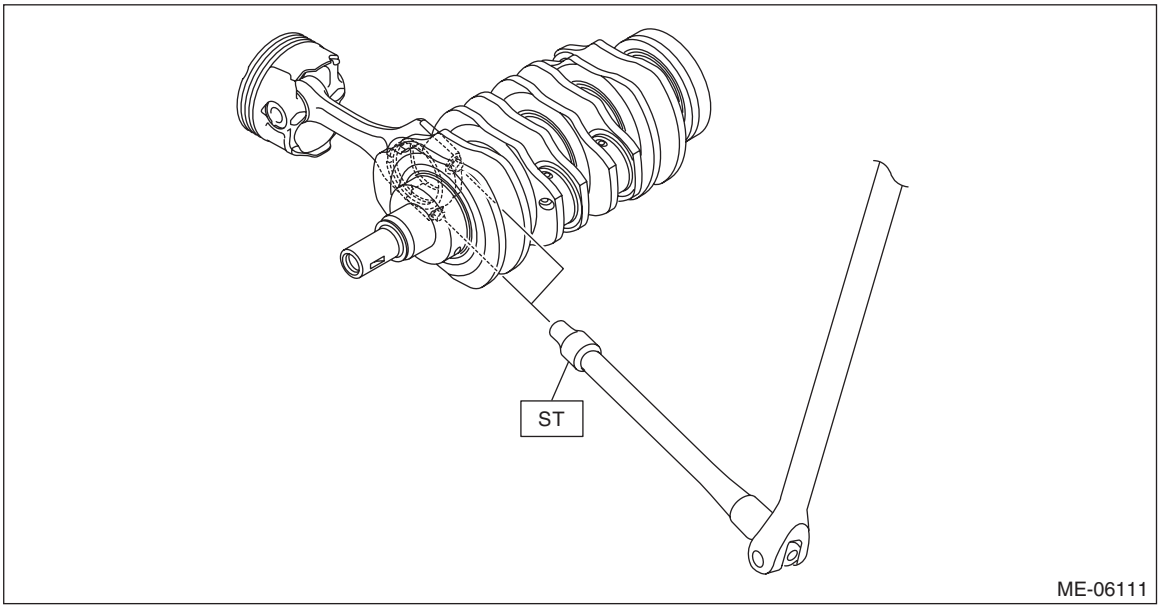
Tightening angle:
$137^{\circ}{}^{+3^{\circ}}_{-2^{\circ}}$



(6) Using ST, loosen the #1 connecting rod cap bolt, and remove the #1 connecting rod cap bolt and #1 connecting rod cap.

CAUTION:
- **Make sure to hold the crankshaft securely during work.**
- **When holding the crankshaft, be careful not to damage the crankshaft.**
- **During removal, be careful not to move the #1 connecting rod and the #1 connecting rod cap.**

ST 18270AA020 SOCKET



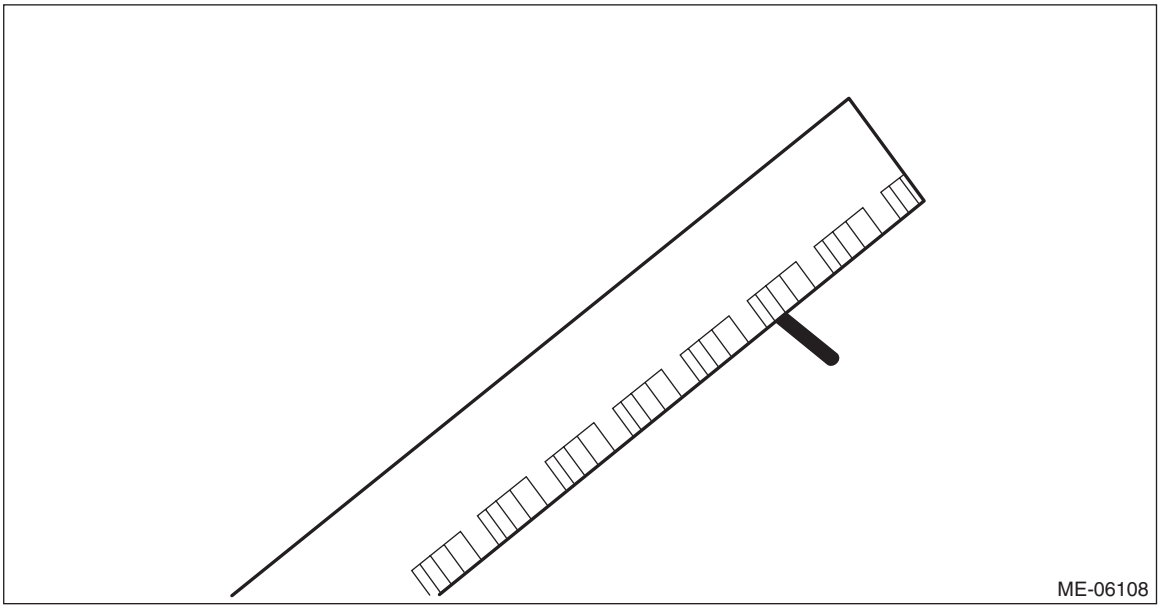
(7) Determine oil clearance of the #1 connecting rod bearing by matching the widest point of the plastigauge on #1 pin of crankshaft against scale printed on a package of the plastigauge. If it is not within the standard, replace the #1 connecting rod bearing.

NOTE:
Measure the outer diameter of crankshaft pin using micrometer, and select the suitable size connecting rod bearing when replacing the connecting rod bearing.

Unit: mm (in)

Bearing	Connecting rod bearing thickness (at center)	Crankshaft pin outer diameter
	Standard	Standard
Standard size	1.492 — 1.508 (0.0587 — 0.0594)	47.976 — 48.000 (1.8888 — 1.8898)
0.03 (0.0012) Undersize	1.511 — 1.515 (0.0595 — 0.0596)	47.946 — 47.970 (1.8876 — 1.8886)
0.05 (0.0020) Undersize	1.521 — 1.525 (0.0599 — 0.0600)	47.926 — 47.950 (1.8868 — 1.8878)
0.25 (0.0098) Undersize	1.621 — 1.625 (0.0638 — 0.0640)	47.726 — 47.750 (1.8790 — 1.8799)

Connecting rod bearing oil clearance:
Standard
0.017 — 0.047 mm (0.0007 — 0.0019 in)

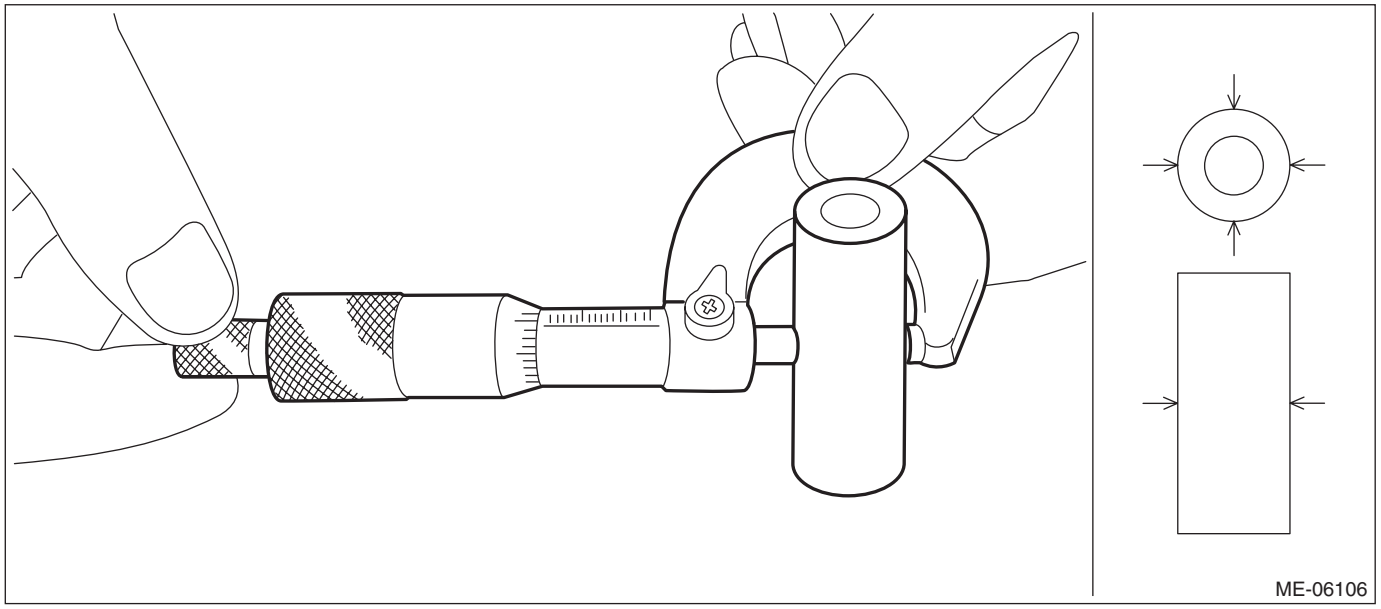


(8) Completely remove the plastigauge.
(9) In the same manner, check oil clearance of the #2, #3 and #4 connecting rod bearings.

5. PISTON PIN & CONNECTING ROD BUSHING

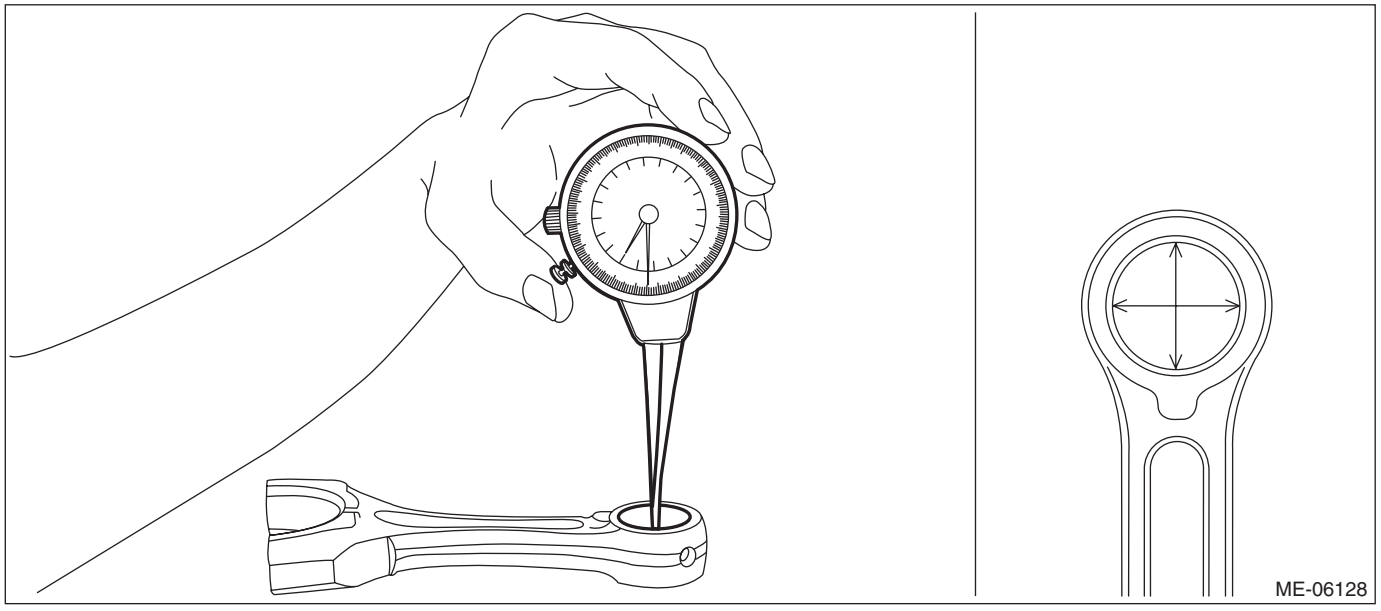
1) Check that the connecting rod bushing is not damaged.
2) Check the clearance between piston pin and connecting rod bushing. Check the clearance between piston pin and connecting rod bushing by measuring the outer diameter of piston pin and the inner diameter of connecting rod bushing respectively.
(1) Measure the outer diameter of piston pin with a micrometer.

NOTE:
- Measurement should be performed at a temperature of 20°C (68°F).
- Measure the outer diameter of the piston pin at the two locations as shown in the figure, and read the value of most worn location.
- Record the measured value.



(2) Using a caliper gauge, measure the inner diameter of connecting rod bushing.

NOTE:
- Measurement should be performed at a temperature of 20°C (68°F).
- Measure the inner diameter of the connecting rod bushing at the two locations as shown in the figure, and read the value of most worn location.
- Record the measured value.



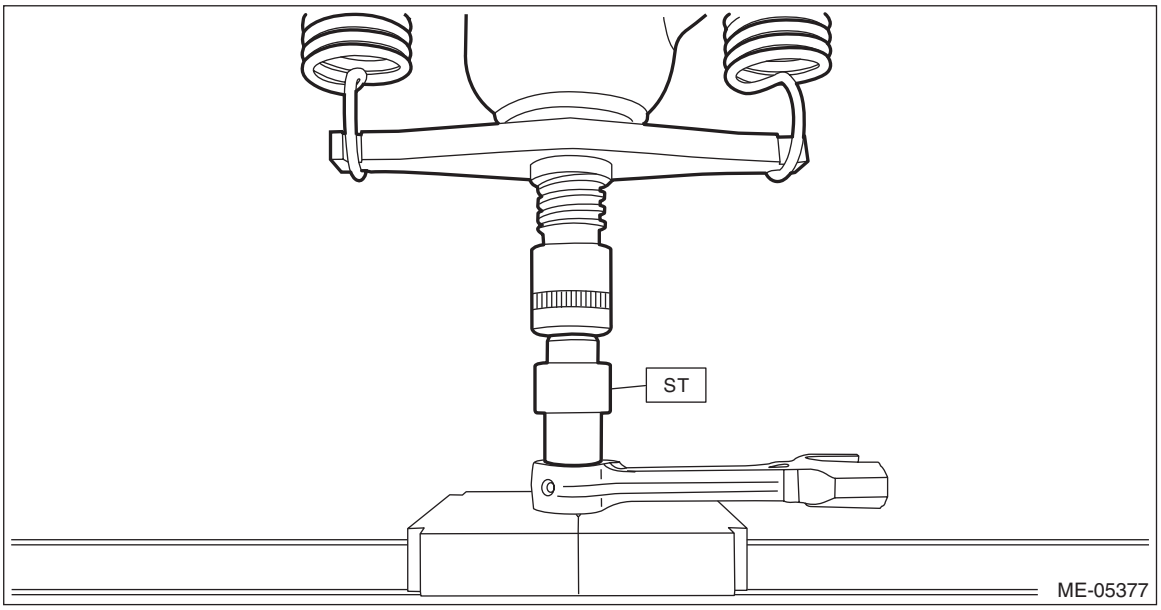
(3) Calculate the clearance between piston pin and connecting rod bushing.

Clearance between piston pin and connecting rod bushing:
Standard
0.004 — 0.026 mm (0.0002 — 0.0010 in)

3) If the clearance between piston pin and connecting rod bushing is not within the standard, replace the connecting rod bushing and piston pin as a set. For replacement procedure of connecting rod bushing, refer to the following.

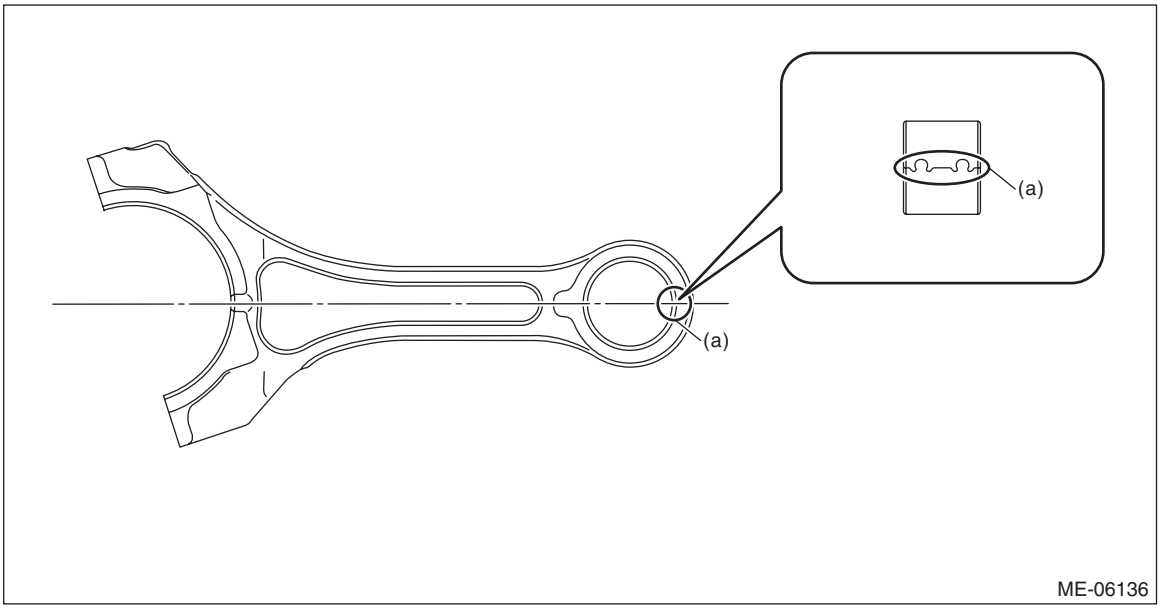
(1) Using the ST and a press, pull out the connecting rod bushing from the small end of the connecting rod.

NOTE:
The direction of ST for pulling out and for press fitting is different. Therefore, attention must be paid to the direction of usage for ST.
ST 18350AA000 CONNECTING ROD BUSHING REMOVER AND INSTALLER



(2) Press the connecting rod bushing with ST and the press, after applying engine oil on the periphery of connecting rod bushing.

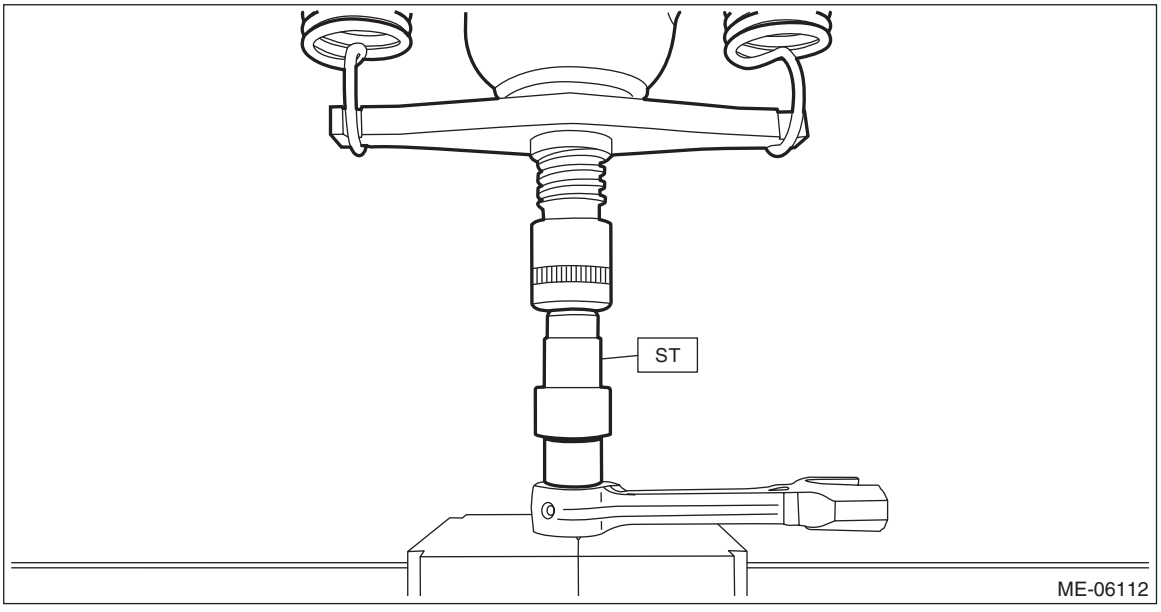
NOTE:
- Clinch area of the connecting rod bushing is as shown in the figure.



(a) Clinch area of connecting rod bushing

- The direction of ST for pulling out and for press fitting is different. Therefore, attention must be paid to the direction of usage for ST.

ST 18350AA000 CONNECTING ROD BUSHING REMOVER AND INSTALLER



(3) Make two 3 mm (0.12 in) holes in the pressed connecting rod bushing by aligning with the pre-manufactured holes provided on the small end of the connecting rod.

(4) Using a reamer, ream the inside surface of the connecting rod bushing. Insert the reamer in the connecting rod bushing, and turn slowly clockwise while pushing lightly. Bring the reamer back while rotating it clockwise.

NOTE:
- Use a reamer with a diameter of ϕ22.
- Apply engine oil to the reamer.
- If the inner surface of connecting rod bushing is damaged, the edge of reamer should be slightly ground with oil stone.
- If the inner surface of connecting rod bushing becomes lustrous and the reamer does not chip, use a new reamer or remedy the reamer.

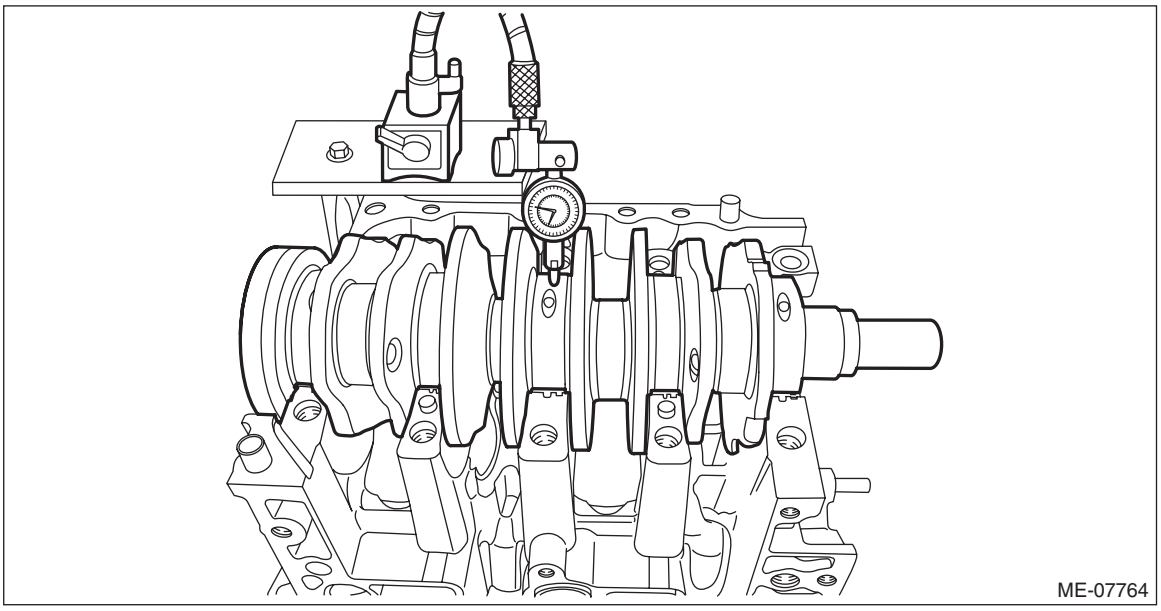
(5) After completion of reaming, clean the connecting rod bushing to remove chips.

6. CRANKSHAFT AND CRANKSHAFT BEARING

1) Clean the crankshaft completely, and check it for cracks using liquid penetrant tester.
2) Using a dial gauge, check the crankshaft bend. If it exceeds the limit, grind to correct the crankshaft journal or replace the crankshaft.

NOTE:
- Measurement should be performed at a temperature of 20°C (68°F).
- If a suitable V-block is not available, using just the #1 and #5 crankshaft bearings on cylinder block, position the crankshaft on cylinder block. Then, measure the crankshaft bend using a dial gauge.
- When grinding to correct the crankshaft journal, refer to step 3).

Crankshaft bend:
Limit
0.035 mm (0.0014 in)



3) Using a micrometer, check the outer diameter of crankshaft pin, outer diameter of journal, cylindricality, and out-of-roundness. If it is not within the standard, replace the connecting rod bearing or crankshaft bearing, and grind to correct the crankshaft pin or journal or replace the crankshaft as required.

NOTE:
- Measurement should be performed at a temperature of 20°C (68°F).
- Select the suitable size connecting rod bearing or crankshaft bearing when replacing the connecting rod bearing or crankshaft bearing.

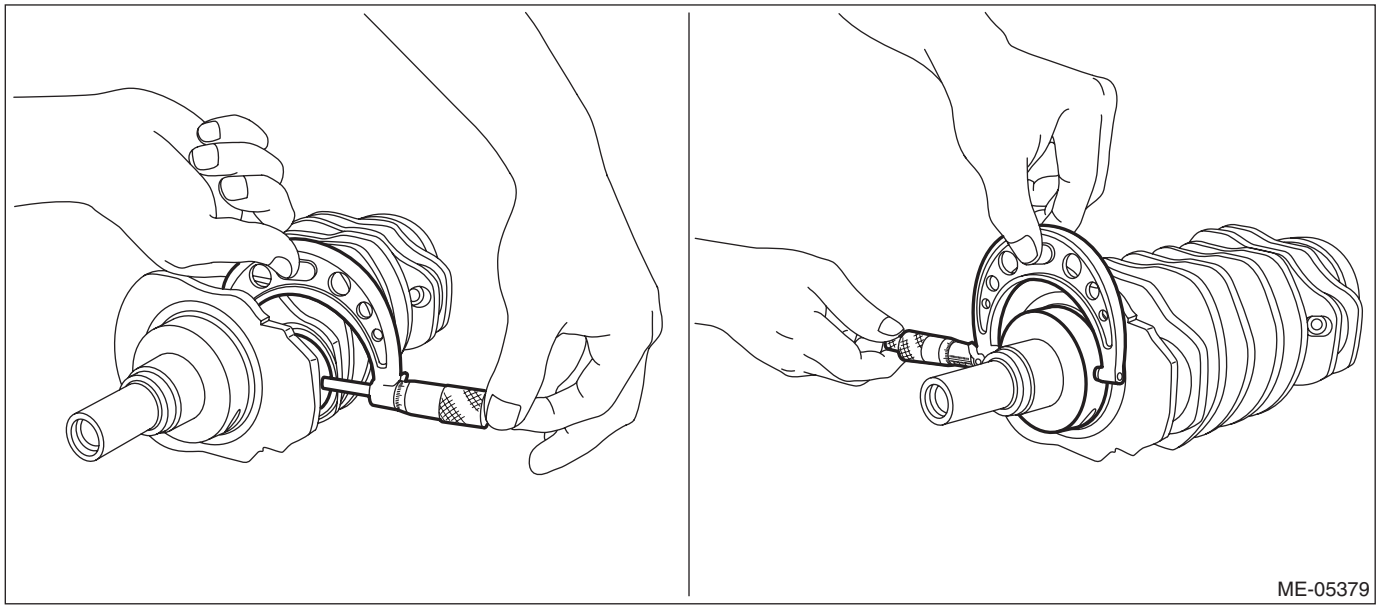
• When grinding to correct the crankshaft pin or journal, finish them to the suitable outer diameter as shown in the table below according to the undersize bearing to be used.

Unit: mm (in)

Bearing	Connecting rod bearing thickness (at center)	Crankshaft pin outer diameter	Crankshaft bearing thickness (at center)		Crankshaft journal outer diameter	
			#1, #2, #3, #4	#5	#1, #2, #3, #4	#5
	Standard	Standard	Standard	Standard	Standard	Standard
Standard size	1.492 — 1.508 (0.0587 — 0.0594)	47.976 — 48.000 (1.8888 — 1.8898)	2.498 — 2.513 (0.0983 — 0.0989)	2.496 — 2.511 (0.0983 — 0.0989)	67.985 — 68.003 (2.6766 — 2.6773)	67.985 — 68.003 (2.6766 — 2.6773)
0.03 (0.0012) Undersize	1.511 — 1.515 (0.0595 — 0.0596)	47.946 — 47.970 (1.8876 — 1.8886)	2.519 — 2.522 (0.0992 — 0.0993)	2.517 — 2.520 (0.0991 — 0.0992)	67.955 — 67.979 (2.6754 — 2.6763)	67.955 — 67.979 (2.6754 — 2.6763)
0.05 (0.0020) Undersize	1.521 — 1.525 (0.0599 — 0.0600)	47.926 — 47.950 (1.8868 — 1.8878)	2.529 — 2.532 (0.0996 — 0.0997)	2.527 — 2.530 (0.0995 — 0.0996)	67.935 — 67.959 (2.6746 — 2.6755)	67.935 — 67.959 (2.6746 — 2.6755)
0.25 (0.0098) Undersize	1.621 — 1.625 (0.0638 — 0.0640)	47.726 — 47.750 (1.8790 — 1.8799)	2.629 — 2.632 (0.1035 — 0.1036)	2.627 — 2.630 (0.1034 — 0.1035)	67.735 — 67.759 (2.6667 — 2.6677)	67.735 — 67.759 (2.6667 — 2.6677)

Crankshaft pin:
Cylindricality
Limit
0.006 mm (0.0002 in)
Out-of-roundness
Limit
0.005 mm (0.0002 in)
Grinding limit (dia.)
To 47.726 mm (1.8790 in)

Crankshaft journal:
Cylindricality
Limit
0.006 mm (0.0002 in)
Out-of-roundness
Limit
0.005 mm (0.0002 in)
Grinding limit (dia.)
To 67.735 mm (2.6667 in)

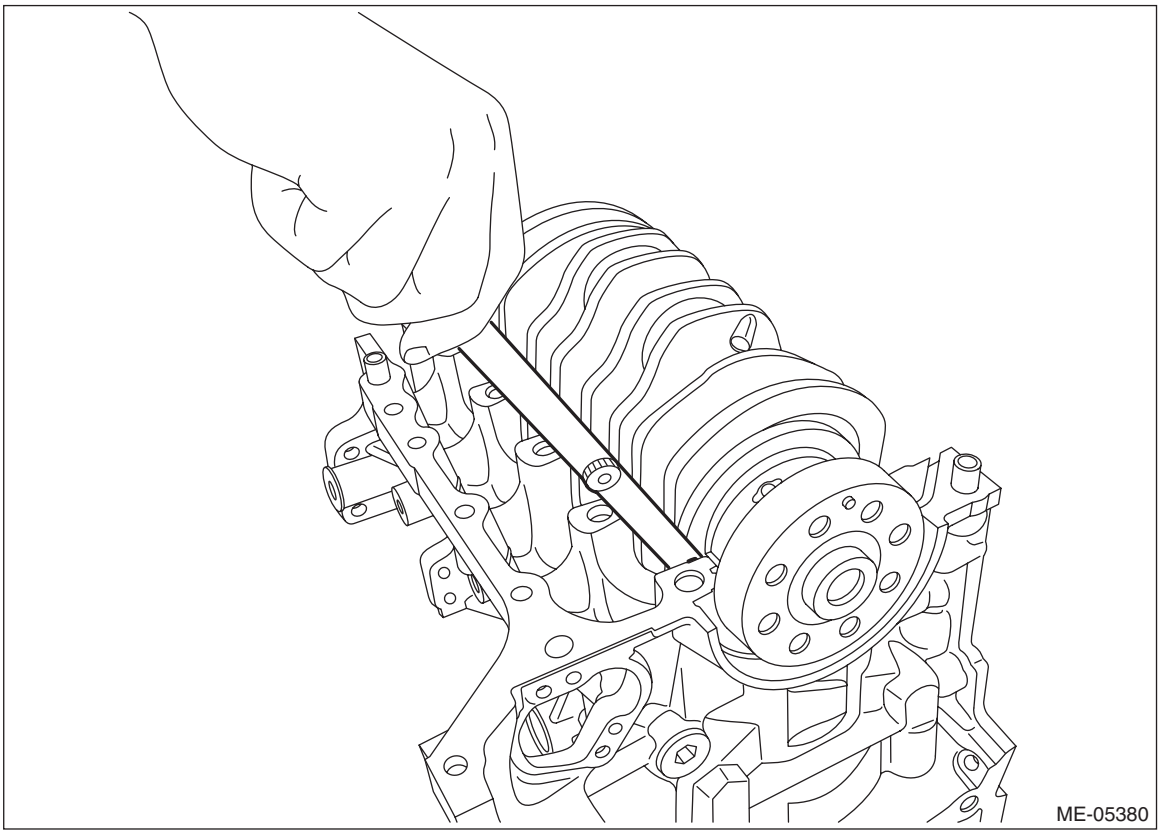


4) Inspect the crankshaft bearing for scar, peeling, seizure, melting or wear, etc.

5) Use a thickness gauge to check the thrust clearance of crankshaft at thrust of #5 crankshaft bearing. If it is not within the standard, replace the #5 crankshaft bearing.

NOTE:
- Measurement should be performed at a temperature of 20°C (68°F).
- Set all the crankshaft bearings onto the cylinder block, then mount the crankshaft on the cylinder block, and use a thickness gauge to measure the thrust clearance of crankshaft.
- Select the #5 crankshaft bearing of suitable size by referring to step 3) when replacing #5 crankshaft bearing.

Crankshaft thrust clearance:
Standard
0.130 — 0.308 mm (0.00512 — 0.01213 in)

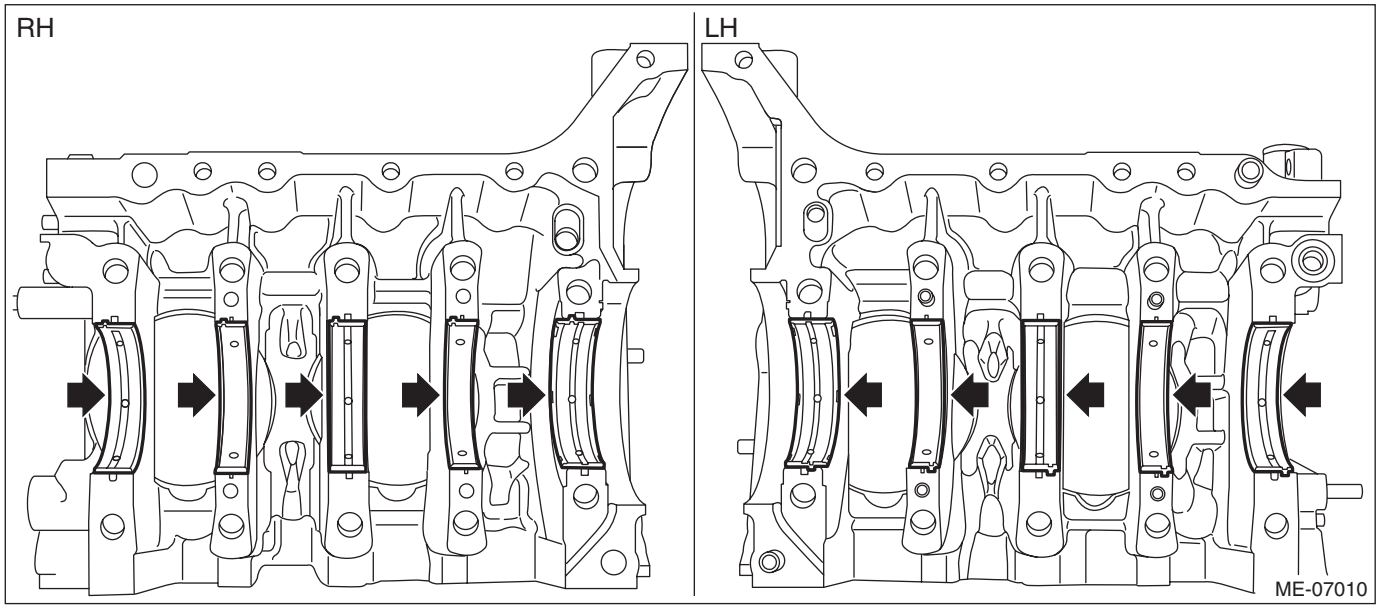


6) Check the oil clearance on each crankshaft bearing using plastigauge.

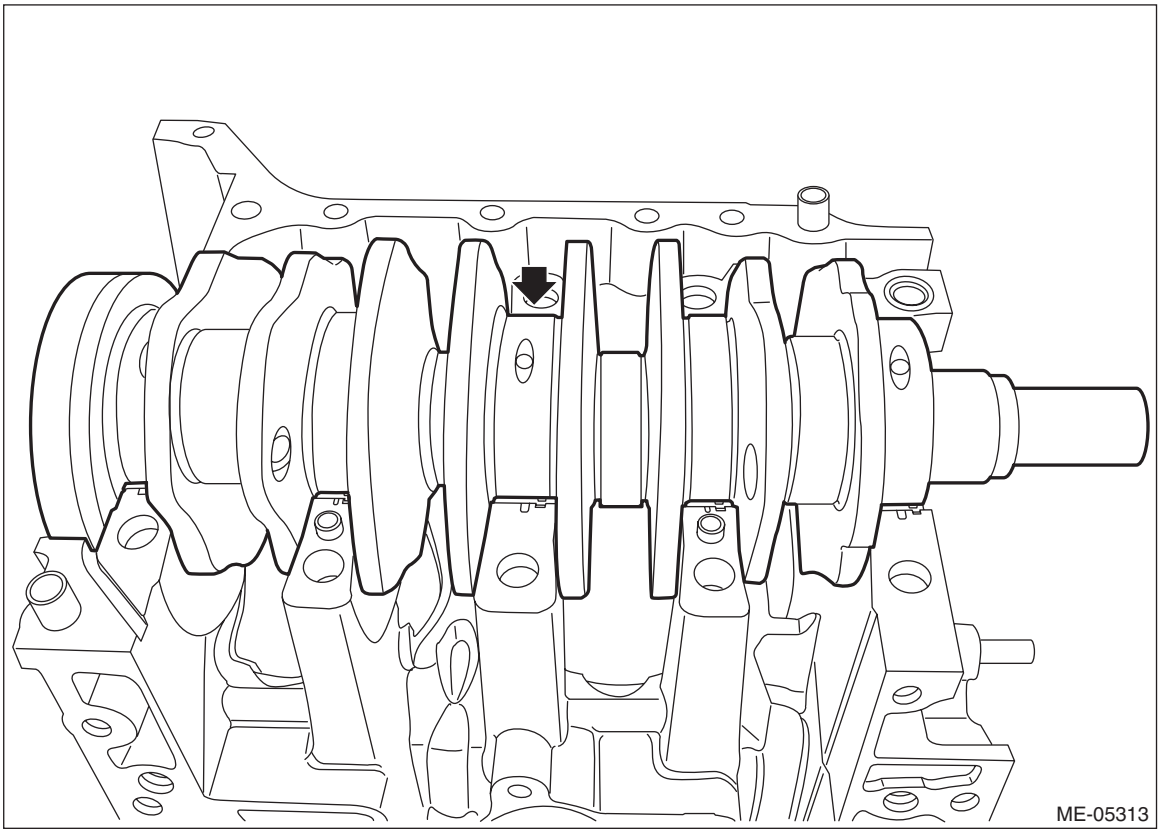
NOTE:
Measurement should be performed at a temperature of 20°C (68°F).

(1) Remove the liquid gasket from cylinder block.
(2) Clean each crankshaft bearing and crankshaft journal.
(3) Set each crankshaft bearing to the cylinder block.

CAUTION:
• Place a wood board wrapped with a waste cloth to prevent the knock pin damage and to stabilize the cylinder block before work.
• Be careful not to scratch the mating surface of cylinder block during work.



(4) Set the crankshaft to the cylinder block LH.



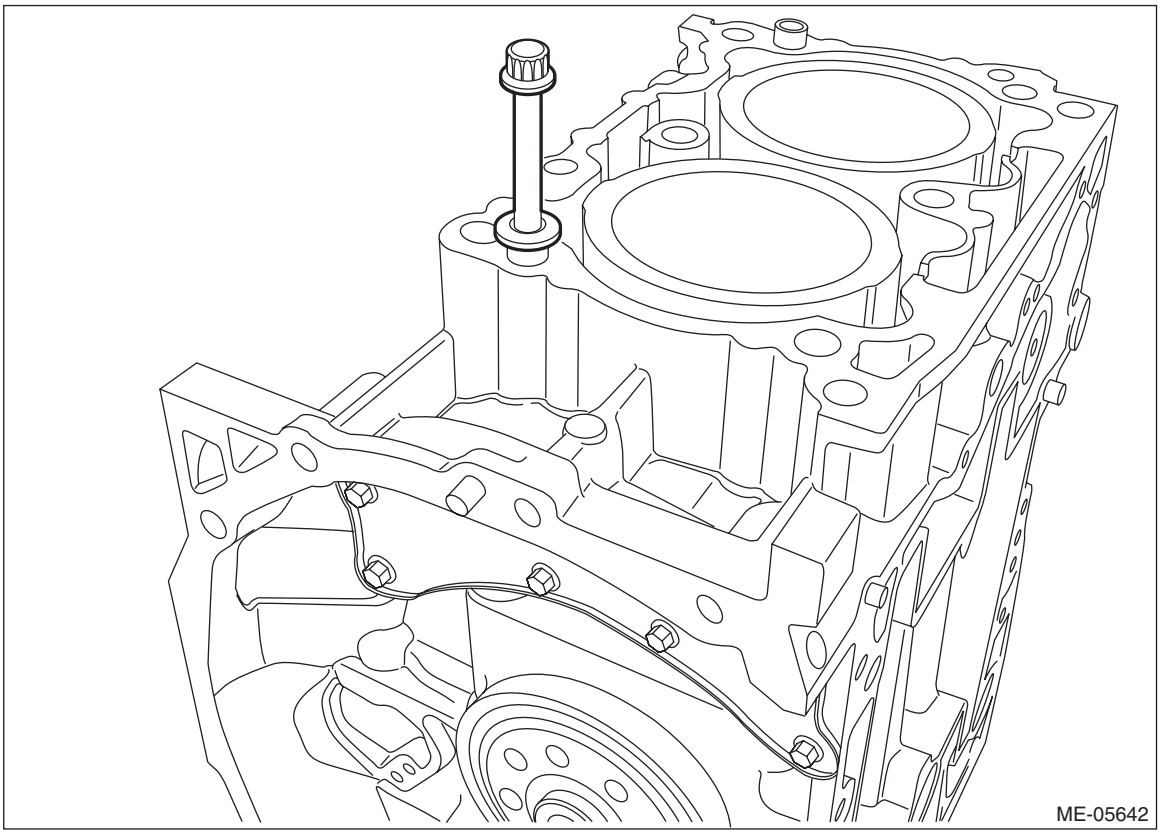
(5) Place a plastigauge across the crankshaft journals and set the cylinder block RH to the cylinder block LH.

(6) Apply a coat of engine oil to the washers and cylinder block mounting bolt threads.

NOTE:
To prevent mixture of engine oil into the water jacket, do not apply a large amount.

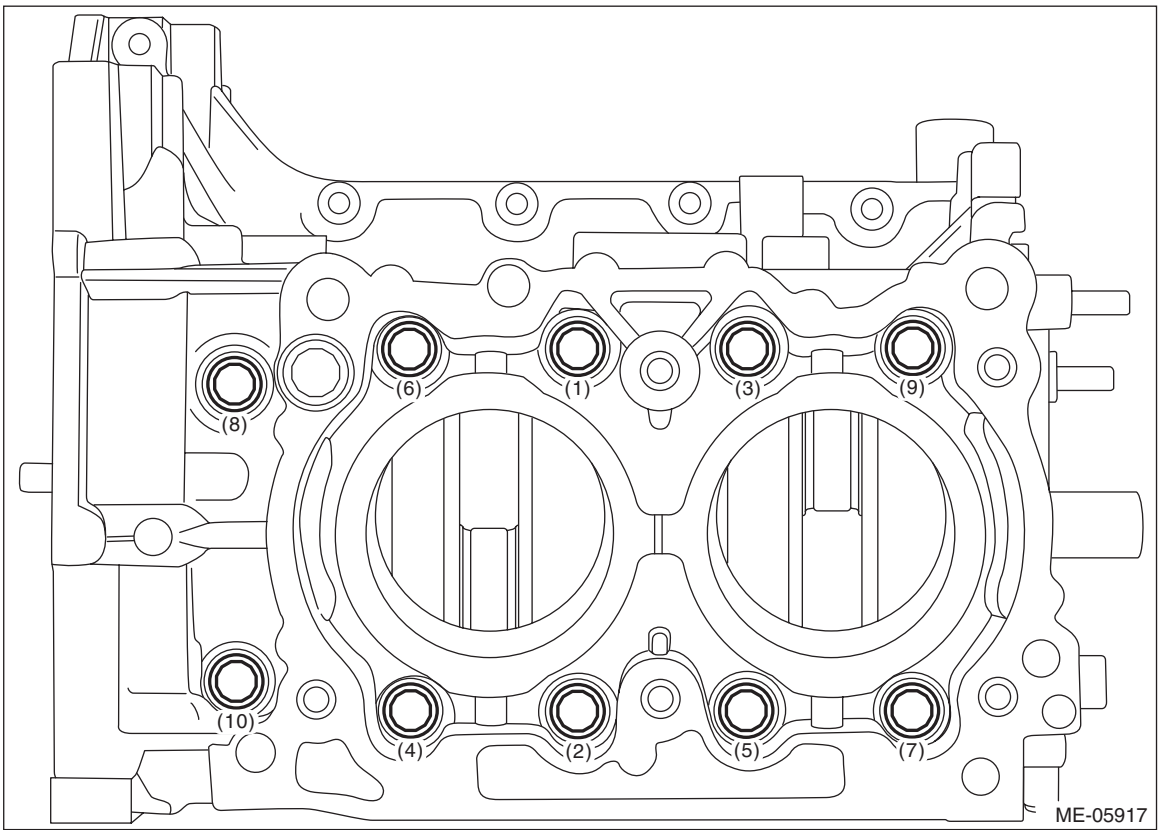
(7) Install the cylinder head bolt at the locations shown in the figure.

NOTE:
This procedure is required to tighten the cylinder block mounting bolts with specified angle using ST.



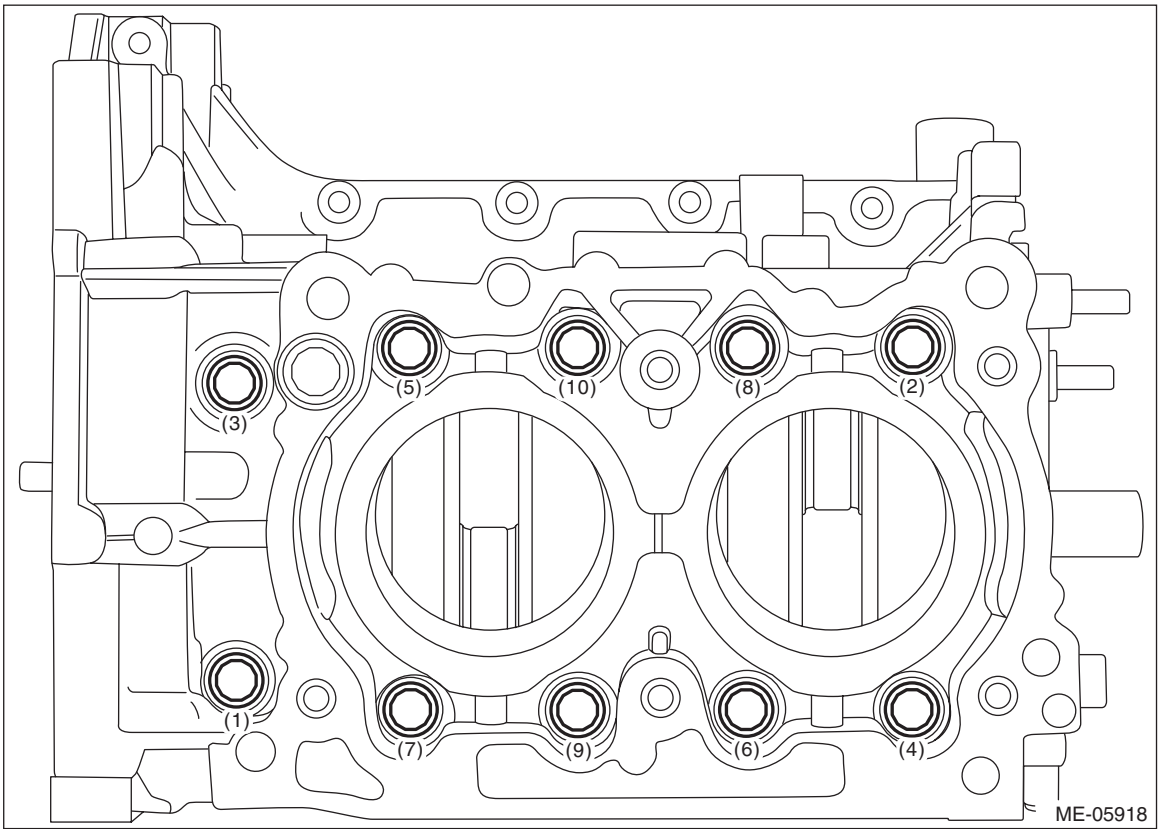
(8) Tighten all mounting bolts with a torque of 35 N·m (3.6 kgf-m, 25.8 ft-lb) in numerical order as shown in the figure.

CAUTION:
When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



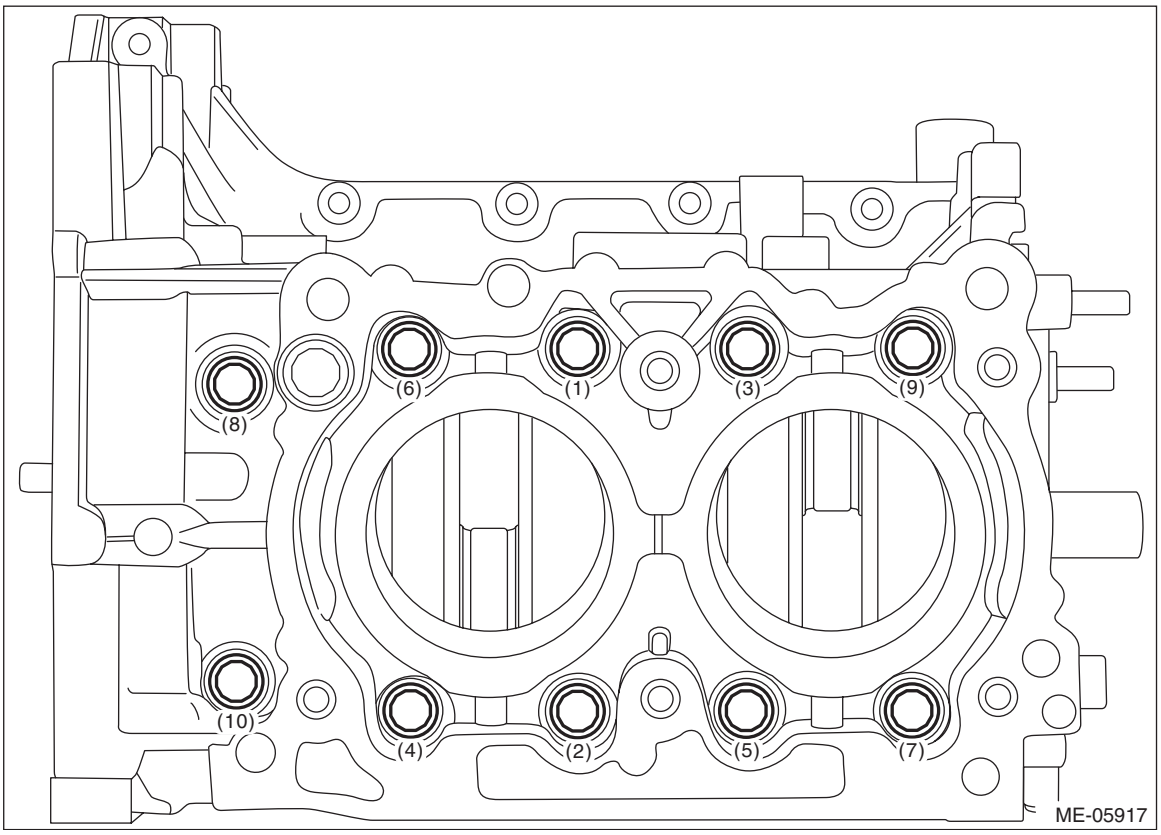
(9) Loosen all mounting bolts by 180° in numerical order as shown in the figure.

CAUTION:
When loosening the mounting bolts, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



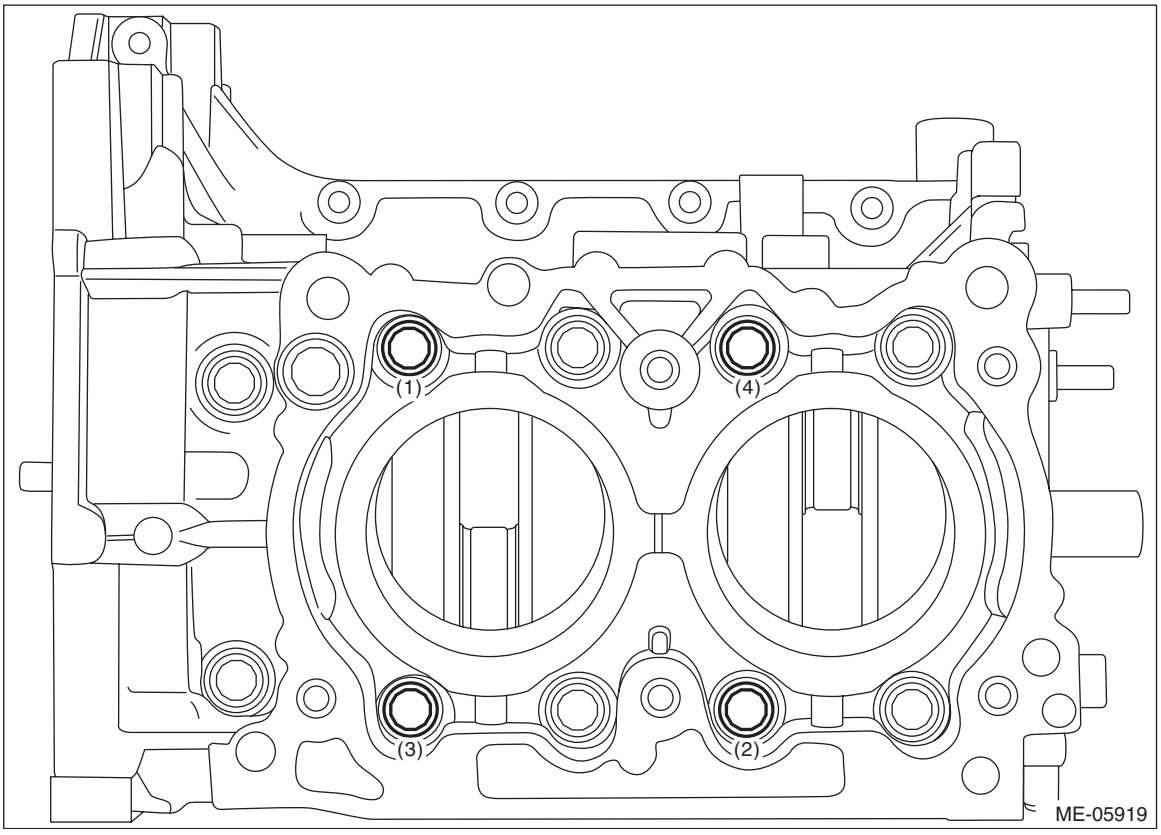
(10) Tighten all mounting bolts with a torque of 35 N·m (3.6 kgf-m, 25.8 ft-lb) in numerical order as shown in the figure.

CAUTION:
When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



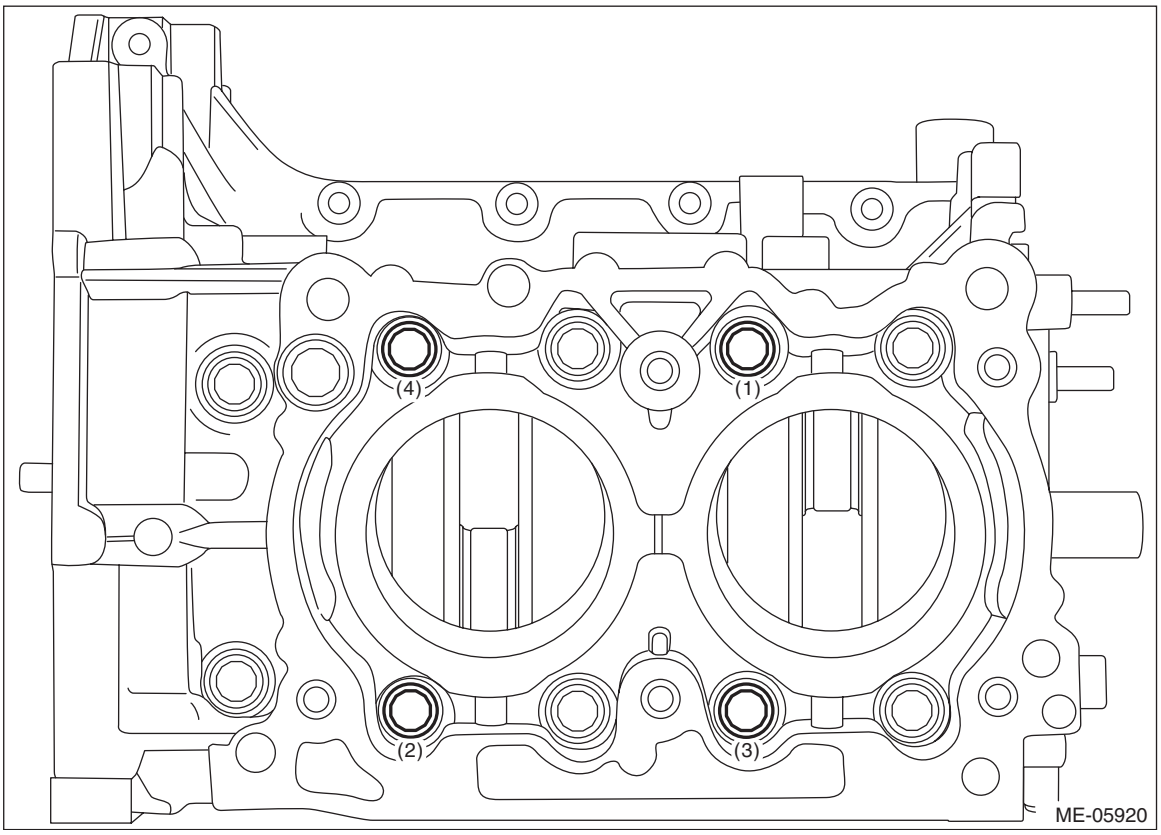
(11) Loosen the mounting bolts (4 places) by 180° in numerical order as shown in the figure.

CAUTION:
When loosening the mounting bolts, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



(12) Tighten the mounting bolts (4 places) with a torque of 17 N·m (1.7 kgf-m, 12.5 ft-lb) in numerical order as shown in the figure.

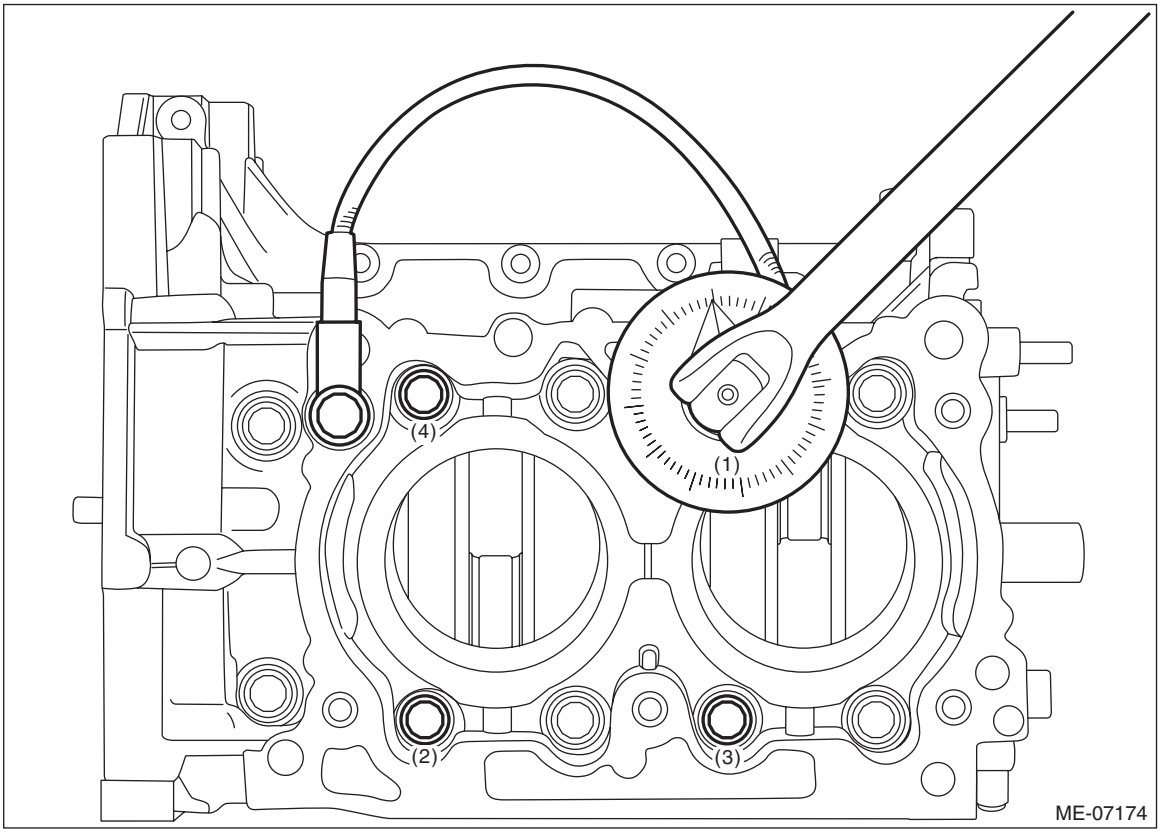
CAUTION:
When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



(13) Using angle gauge, tighten the mounting bolts (4 places) with specified angle in numerical order as shown in the figure.

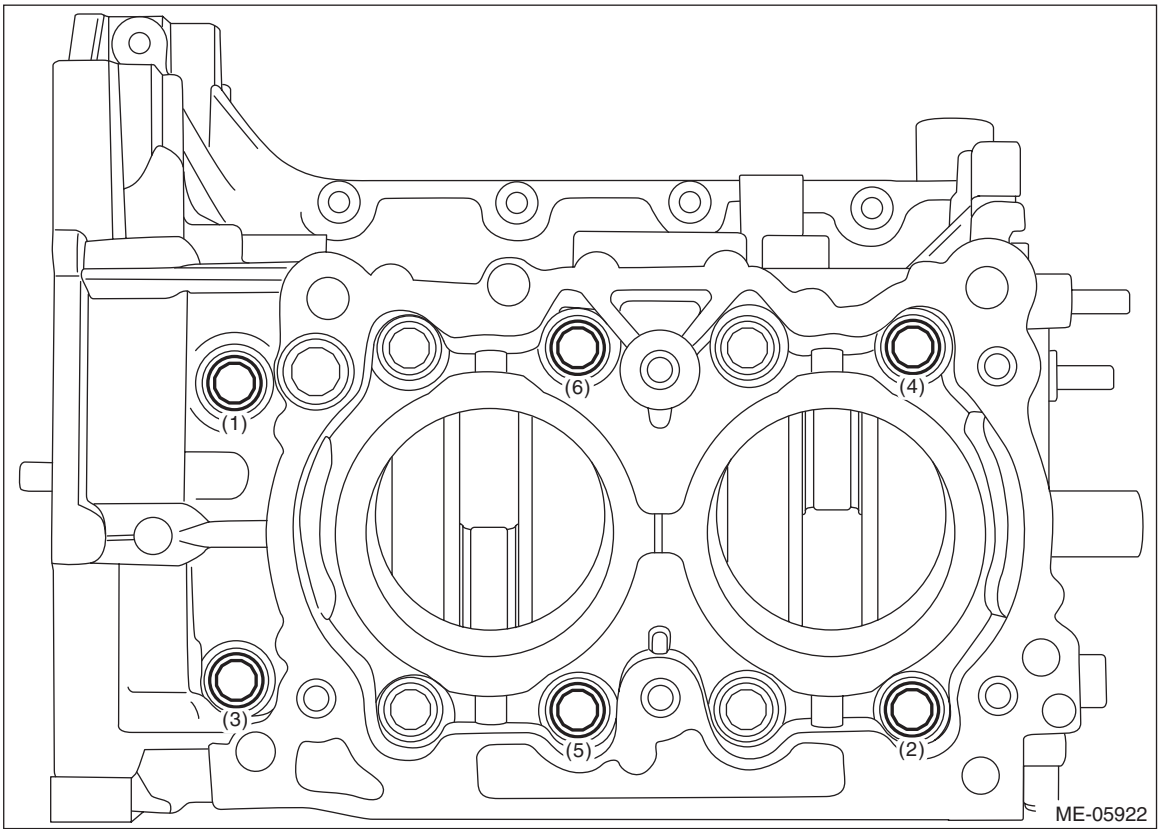
CAUTION:
When tightening the mounting bolts with specified angle, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.

Tightening angle:
60°±2°



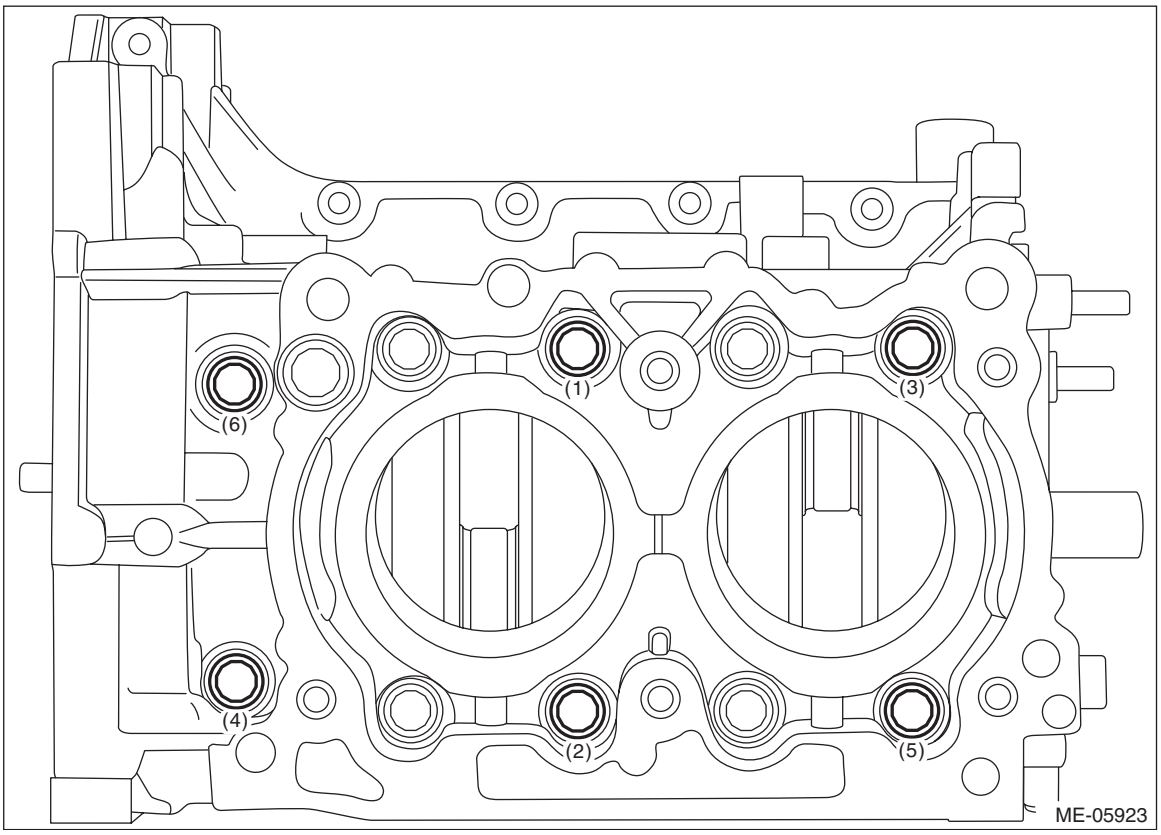
(14) Loosen the mounting bolts (6 places) by 180° in numerical order as shown in the figure.

CAUTION:
When loosening the mounting bolts, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



(15) Tighten the mounting bolts (6 places) with a torque of 17 N·m (1.7 kgf-m, 12.5 ft-lb) in numerical order as shown in the figure.

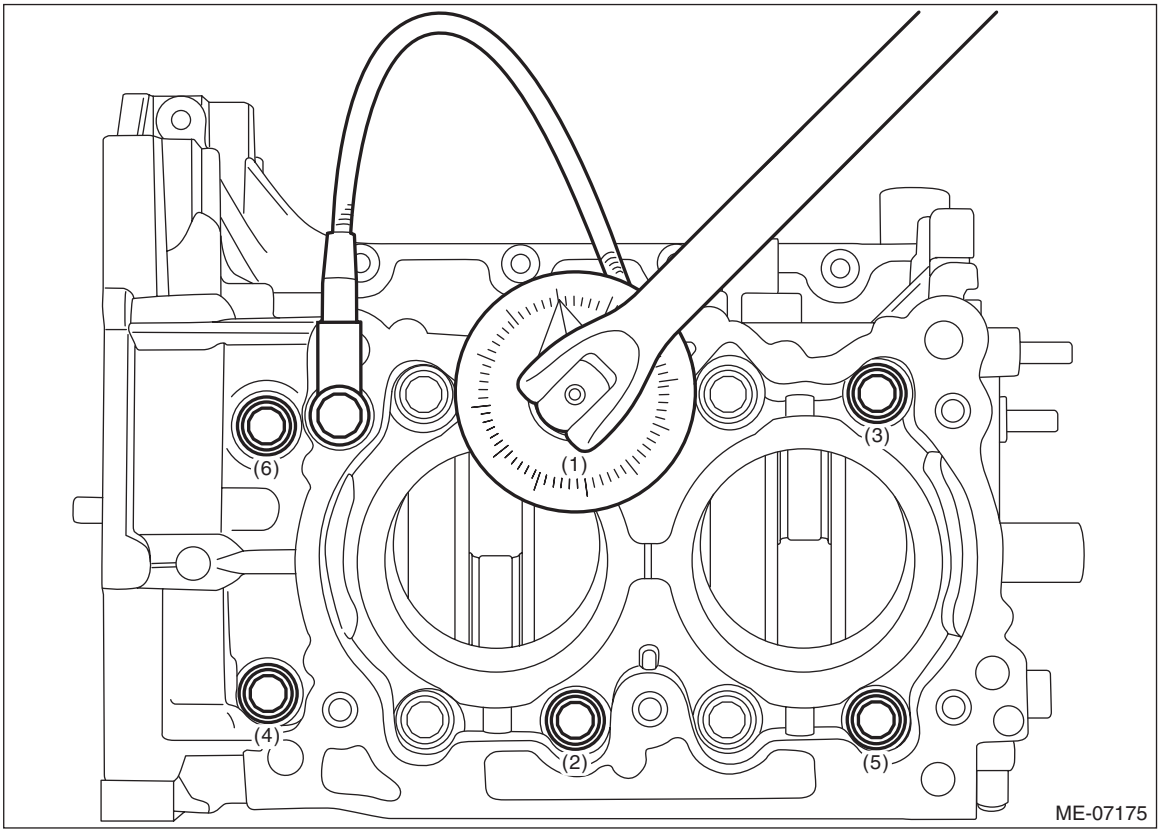
CAUTION:
When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



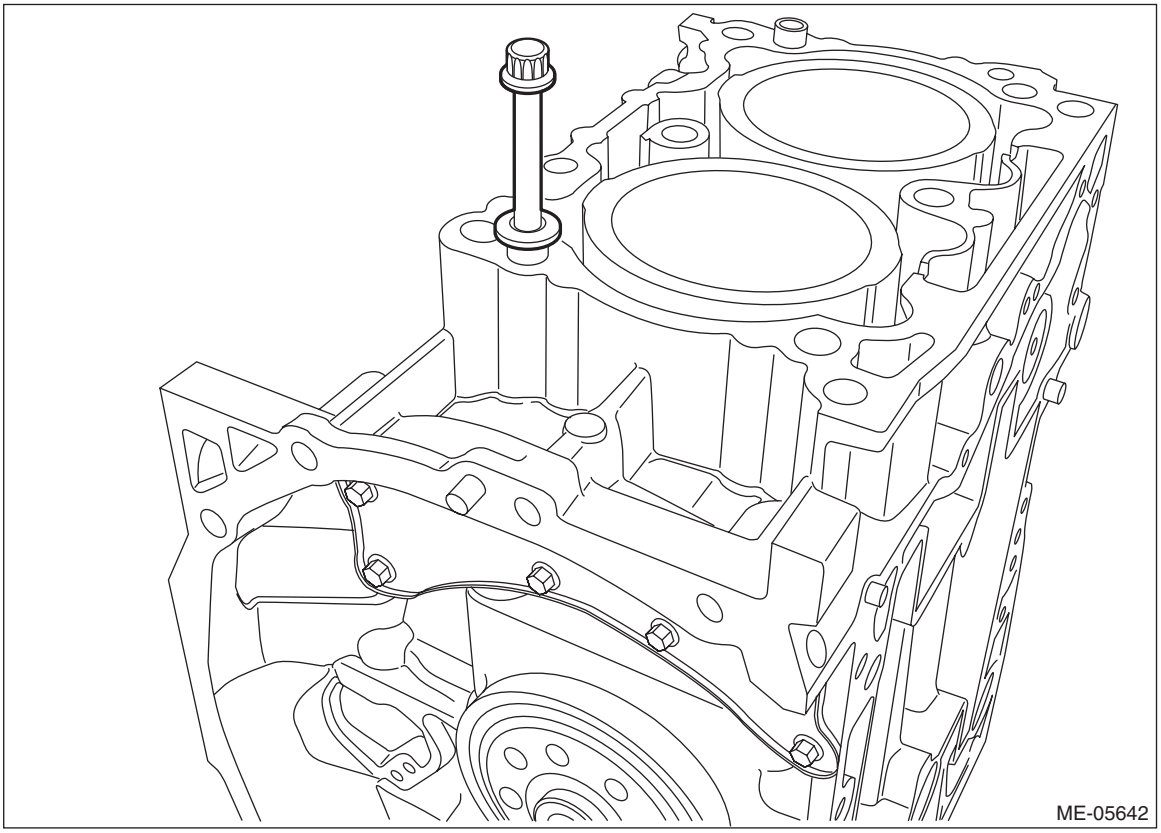
(16) Using angle gauge, tighten the mounting bolts (6 places) with specified angle in numerical order as shown in the figure.

CAUTION:
When tightening the mounting bolts with specified angle, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.

Tightening angle:
60°±2°

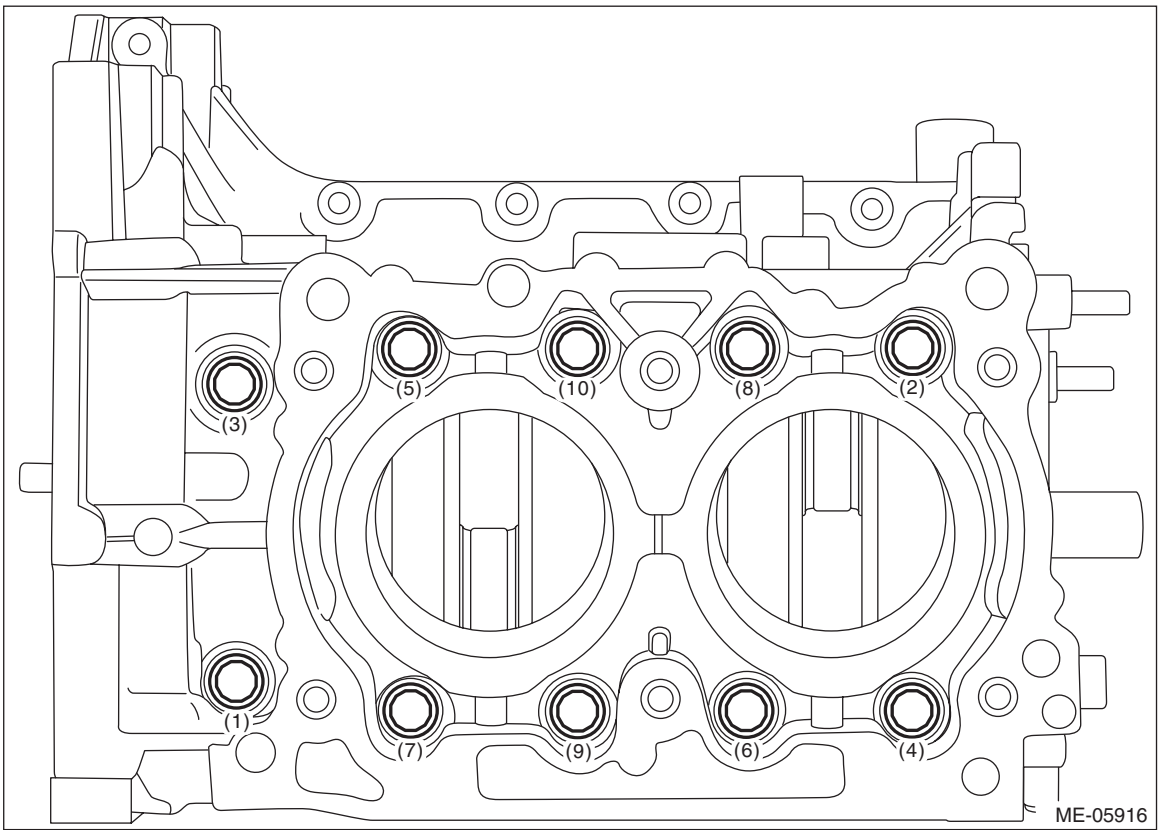


(17) Remove the cylinder head bolt attached at the locations shown in the figure.



(18) Loosen the cylinder block mounting bolts in numerical order as shown in the figure, and separate the cylinder block RH and LH.

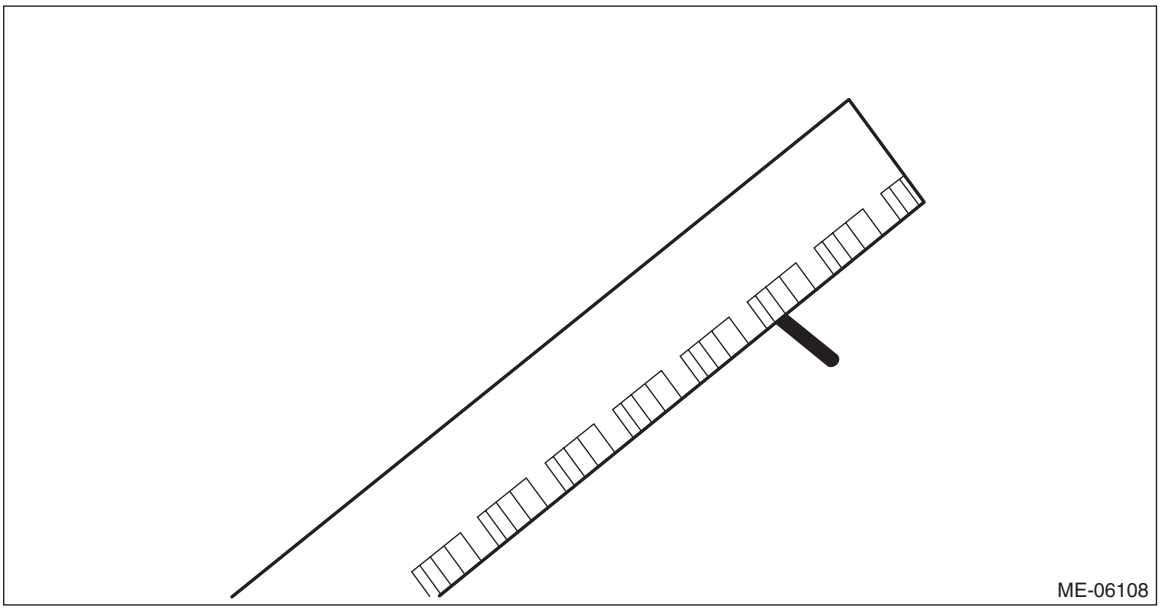
NOTE:
Lift the cylinder block RH slightly, and confirm that the crankshaft is remaining in the cylinder block LH. If the cylinder block RH is lifted carelessly when separating, the crankshaft may stick to cylinder block RH, then fall off.



(19) Determine the crankshaft oil clearance by matching the widest point of the plastigauge on each journal against scale printed on a package of the plastigauge. If it is not within the standard, replace the crankshaft bearing, and grind to correct the crankshaft journal or replace the crankshaft as required.

NOTE:
- Select the crankshaft bearing of suitable size by referring to step 3) when replacing crankshaft bearing.
- When grinding to correct the crankshaft journal, finish it to the suitable outer diameter by referring to step 3) according to the undersize bearing to be used.

Crankshaft oil clearance:
Standard
0.013 — 0.031 mm (0.00051 — 0.00122 in)



(20) Completely remove the plastigauge.

23.Intake and Exhaust Valve

A: SPECIFICATION

Refer to “Cylinder Head” for removal and installation procedures of the intake and exhaust valves. <Ref. to ME(H4DO(w/o HEV))-263, REMOVAL, Cylinder Head.> <Ref. to ME(H4DO(w/o HEV))-265, INSTALLATION, Cylinder Head.>

24.Piston

A: SPECIFICATION

Refer to “Cylinder Block” for removal and installation procedures of pistons. <Ref. to ME(H4DO(w/o HEV))-304, REMOVAL, Cylinder Block.> <Ref. to ME(H4DO(w/o HEV))-323, INSTALLATION, Cylinder Block.>

25.Connecting Rod

A: SPECIFICATION

Refer to “Cylinder Block” for removal and installation procedures of connecting rod.
<Ref. to ME(H4DO(w/o HEV))-304, REMOVAL, Cylinder Block.> <Ref. to ME(H4DO(w/o HEV))-323, INSTALLATION, Cylinder Block.>

26.Crankshaft

A: SPECIFICATION

Refer to “Cylinder Block” for removal and installation procedures of the crankshaft. <Ref. to ME(H4DO(w/o HEV))-304, REMOVAL, Cylinder Block.> <Ref. to ME(H4DO(w/o HEV))-323, INSTALLATION, Cylinder Block.>

27.Engine Trouble in General

A: INSPECTION

NOTE:
The “RANK” shown in the chart shows the possibilities of the cause of trouble in order from “Very often” to “Rarely”.
A — Very often
B — Sometimes
C — Rarely

Symptoms	Problem parts etc.	Possible cause	RANK
1. Engine does not start.			
1) Starter does not turn.	Starter	Defective battery-to-starter harness	B
		Defective starter switch	C
		Defective inhibitor switch	C
		Defective starter	B
	Battery	Improper connection of terminal	A
		Run-down battery	A
		Defective charging system	B
	Friction	Seizure of crankshaft and connecting rod bearing	C
		Seized camshaft	C
		Seized or stuck piston and cylinder	C
	Immobilizer system <Ref. to IM(diag)-2, Basic Diagnostic Procedure.>		A
2) Initial combustion does not occur.	Starter	Defective starter	C
	Engine control system <Ref. to EN(H4DO w/o HEV)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(H4DO HEV)(diag)-2, Basic Diagnostic Procedure.>		A
	Fuel line	Defective fuel pump and relay	A
		Clogged fuel line	C
		Lack of fuel or insufficient fuel	B
	Timing chain	Trouble	B
		Defective timing	B
	Compression	Incorrect cam clearance	C
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective cylinder head gasket	C
		Improper valve sealing	C
		Defective valve stem	C
		Worn or broken valve spring	B
		Worn or stuck piston rings, cylinder liner and piston	C
		Incorrect valve timing	B
		Improper engine oil (low viscosity)	B

Symptoms	Problem parts etc.	Possible cause	RANK
3) Initial combustion occurs.	Engine control system <Ref. to EN(H4DO w/o HEV)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(H4DO HEV)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Defective intake manifold gasket	B
		Defective throttle body gasket	B
	Fuel line	Defective fuel pump and relay	C
		Clogged fuel line	C
		Lack of fuel or insufficient fuel	B
	Timing chain	Trouble	B
		Defective timing	B
	Compression	Incorrect cam clearance	C
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective cylinder head gasket	C
		Improper valve sealing	C
		Defective valve stem	C
		Worn or broken valve spring	B
		Worn or stuck piston rings, cylinder liner and piston	C
		Incorrect valve timing	B
		Improper engine oil (low viscosity)	B
4) Engine stalls after initial combustion.	Engine control system <Ref. to EN(H4DO w/o HEV)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(H4DO HEV)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	B
		Loosened or cracked PCV hose	C
		Loosened or cracked vacuum hose	C
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Dirty air cleaner element	C
	Fuel line	Clogged fuel line	C
		Lack of fuel or insufficient fuel	B
	Timing chain	Trouble	B
		Defective timing	B
	Compression	Incorrect cam clearance	C
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective cylinder head gasket	C
		Improper valve sealing	C
		Defective valve stem	C
		Worn or broken valve spring	B
		Worn or stuck piston rings, cylinder and piston	C
		Incorrect valve timing	B
		Improper engine oil (low viscosity)	B

Symptoms	Problem parts etc.	Possible cause	RANK
2. Rough idle and engine stall	Engine control system <Ref. to EN(H4DO w/o HEV)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(H4DO HEV)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	A
		Loosened or cracked PCV hose	A
		Loosened or cracked vacuum hose	A
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Defective PCV valve	C
		Loosened oil filler cap	B
		Dirty air cleaner element	C
	Fuel line	Defective fuel pump and relay	C
		Clogged fuel line	C
		Lack of fuel or insufficient fuel	B
	Timing chain	Defective timing	C
	Compression	Incorrect cam clearance	B
		Loosened spark plug or defective gasket	B
		Loosened cylinder head bolt or defective cylinder head gasket	B
		Improper valve sealing	B
		Defective valve stem	C
		Worn or broken valve spring	B
		Worn or stuck piston rings, cylinder and piston	B
		Incorrect valve timing	A
		Improper engine oil (low viscosity)	B
	Lubrication system	Incorrect oil pressure	B
		Defective rocker cover gasket	C
	Cooling system	Over-heating	C
	Other	Evaporative emission control system malfunction	A
		Stuck or damaged throttle valve	B

Symptoms	Problem parts etc.	Possible cause	RANK
3. Low output, hesitation and poor acceleration	Engine control system <Ref. to EN(H4DO w/o HEV)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(H4DO HEV)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	A
		Loosened or cracked PCV hose	A
		Loosened or cracked vacuum hose	B
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Defective PCV valve	B
		Loosened oil filler cap	B
		Dirty air cleaner element	A
	Fuel line	Defective fuel pump and relay	B
		Clogged fuel line	B
		Lack of fuel or insufficient fuel	C
	Timing chain	Defective timing	B
	Compression	Incorrect cam clearance	B
		Loosened spark plug or defective gasket	B
		Loosened cylinder head bolt or defective cylinder head gasket	B
		Improper valve sealing	B
		Defective valve stem	C
		Worn or broken valve spring	B
		Worn or stuck piston rings, cylinder and piston	C
		Incorrect valve timing	A
		Improper engine oil (low viscosity)	B
	Lubrication system	Incorrect oil pressure	B
	Cooling system	Over-heating	C
		Over-cooling	C
	Other	Evaporative emission control system malfunction	A

Symptoms	Problem parts etc.	Possible cause	RANK
4. Surging	Engine control system <Ref. to EN(H4DO w/o HEV)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(H4DO HEV)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	A
		Loosened or cracked PCV hose	A
		Loosened or cracked vacuum hose	A
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Defective PCV valve	B
		Loosened oil filler cap	B
		Dirty air cleaner element	B
	Fuel line	Defective fuel pump and relay	B
		Clogged fuel line	B
		Lack of fuel or insufficient fuel	C
	Timing chain	Defective timing	B
	Compression	Incorrect cam clearance	B
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective cylinder head gasket	C
		Improper valve sealing	C
		Defective valve stem	C
		Worn or broken valve spring	C
		Worn or stuck piston rings, cylinder and piston	C
		Incorrect valve timing	A
		Improper engine oil (low viscosity)	B
	Cooling system	Over-heating	B
	Other	Evaporative emission control system malfunction	C
5. Engine does not return to idle	Engine control system <Ref. to EN(H4DO w/o HEV)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(H4DO HEV)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked vacuum hose	A
	Other	Stuck or damaged throttle valve	A
6. Dieseling (run-on)	Engine control system <Ref. to EN(H4DO w/o HEV)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(H4DO HEV)(diag)-2, Basic Diagnostic Procedure.>		A
	Cooling system	Over-heating	B
	Other	Evaporative emission control system malfunction	B

Symptoms	Problem parts etc.	Possible cause	RANK
7. After burning in exhaust system	Engine control system <Ref. to EN(H4DO w/o HEV)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(H4DO HEV)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	C
		Loosened or cracked PCV hose	C
		Loosened or cracked vacuum hose	B
		Defective PCV valve	B
		Loosened oil filler cap	C
	Timing chain	Defective timing	B
	Compression	Incorrect cam clearance	B
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective cylinder head gasket	C
		Improper valve sealing	B
		Defective valve stem	C
		Worn or broken valve spring	C
		Worn or stuck piston rings, cylinder and piston	C
		Incorrect valve timing	A
	Lubrication system	Incorrect oil pressure	C
	Cooling system	Over-cooling	C
	Other	Evaporative emission control system malfunction	C
8. Knocking	Engine control system <Ref. to EN(H4DO w/o HEV)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(H4DO HEV)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened oil filler cap	B
	Timing chain	Defective timing	B
	Compression	Incorrect cam clearance	C
		Incorrect valve timing	B
	Cooling system	Over-heating	A
9. Excessive engine oil consumption	Intake system	Loosened or cracked PCV hose	A
		Defective PCV valve	B
		Loosened oil filler cap	C
	Compression	Defective valve stem	A
		Worn or stuck piston rings, cylinder and piston	A
	Lubrication system	Loosened chain cover attaching bolts and defective gasket	B
		Defective oil filter gasket	B
		Defective crankshaft oil seal	B
		Defective rocker cover gasket	B
		Loosened oil drain plug or defective gasket	B
		Loosened oil pan mounting bolt or defective oil pan	B

Symptoms	Problem parts etc.	Possible cause	RANK
10. Excessive fuel consumption	Engine control system <Ref. to EN(H4DO w/o HEV)(diag)-2, Basic Diagnostic Procedure.> <Ref. to EN(H4DO HEV)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Dirty air cleaner element	A
	Timing chain	Defective timing	B
	Compression	Incorrect cam clearance	B
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective cylinder gasket	C
		Improper valve sealing	B
		Defective valve stem	C
		Worn or broken valve spring	C
		Worn or stuck piston rings, cylinder and piston	B
		Incorrect valve timing	B
	Lubrication system	Incorrect oil pressure	C
	Cooling system	Over-cooling	C

28.Engine Noise

A: INSPECTION

Type of sound	Condition	Possible cause
Regular clicking sound	Sound increases as engine speed increases.	• Valve mechanism is defective • Incorrect cam clearance • Worn camshaft • Broken valve spring • Defective valve shim
Heavy and dull clank	Oil pressure is low.	• Worn crankshaft bearing • Worn connecting rod bearing
	Oil pressure is normal.	• Loosened flywheel mounting bolt • Damaged engine mounting
High-pitched clank	Sound is noticeable when accelerating with an overload condition.	• Ignition timing advanced • Accumulation of carbon inside combustion chamber • Wrong heat range of spark plug • Improper octane value gasoline
Clank noise when engine speed is between 1,000 and 2,000 r/min	Sound is reduced when the fuel injector connector of the noisy cylinder is disconnected.*	• Worn crankshaft bearing • Worn connecting rod bearing
Knocking sound when engine is operating under idling speed and engine is warm	Sound is reduced when the fuel injector connector of the noisy cylinder is disconnected.*	• Worn cylinder liner and piston ring • Broken or stuck piston ring • Worn piston pin and piton pin hole of piston
	Sound is not reduced if each fuel injector connector is disconnected in turn.*	• Unusually worn valve rocker • Unusually worn valve shim • Worn cam sprocket • Worn journal of cam carrier and camshaft cap
Squeaky sound	—	• Insufficient generator lubrication
Rubbing sound	—	• Poor contact of generator brush and rotor
Gear scream when starting engine	—	• Defective ignition starter switch • Worn gear and starter pinion
Sound like polishing glass with a dry cloth	—	• Defective V-belt tensioner assembly (loose V-belt) • Defective water pump shaft
Hissing sound	—	• Insufficient compression • Air leakage in air intake system, hose, connection or manifold
Timing chain noise	—	• Loose timing chain • Timing chain contacting with adjacent part
Valve noise	—	• Incorrect cam clearance

* When disconnecting the fuel injector connector, the malfunction indicator light illuminates and DTC is stored in ECM memory. Therefore, perform the Clear Memory Mode <Ref. to EN(H4DO w/o HEV)(diag)-65, OPERATION, Clear Memory Mode.> <Ref. to EN(H4DO HEV)(diag)-66, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DO w/o HEV)(diag)-50, PROCEDURE, Inspection Mode.> <Ref. to EN(H4DO HEV)(diag)-52, PROCEDURE, Inspection Mode.> after connecting the fuel injector connector.

EXHAUST

EX(H4DO(w/o HEV))

Page

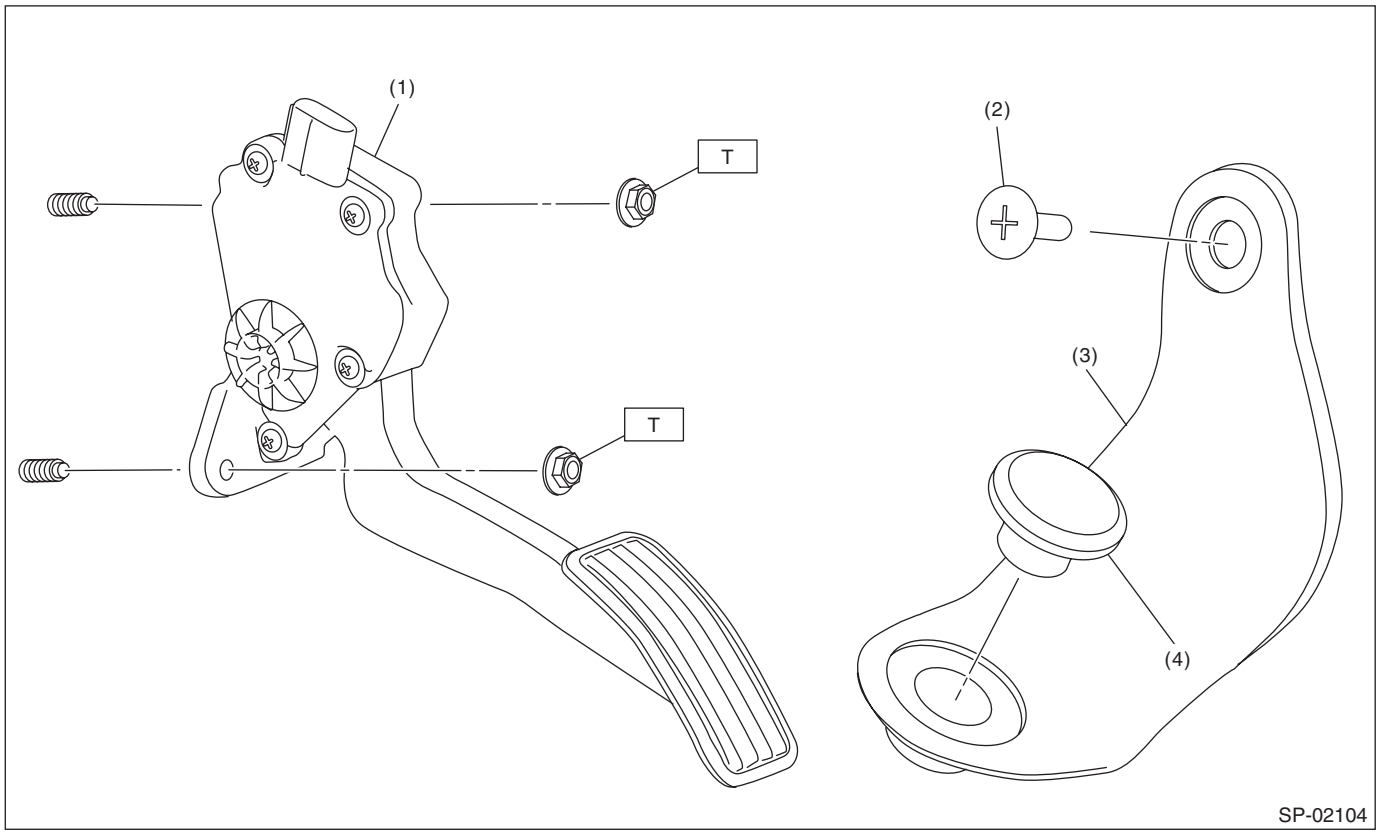
1. General Description 2
2. Front Exhaust Pipe 6
3. Center Exhaust Pipe 14
4. Rear Exhaust Pipe 18
5. Muffler 22

1. General Description

A: SPECIFICATION

Accelerator pedal	Stroke	At pedal pad	50 — 59 mm (1.97 — 2.32 in)

B: COMPONENT



(1) Accelerator pedal ASSY
(2) Clip
(3) Accelerator plate
(4) Accelerator stopper

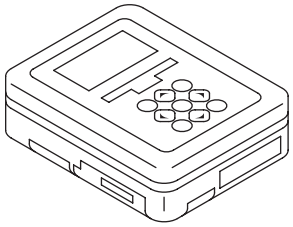
Tightening torque: N·m (kgf-m, ft-lb)
T: 7.5 (0.8, 5.5)

C: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a work cap, and protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.

D: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for setting of each function and trouble-shooting for electrical system. NOTE: For detailed operation procedures of Subaru Select Monitor III, refer to “PC application help for Subaru Select Monitor”.

2. GENERAL TOOL

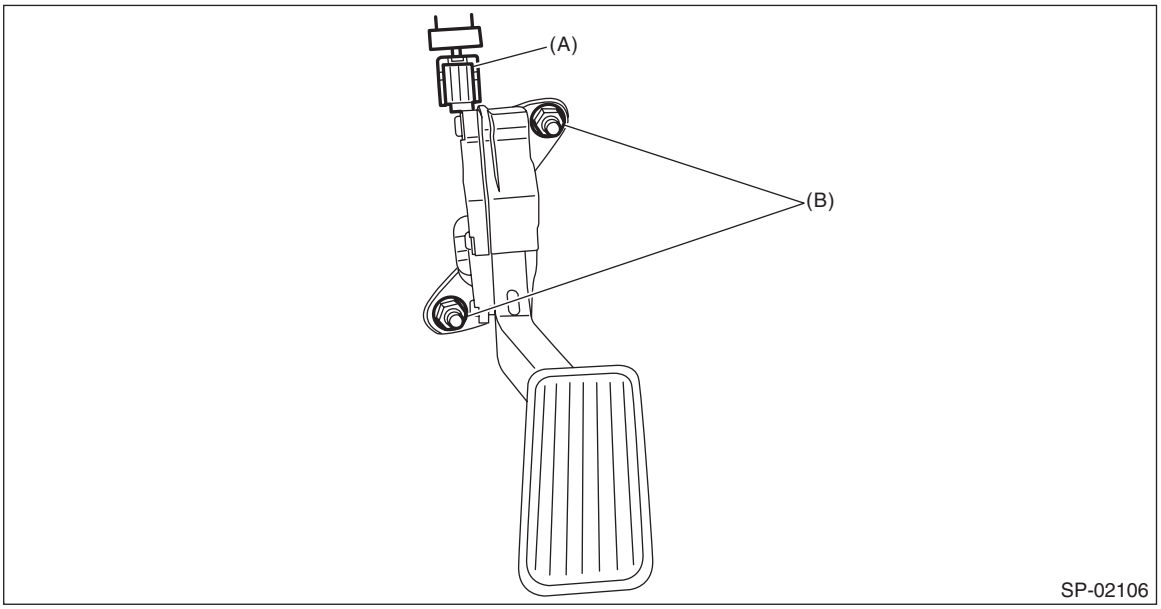
TOOL NAME	REMARKS
Circuit tester	Used for measuring voltage.

2. Accelerator Pedal

A: REMOVAL

1) Disconnect the ground cable from battery. <Ref. to NT-5, BATTERY, NOTE, Note.>

NOTE:
For the 12 volt engine restart battery of HEV model, disconnect the ground terminal from 12V engine restart battery sensor.
2) Disconnect the connector (A).
3) Remove the nut (B) securing accelerator pedal assembly, and remove the accelerator pedal assembly.



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

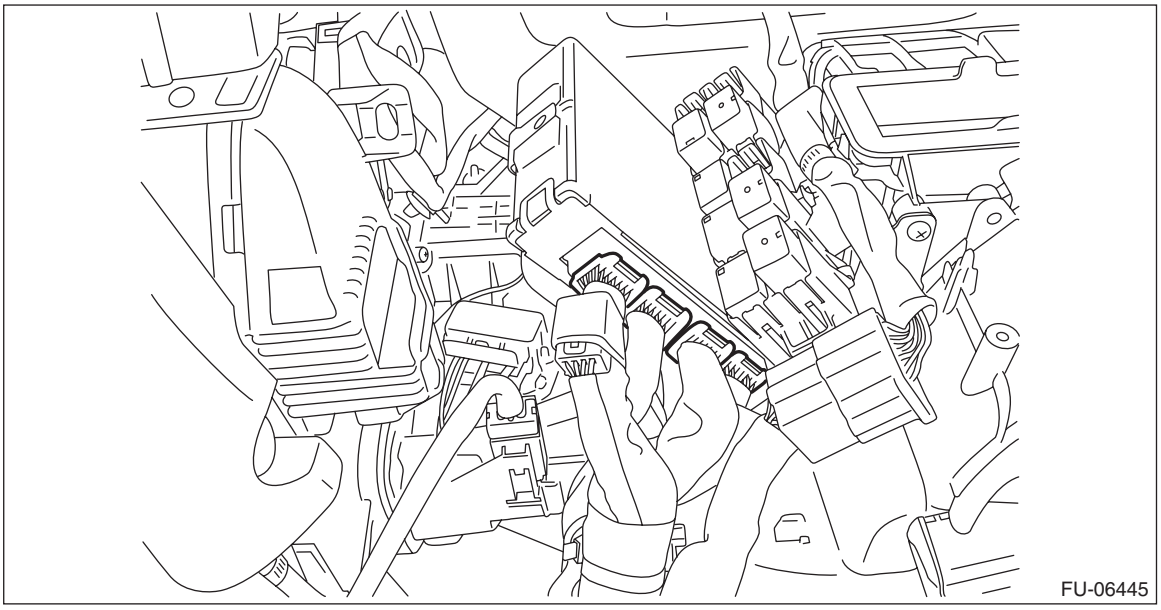
C: DISASSEMBLY

NOTE:
The accelerator pedal cannot be disassembled.

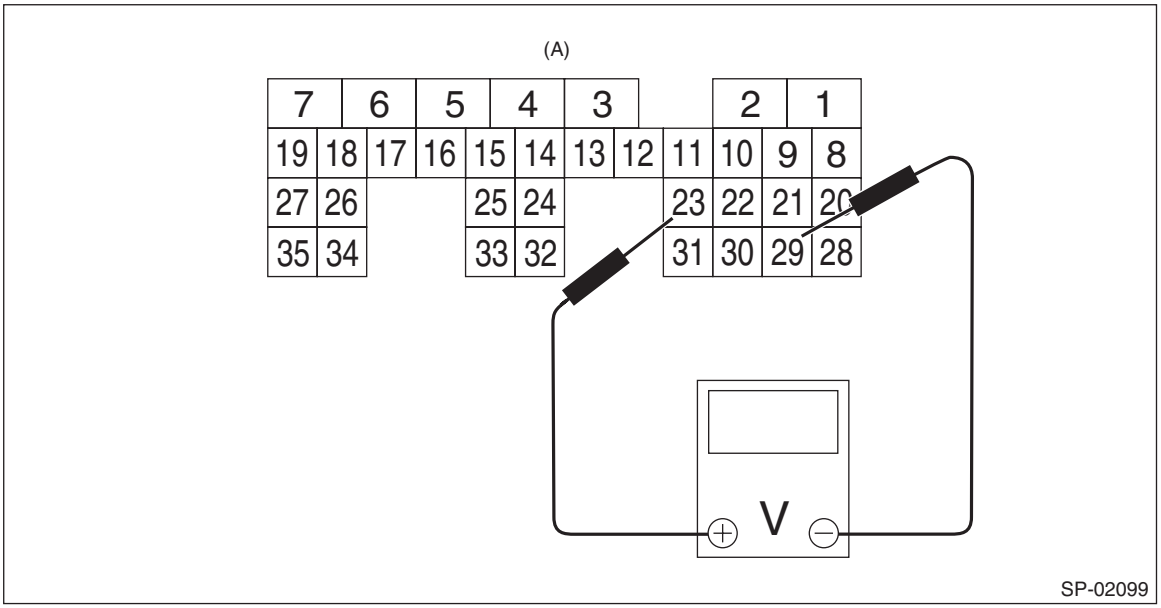
D: INSPECTION

1. CHECK ACCELERATOR PEDAL SENSOR AREA (METHOD WITH CIRCUIT TESTER)

1) Remove the glove box. <Ref. to EI-78, REMOVAL, Glove Box.>
2) Turn the ignition switch to ON. (engine OFF)
3) Measure the voltage between ECM connector terminals.

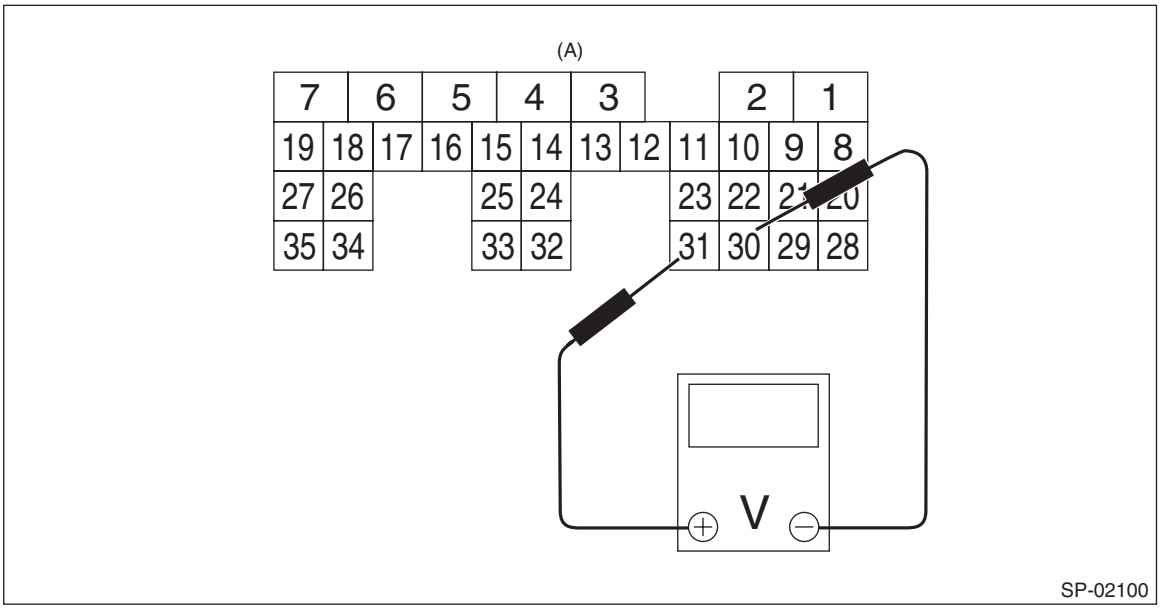

FU-06445

Main sensor side



SP-02099

Sub sensor side



(A) To ECM connector

Accelerator pedal sensor	Accelerator pedal	Terminal No.	Standard
Main	Not depressed (full closed)	23 (+) and 29 (–)	0.4 — 1.0 V
	Depressed (full opened)		2.4 — 3.7 V
Sub	Not depressed (full closed)	31 (+) and 30 (–)	0.3 — 1.1 V
	Depressed (full opened)		2.3 — 3.8 V

4) After inspection, install the related parts in the reverse order of removal.

2. CHECK ACCELERATOR PEDAL SENSOR AREA (METHOD WITH SUBARU SELECT MONITOR)

1) Turn the ignition switch to ON. (engine OFF)
2) Read the accelerator pedal opening angle signal and voltage of accelerator pedal sensor using Subaru Select Monitor. <Ref. to EN(H4DO w/o HEV)(diag)-37, DISPLAY ENGINE CURRENT DATA, OPERATION, Subaru Select Monitor.> <Ref. to EN(H4DO HEV)(diag)-36, DISPLAY CURRENT ENGINE DATA, OPERATION, Subaru Select Monitor.>

Accelerator pedal sensor	Accelerator pedal opening angle signal	Standard
Main	0.0%	0.4 — 1.0 V
	100.0%	2.4 — 3.7 V
Sub	0.0%	0.3 — 1.1 V
	100.0%	2.3 — 3.8 V

3. OTHER INSPECTIONS

1) Check that the accelerator pedal does not have deformation, cracks or damage.
2) Check for smooth operation when the accelerator pedal is depressed.
3) Check if the accelerator pedal returns to its original position smoothly when the pedal is released.

IGNITION

IG(H4DO(w/o HEV))

Page

1. General Description 2
2. Spark Plug 4
3. Ignition Coil 12

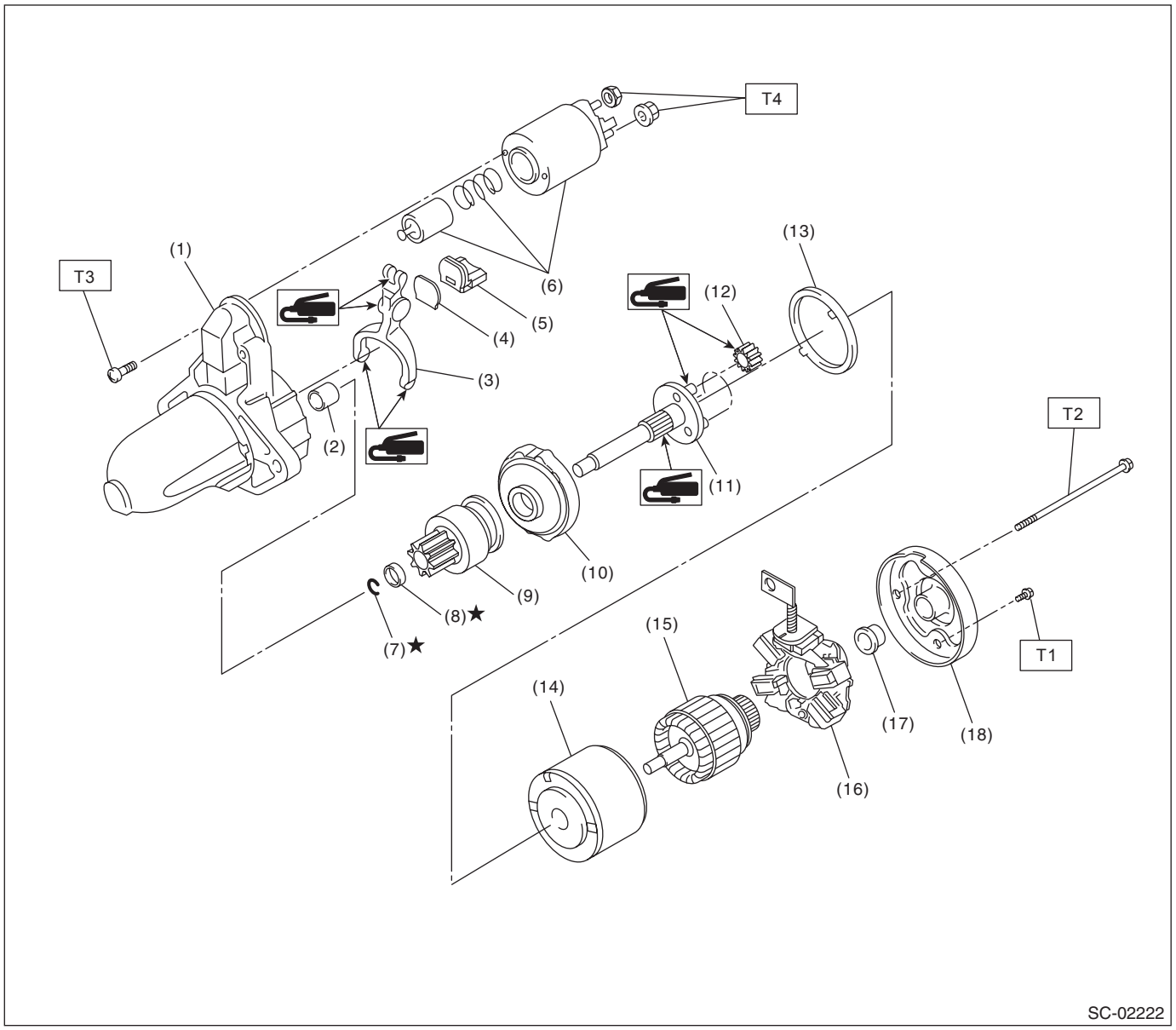
1. General Description

A: SPECIFICATION

Item			Specifications	
Vehicle model			CVT	MT
Starter	Type		Reduction type	
	Model		M000T38571	M000T33176
	Manufacturer		Mitsubishi Electric	
	Voltage and output		12 V — 1.2 kW	12 V — 1.0 kW
	Direction of rotation		Counterclockwise (when observed from pinion)	
	Number of pinion teeth		9	8
	Armature commutator runout	Standard	0.05 mm (0.0020 in)	
		Limit	0.10 mm (0.0039 in)	
	Armature depth of segment mold	Standard	0.50 mm (0.020 in)	
	Brush length	Standard	12.3 mm (0.484 in)	
		Limit	7.0 mm (0.276 in)	
	Brush spring force	Standard	15.9 — 19.5 N (1.62 — 1.99 kgf, 3.57 — 4.38 lbf)	
		Limit	2.5 N (0.25 kgf, 0.56 lbf)	
	No-load characteristics	Voltage	11 V	
		Current	90 A or less	95 A or less
		Rotating speed	2,370 r/min or more	2,500 r/min or more
	Load characteristics	Voltage	7.5 V	7.5 V
		Current	300 A	300 A
		Torque	10.65 N·m (1.1 kgf-m, 7.8 ft-lb) or more	8.84 N·m (0.9 kgf-m, 6.5 ft-lb) or more
		Rotating speed	840 r/min or more	870 r/min or more
	Lock characteristics	Voltage	4 V	4 V
		Current	780 A or less	680 A or less
		Torque	20 N·m (2.0 kgf-m, 14.8 ft-lb) or more	17 N·m (1.7 kgf-m, 12.5 ft-lb) or more
Generator	Type		Rotating-field three-phase type, voltage regulator built-in type, with load response control system	
	Model		A2TX5081	
	Manufacturer		Mitsubishi Electric	
	Voltage and output		12 V — 130 A	
	Polarity on ground side		Negative	
	Direction of rotation		Clockwise (when observed from pulley side)	
	Stator connection		3-phase △ type	
	Output current		1,500 r/min — 50 A or more 2,500 r/min — 111 A or more 5,000 r/min — 133 A or more	
	Regulated voltage		14.1 — 14.8 V [20°C (68°F)]	
	Rotor slip ring outer diameter	Standard	22.7 mm (0.894 in)	
		Limit	22.1 mm (0.870 in)	
	Brush length	Standard	22.5 mm (0.886 in)	
		Limit	5.0 mm (0.197 in)	
Battery	Type and capacity		12 V — 48 AH (55D 23L)	
	CCA		390 A	

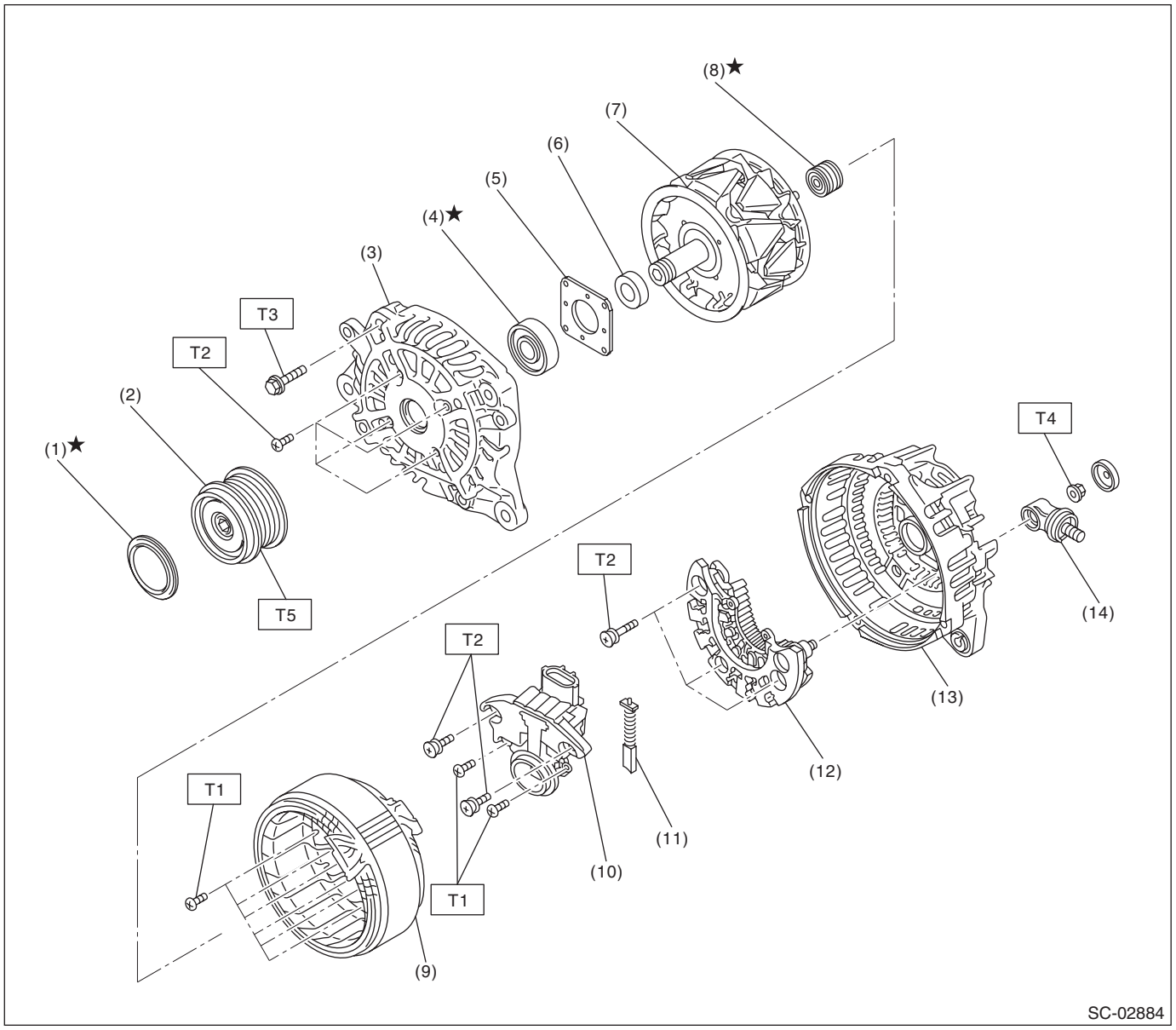
B: COMPONENT

1. STARTER



(1)	Starter housing ASSY	(9)	Overrunning clutch	(17)	Sleeve bearing
(2)	Sleeve bearing	(10)	Internal gear ASSY	(18)	Starter cover ASSY
(3)	Shift lever	(11)	Shaft		
(4)	Plate	(12)	Pinion gear	***Tightening torque: N·m (kgf-m, ft-lb)***	
(5)	Seal rubber	(13)	Seal rubber	***T1:***	***1.4 (0.1, 1.0)***
(6)	Magnet switch ASSY	(14)	Yoke ASSY	***T2:***	***6 (0.6, 4.4)***
(7)	Snap ring	(15)	Armature ASSY	***T3:***	***7.5 (0.8, 5.5)***
(8)	Stopper	(16)	Brush holder ASSY	***T4:***	***10 (1.0, 7.4)***

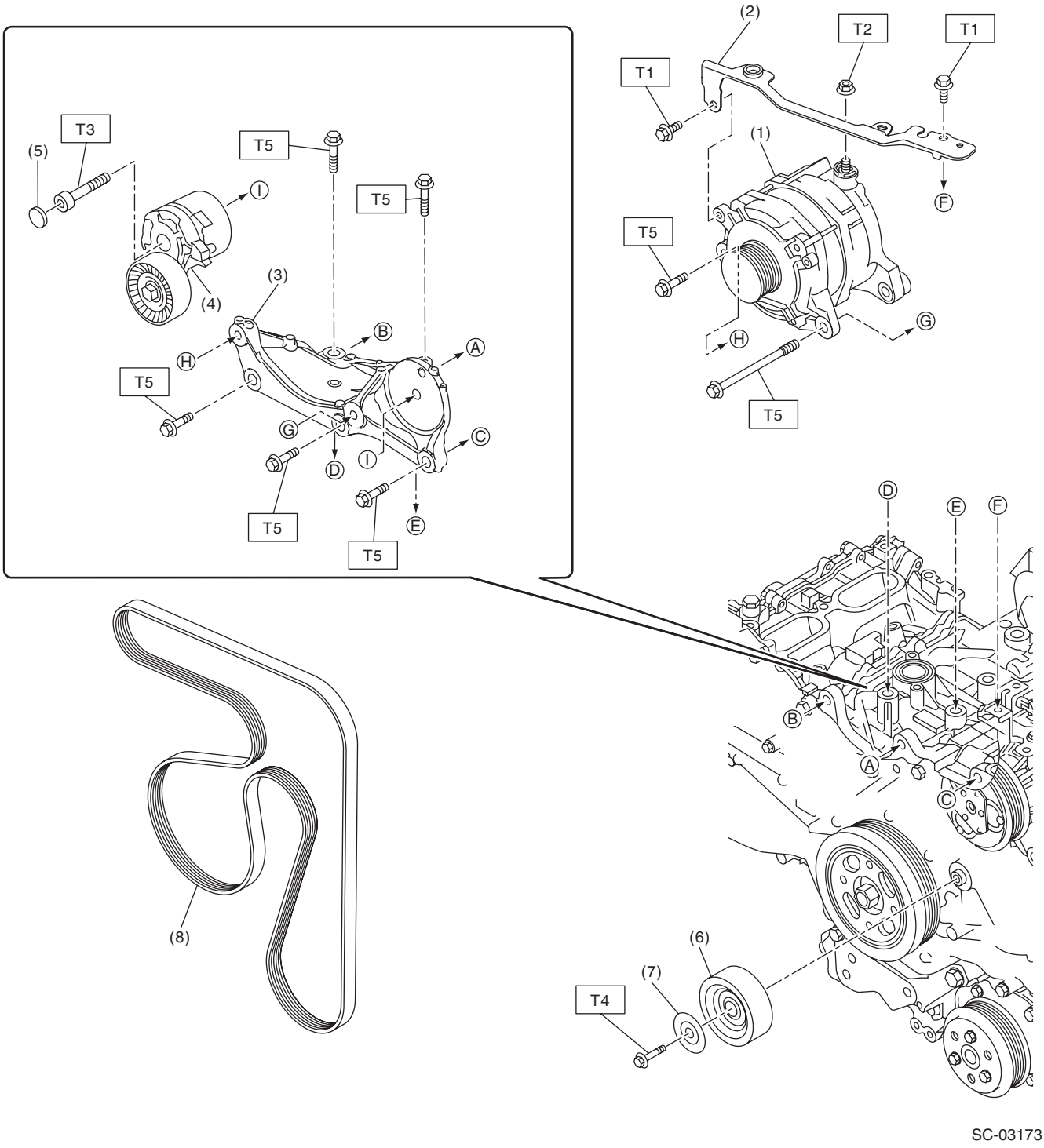
2. GENERATOR



(1)	Cap	(8)	Bearing
(2)	Pulley	(9)	Stator coil
(3)	Front cover	(10)	IC regulator
(4)	Ball bearing	(11)	Brush
(5)	Bearing retainer	(12)	Rectifier
(6)	Spacer	(13)	Rear cover
(7)	Rotor	(14)	Terminal B

Tightening torque: N·m (kgf-m, ft-lb)
T1: 2 (0.2, 1.5)
T2: 3.9 (0.4, 2.9)
T3: 4.4 (0.4, 3.2)
T4: 8.9 (0.9, 6.6)
T5: 108 (11.0, 79.8)

3. GENERATOR BRACKET

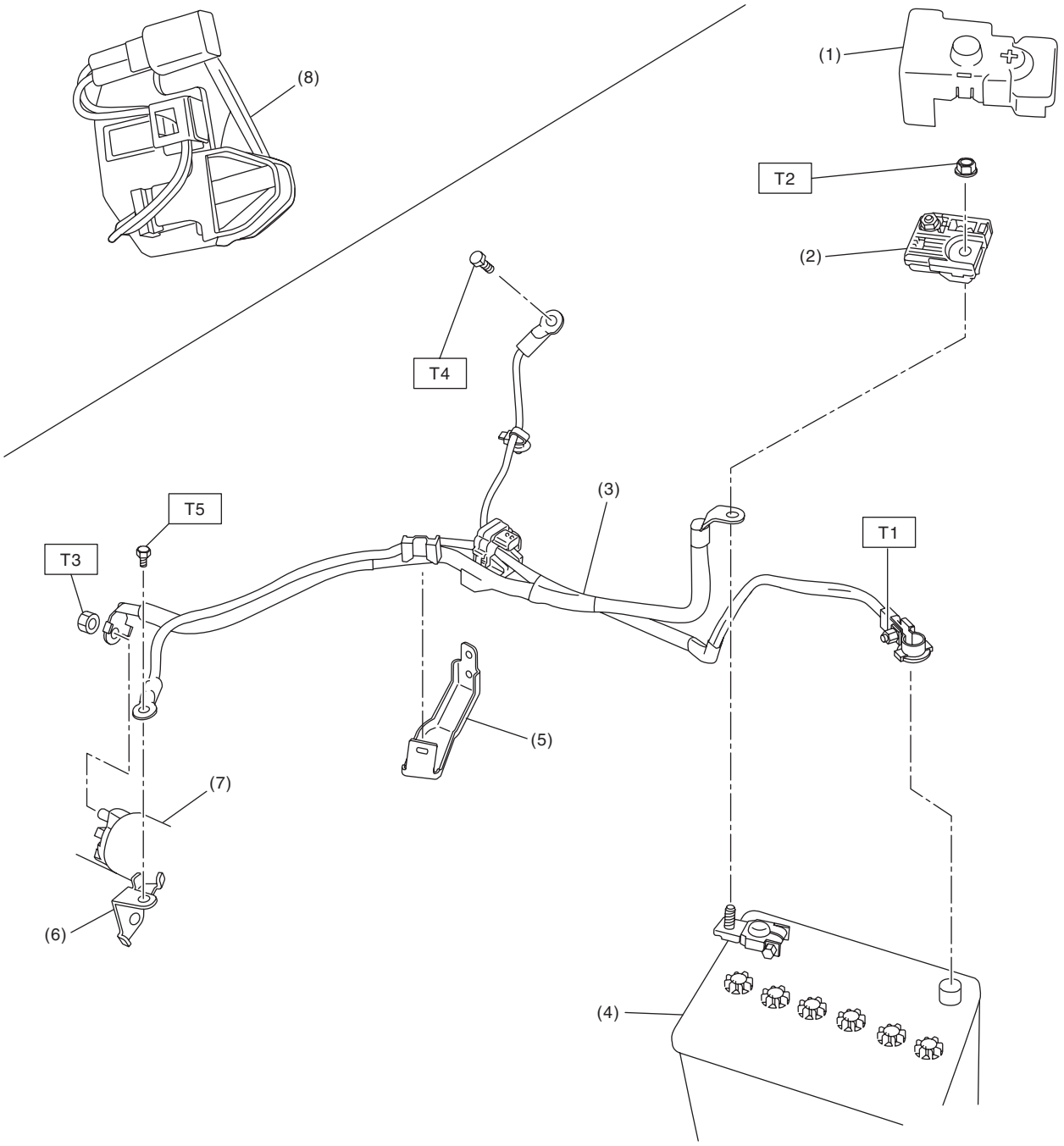


SC-03173

(1) Generator
(2) V-belt cover bracket
(3) Generator bracket
(4) V-belt tensioner ASSY
(5) Cap
(6) Idler pulley
(7) Idler pulley cover
(8) V-belt

Tightening torque: N·m (kgf-m, ft-lb)
T1: 6.4 (0.7, 4.7)
T2: 15 (1.5, 11.1)
T3: 25 (2.5, 18.4)
T4: 36 (3.7, 26.6)
T5: <Ref. to SC(H4DO(w/o HEV))-34, INSTALLATION, Generator.>

4. BATTERY CURRENT & TEMPERATURE SENSOR



SC-02563

(1)	Terminal boot	(7)	Starter
(2)	Terminal fuse ASSY	(8)	Battery temperature sensor
(3)	Battery cable ASSY		
(4)	Battery		
(5)	Battery cable bracket		
(6)	Battery cable stay		

Tightening torque: N·m (kgf-m, ft-lb)
T1: 6 (0.6, 4.4)
T2: 7.5 (0.8, 5.5)
T3: 11 (1.1, 8.1)
T4: 13 (1.3, 9.6)
T5: 14 (1.4, 10.3)

C: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a work cap, and protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.

D: PREPARATION TOOL

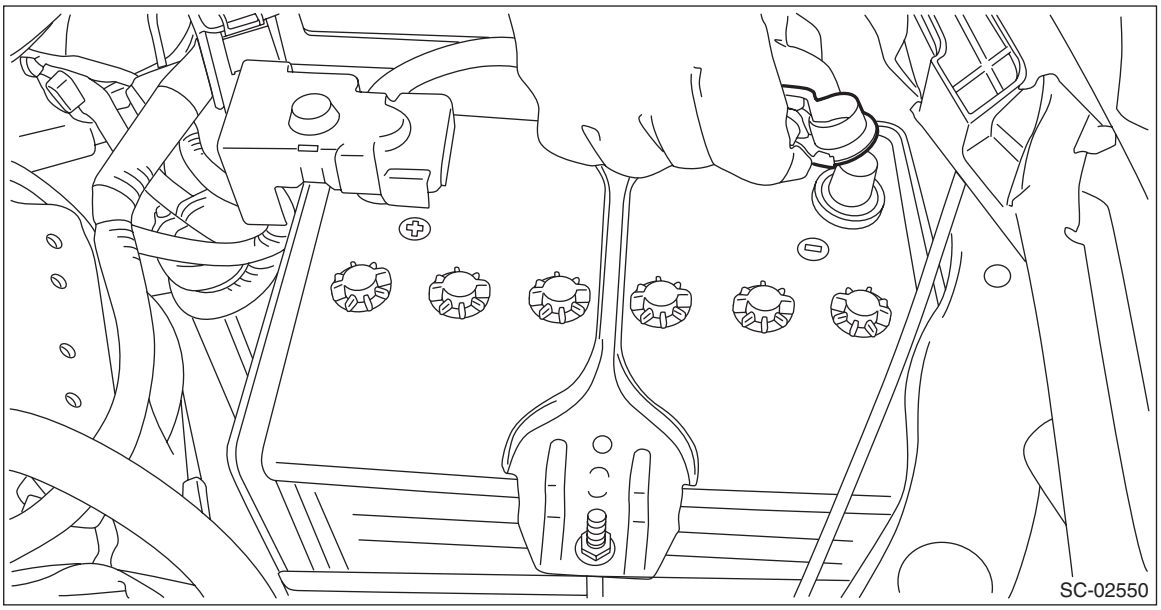
1. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance, voltage and current. NOTE: • For measuring standby current, prepare a circuit tester that can measure by 1 mA unit. • For measuring standby current in the models with keyless access, prepare an analog type circuit tester.

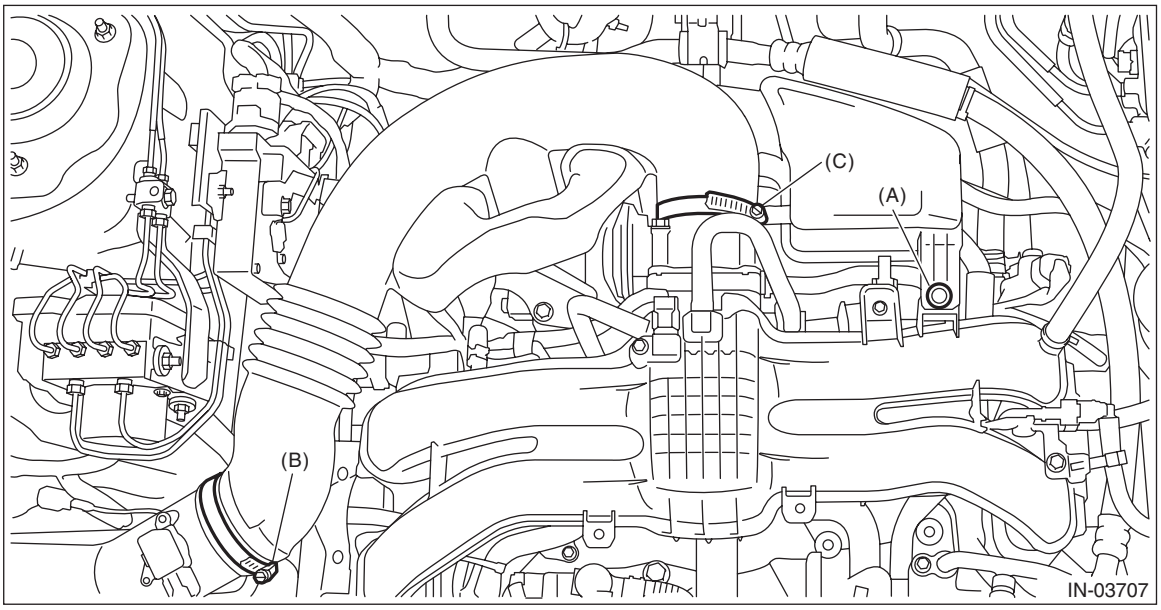
2. Starter

A: REMOVAL

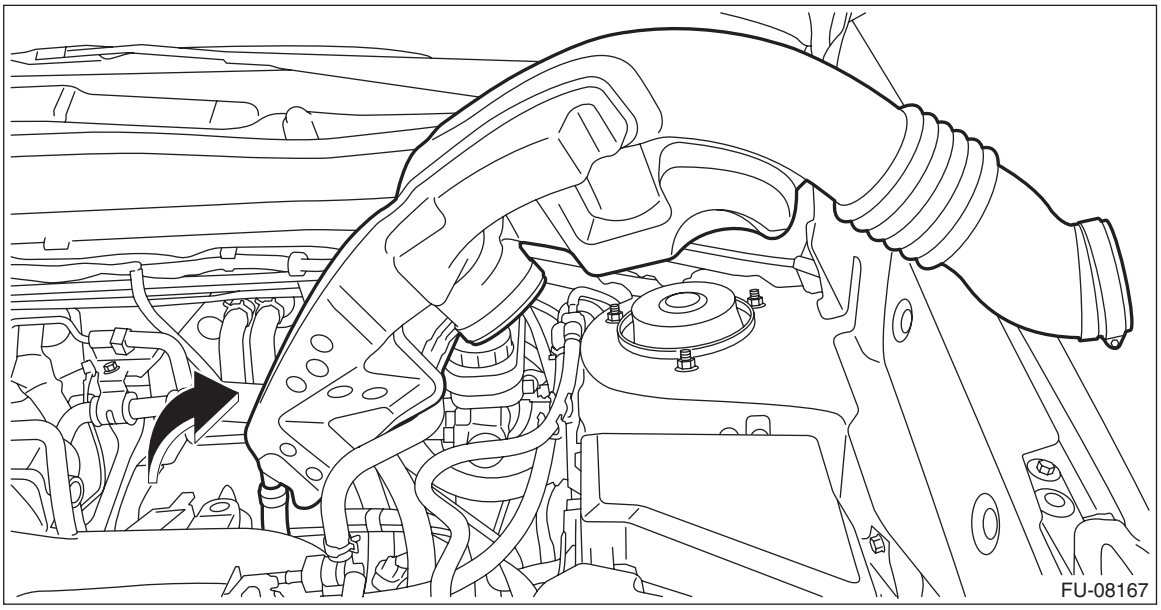
1) Disconnect the ground cable from battery.



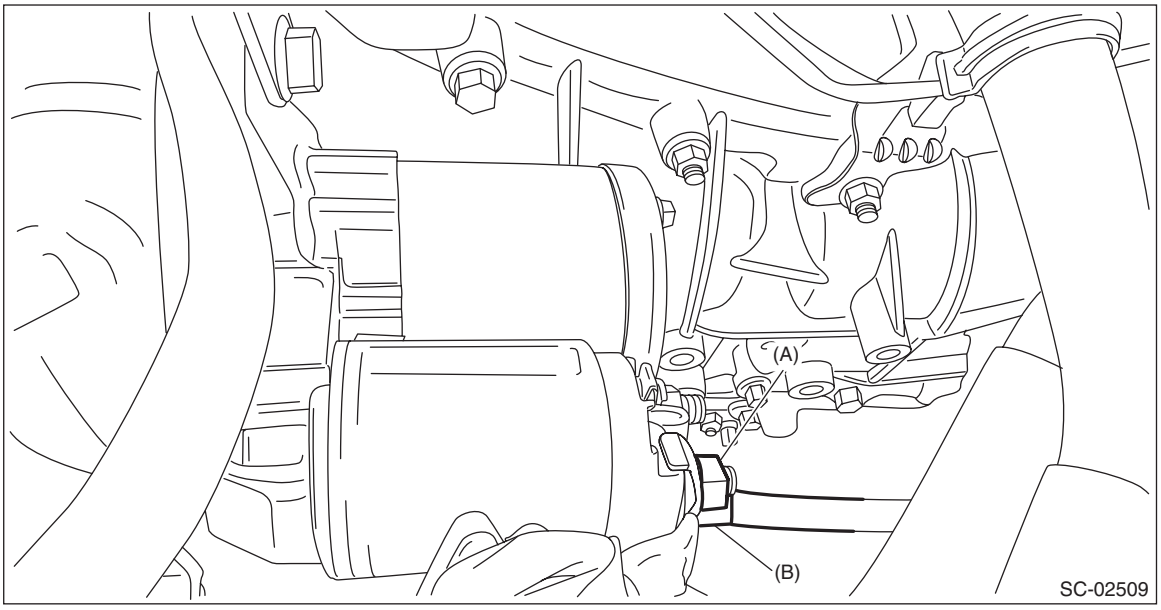
2) Remove the clip (A) from the air intake boot.
3) Loosen the clamp (B) securing the air cleaner case (rear) to the air intake boot.
4) Loosen the clamp (C) which secures the throttle body to the air intake boot.



5) Remove the air intake boot from the throttle body, and move the air intake boot to the left side wheel apron.

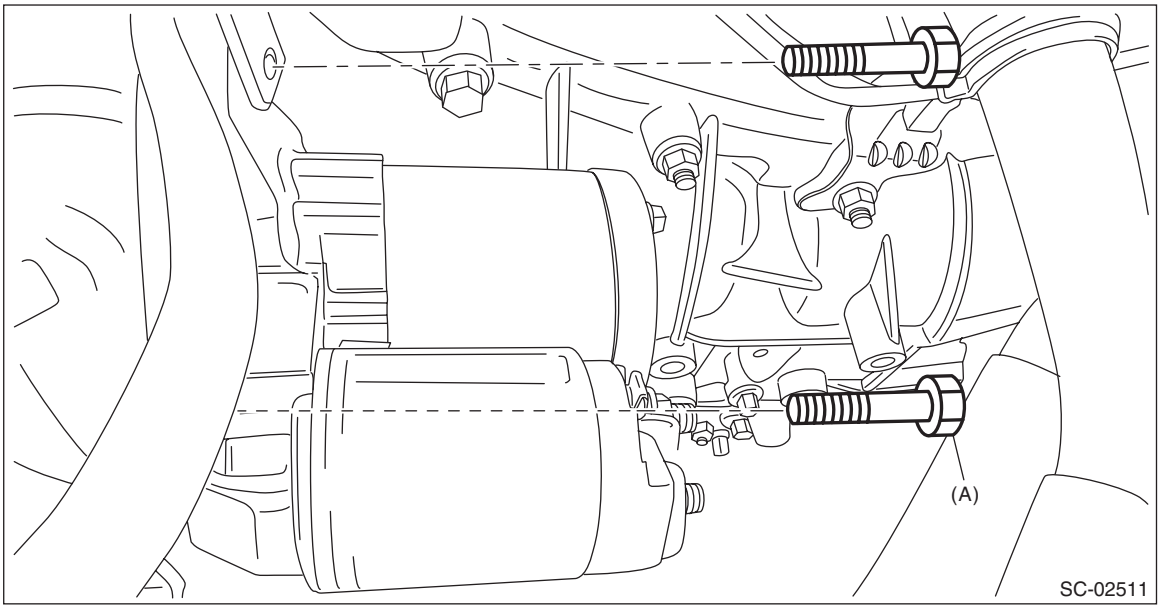


6) Disconnect the connector (B) and terminal (A) from starter.



7) Remove the starter from transmission.

NOTE:
For CVT model, a nut is used at (A).

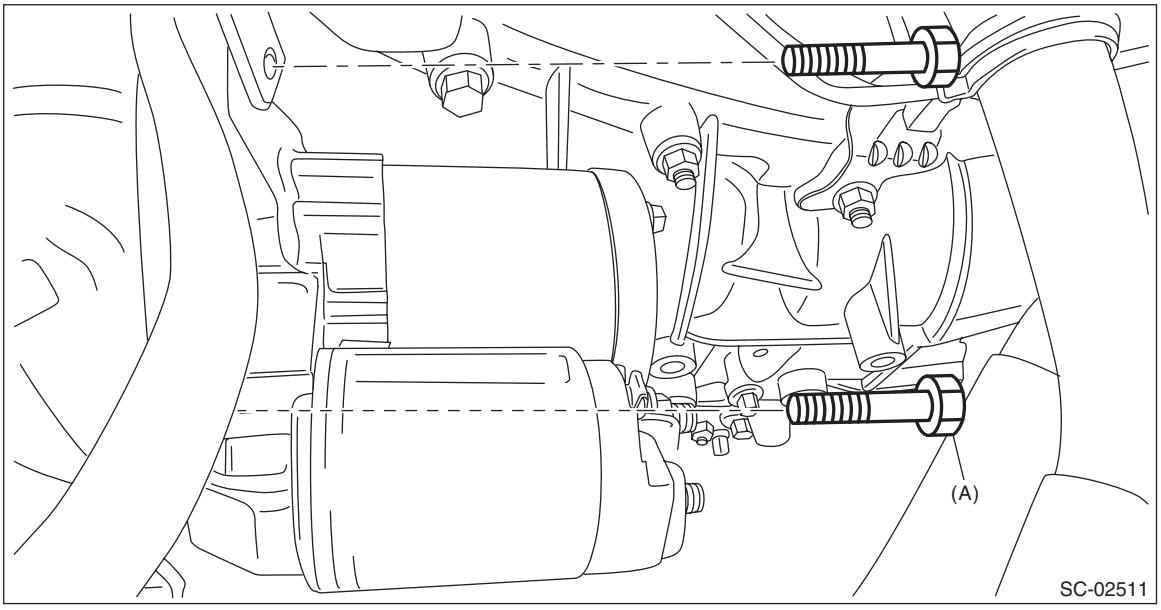


B: INSTALLATION

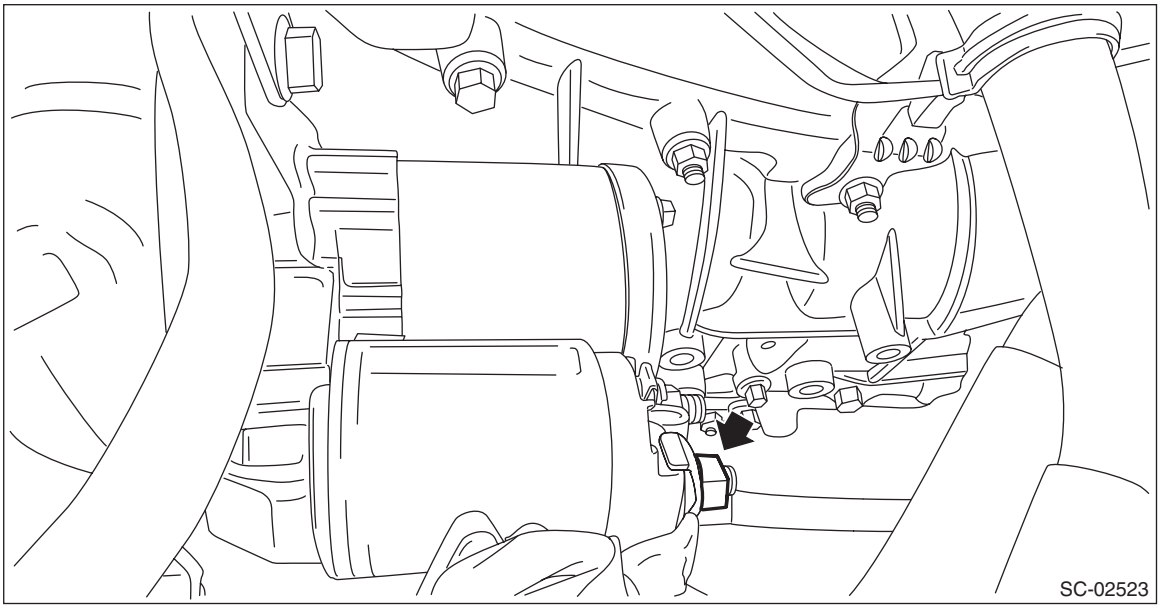
Install in the reverse order of removal.

NOTE:
For CVT model, a nut is used at (A).

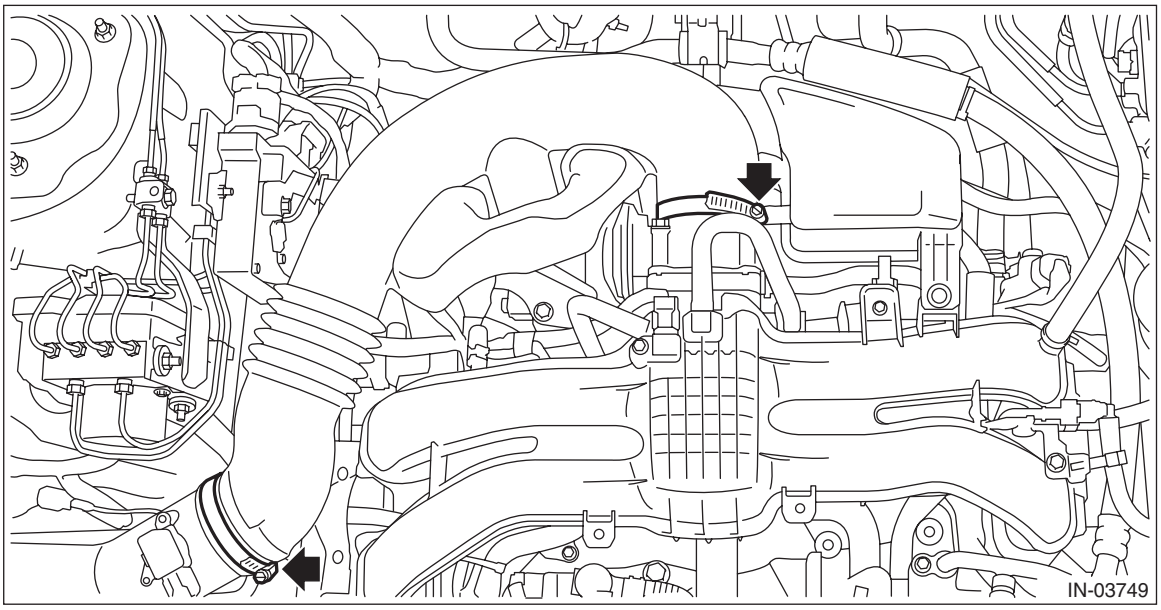
Tightening torque:
50 N·m (5.1 kgf-m, 36.9 ft-lb)



Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)

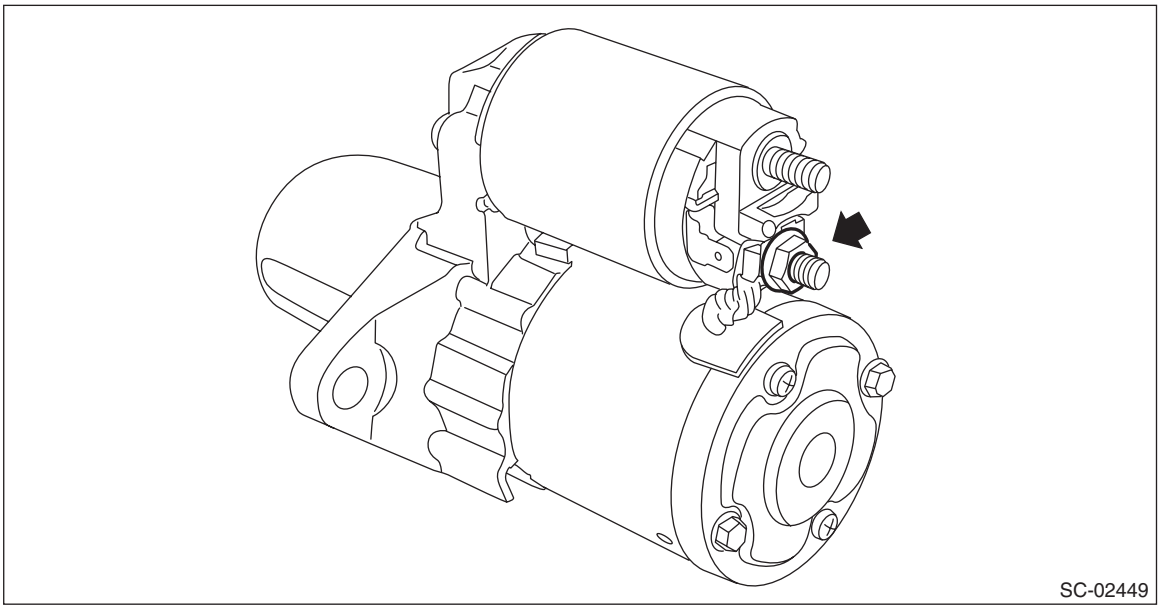


Tightening torque:
3 N·m (0.3 kgf-m, 2.2 ft-lb)

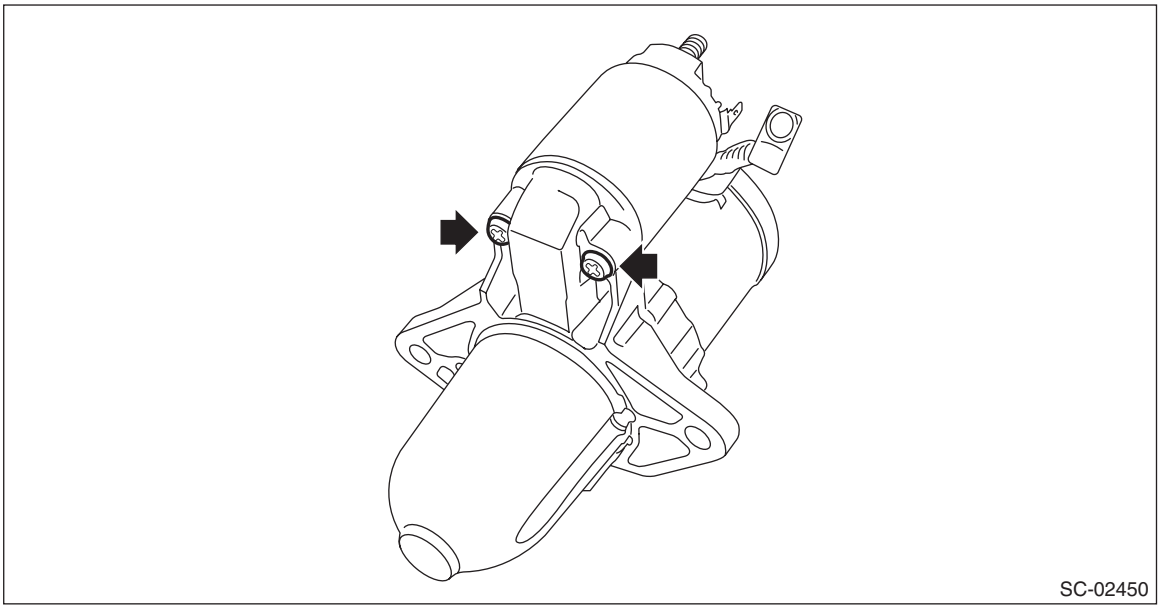


C: DISASSEMBLY

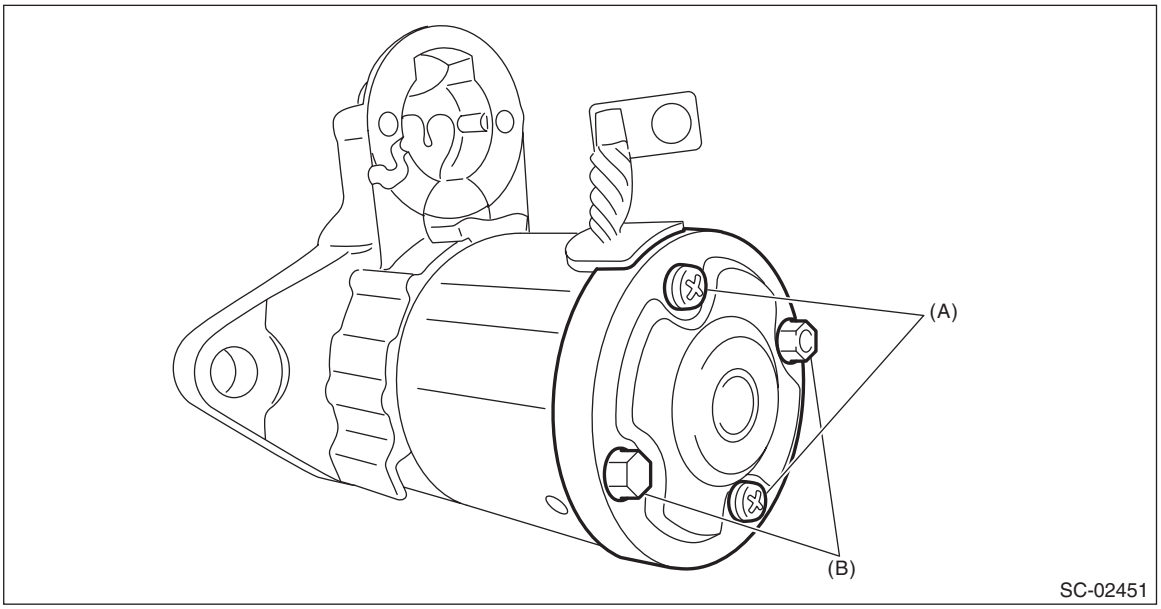
1) Disconnect the terminal M from the magnet switch assembly.



2) Remove the magnet switch assembly from the starter housing assembly.

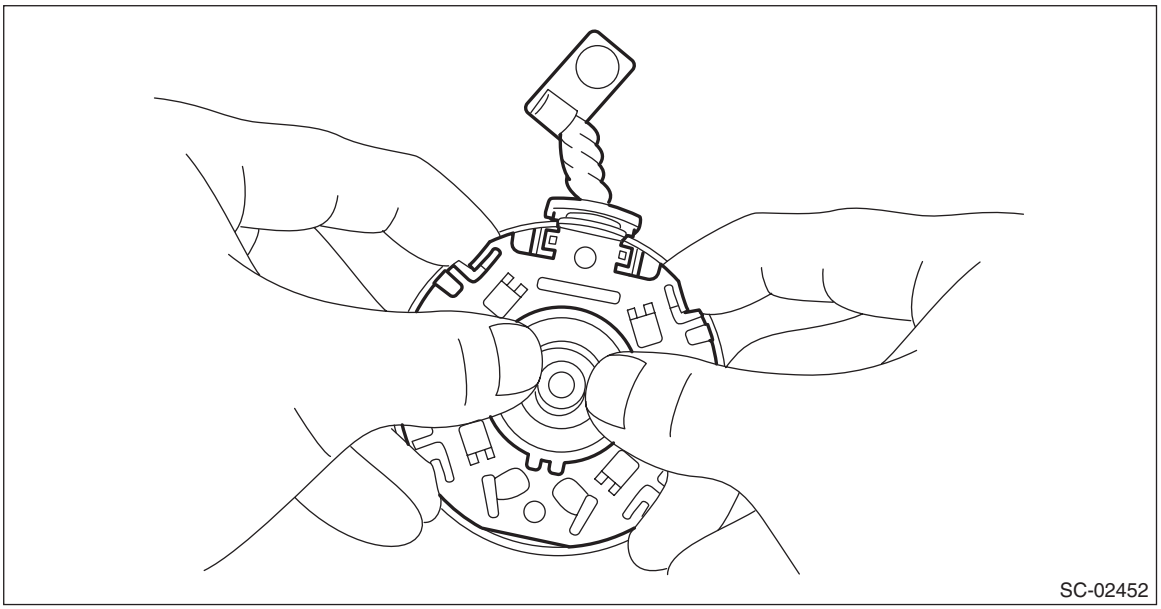


3) Remove screws (A) of the brush holder assembly, and through bolts (B) on both sides, and remove the starter cover assembly.

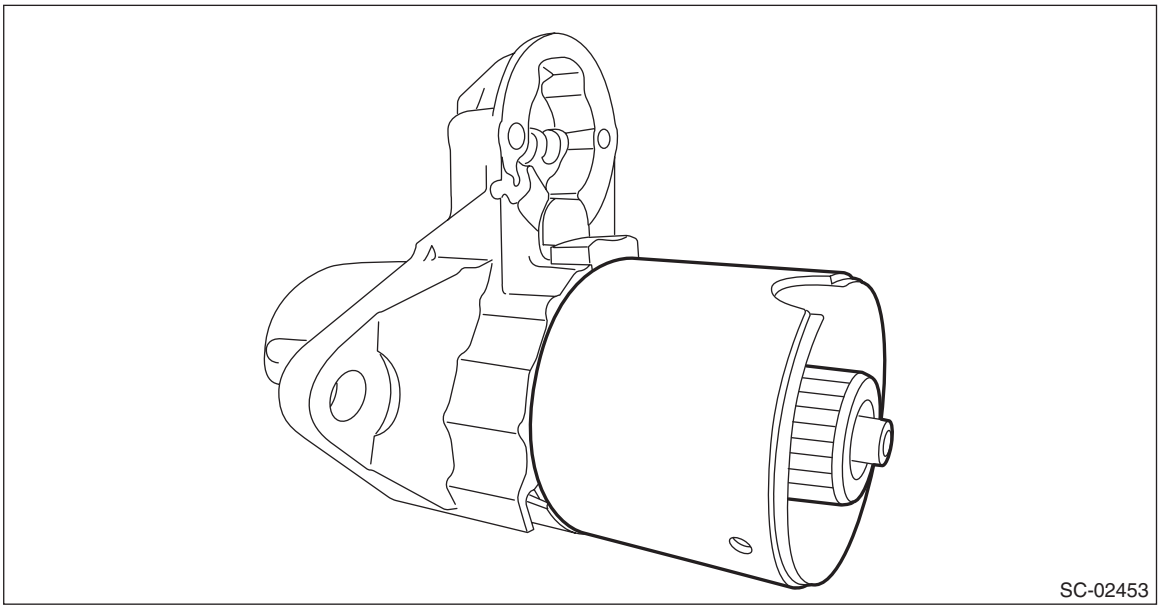


4) Remove the brush holder assembly from the armature assembly.

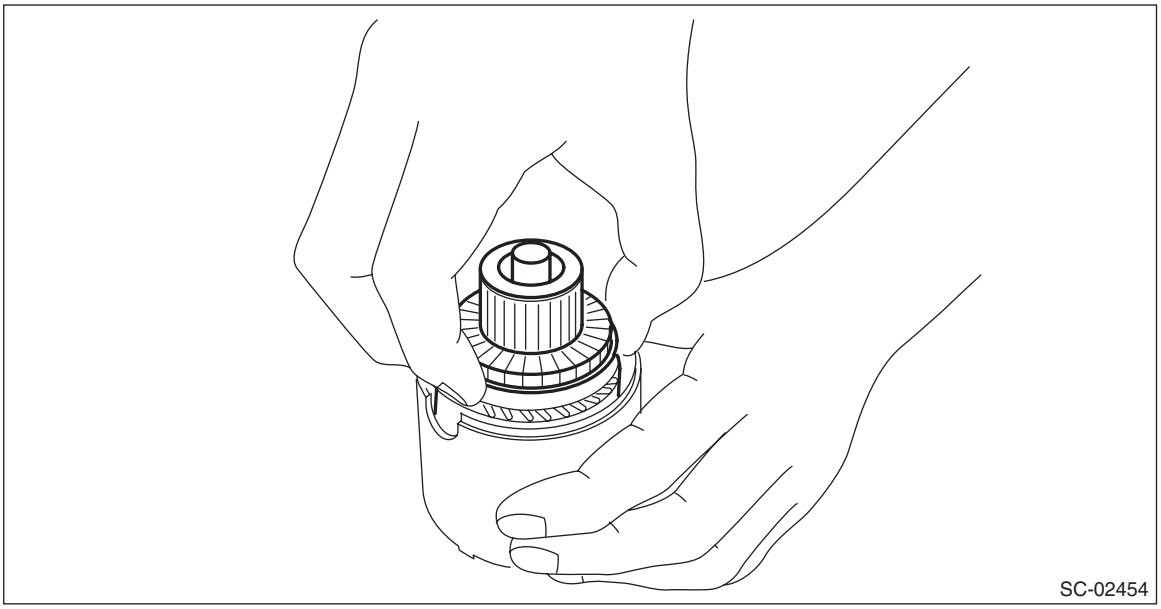
NOTE:
Hold the brush with your fingers so that the brush spring does not come flying out.



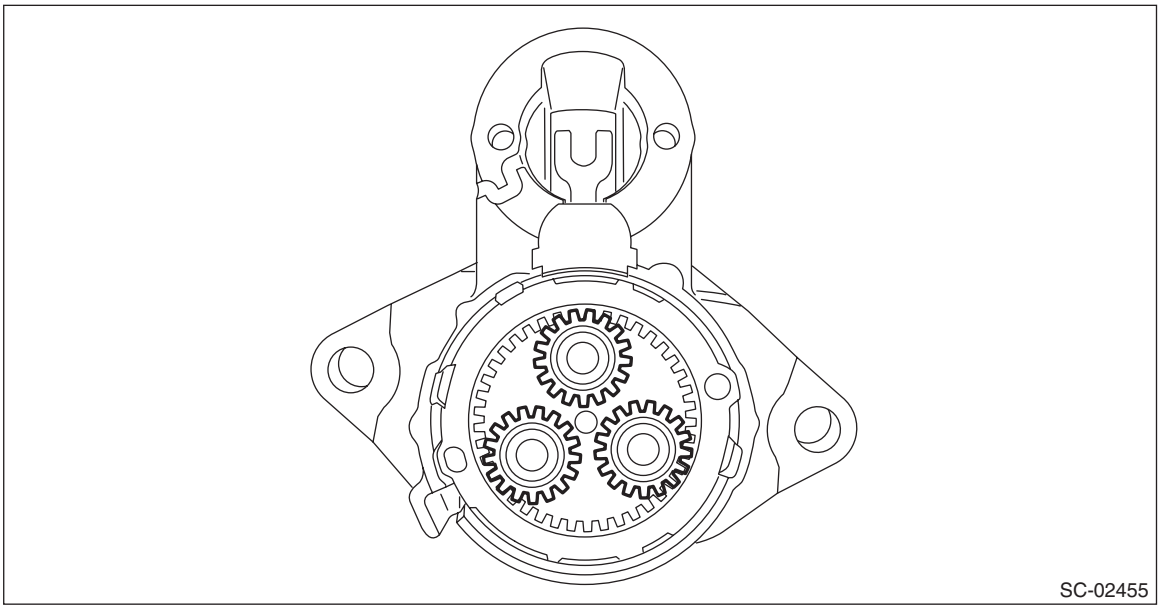
5) Remove the armature assembly and yoke assembly from the starter housing assembly together as a single unit.


SC-02453

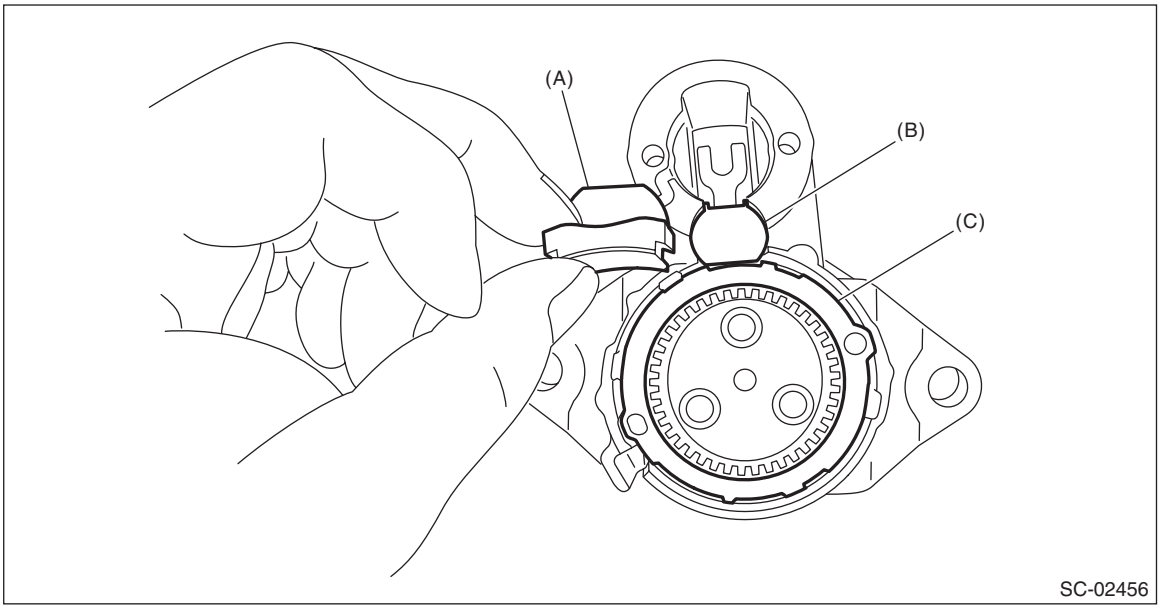
6) Separate the armature assembly and yoke assembly.


SC-02454

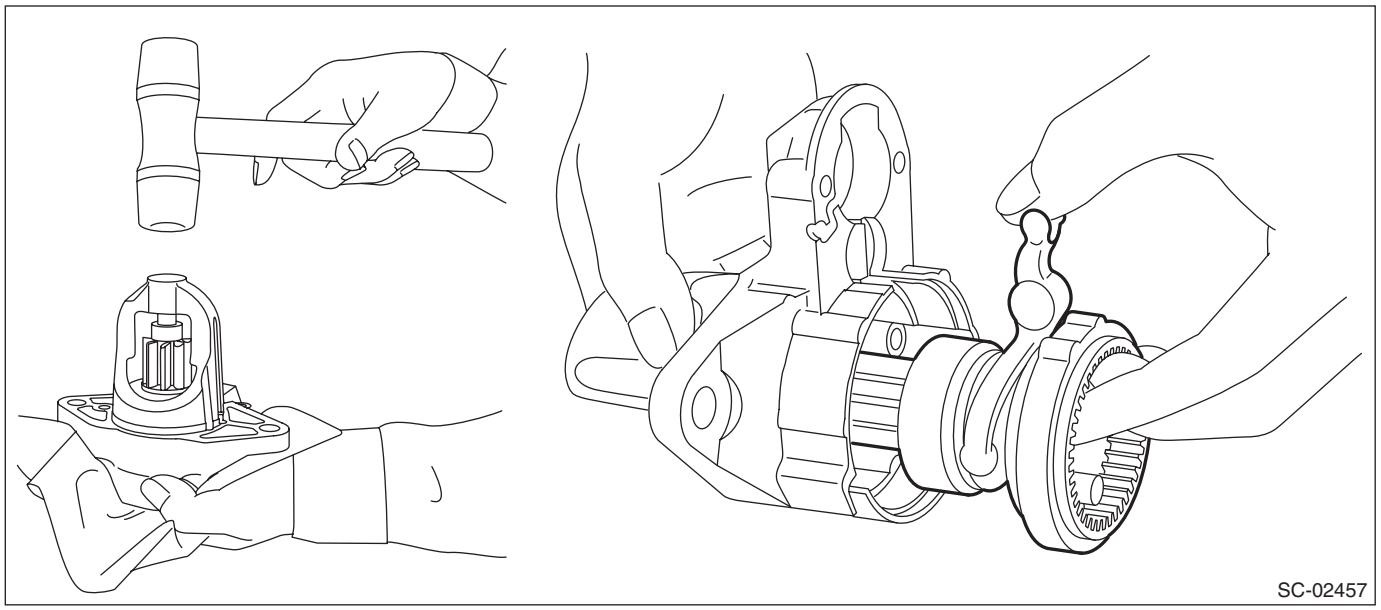
7) Remove the pinion gear from the internal gear assembly.



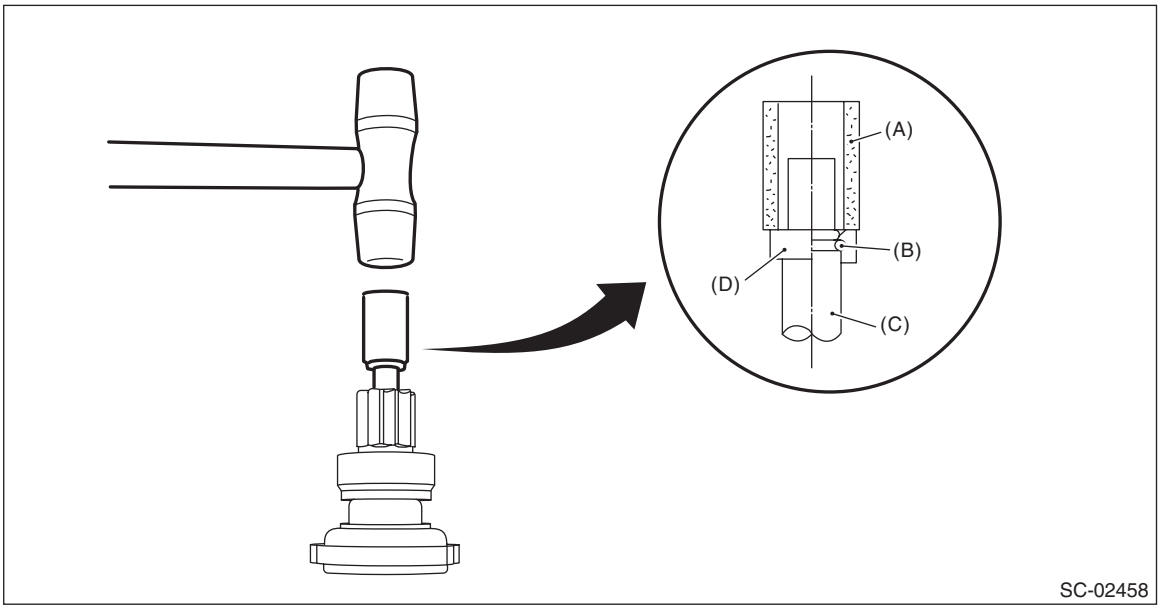
8) Remove seal rubber (A), plate (B), and seal rubber (C).



9) Lightly tap the starter housing assembly with a plastic hammer as shown in the figure, and remove the overrunning clutch, internal gear assembly, shaft and shift lever together as one unit.


SC-02457

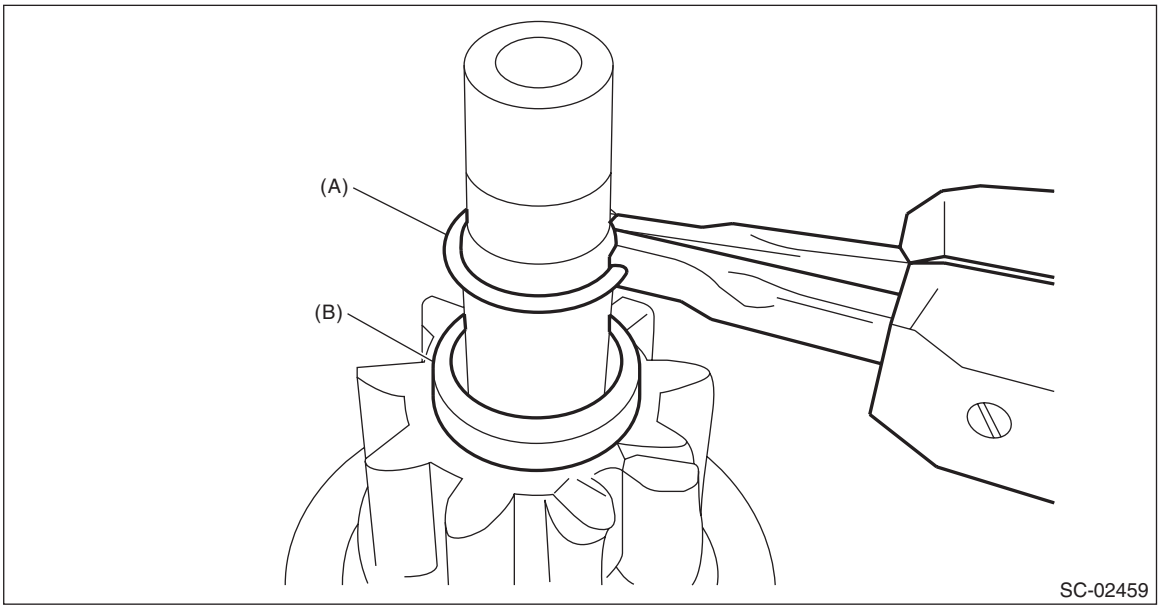
10) Use the following procedures to remove the overrunning clutch from the shaft.
(1) Use an appropriate tool (such as a fit socket wrench), and remove the stopper from snap ring by lightly tapping the stopper with a plastic hammer.



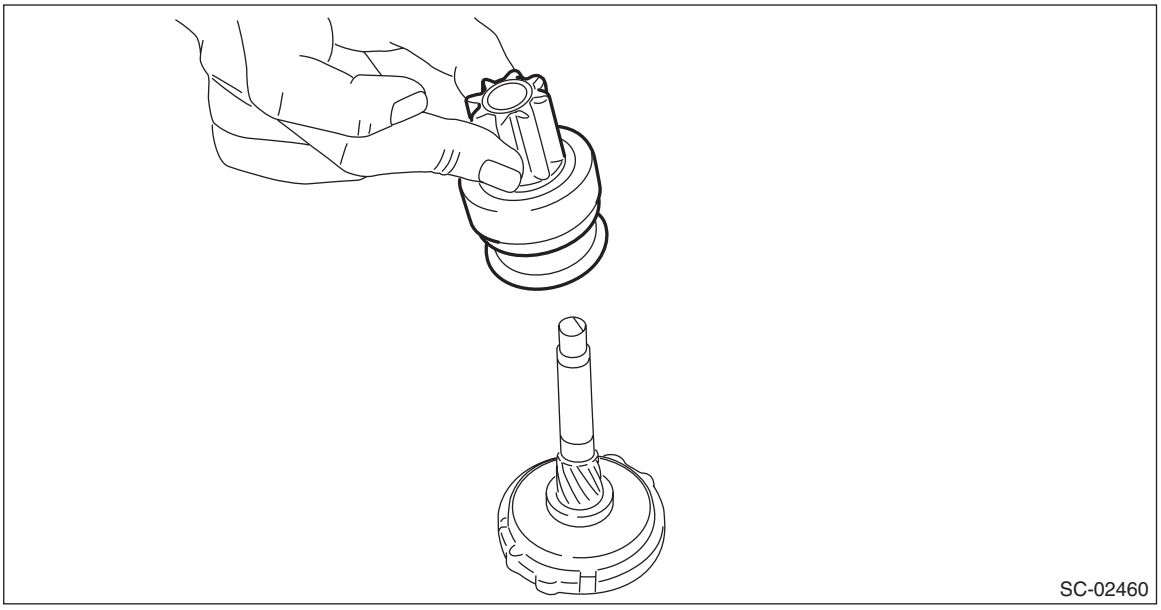
SC-02458

(A) Appropriate tool (B) Snap ring (C) Shaft
(D) Stopper

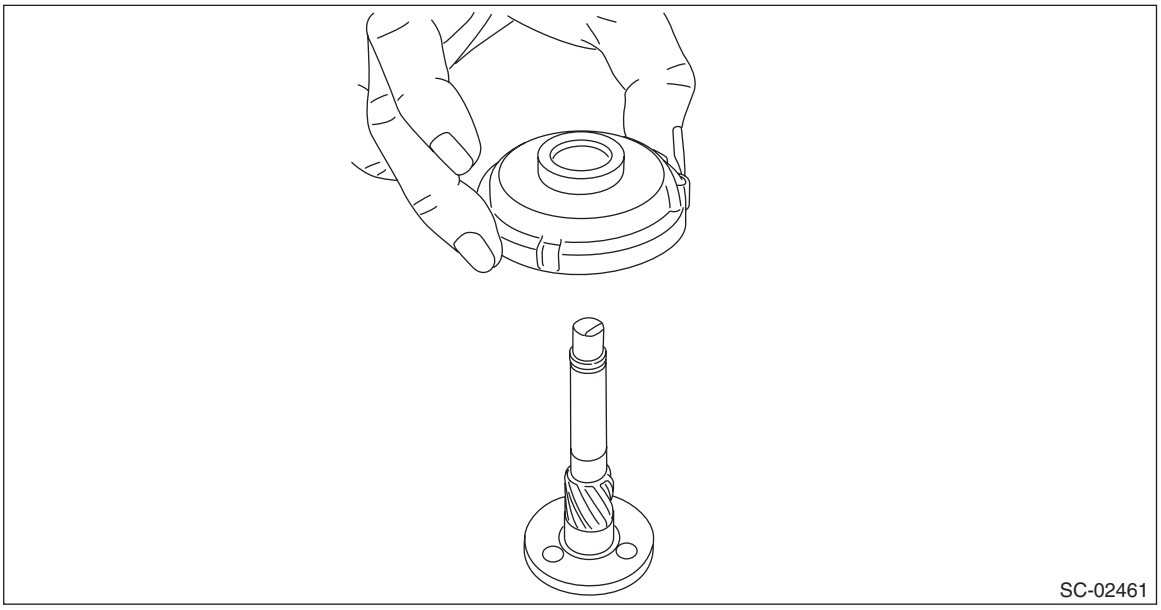
(2) Remove snap ring (A) from the shaft, and remove stopper (B).



(3) Remove the overrunning clutch from the shaft.



11) Separate the internal gear assembly and shaft.

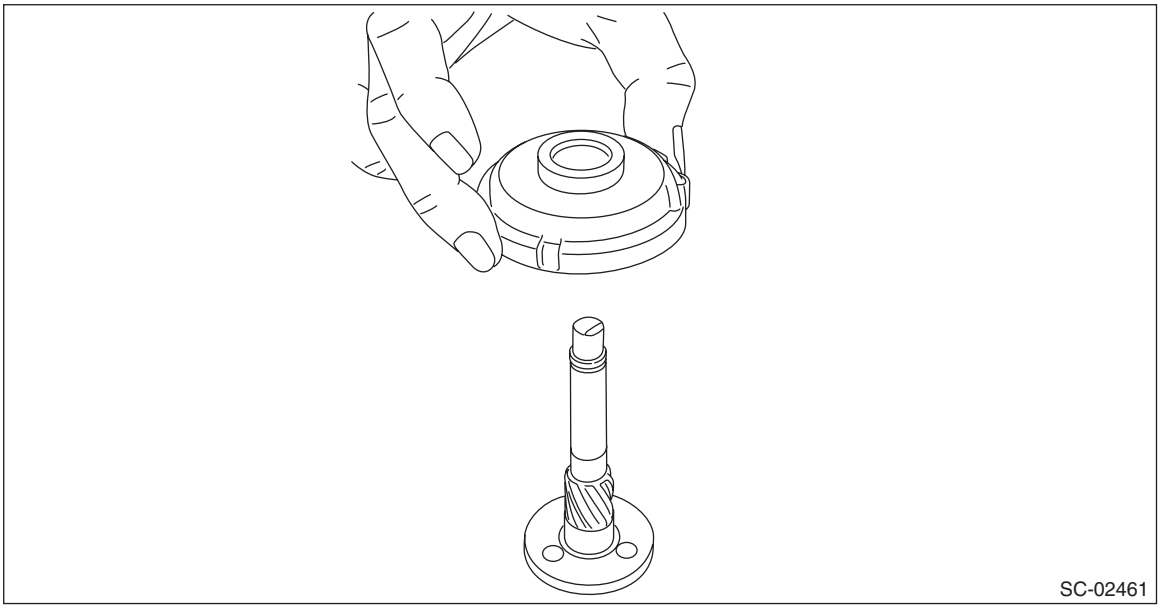


D: ASSEMBLY

1) Apply grease to the shaft sliding surfaces of the internal gear assembly.

Grease:
Multemp #6129 or equivalent

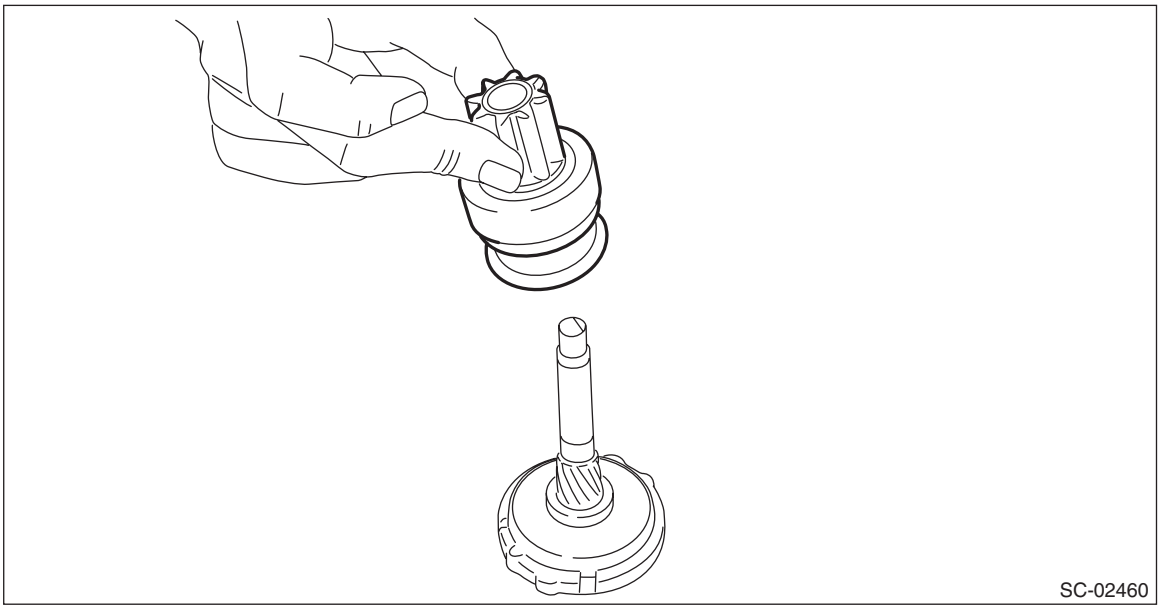
2) Assemble the shaft to the internal gear assembly.



3) Assemble the overrunning clutch as follows:
(1) Apply grease to the spline portion of the shaft.

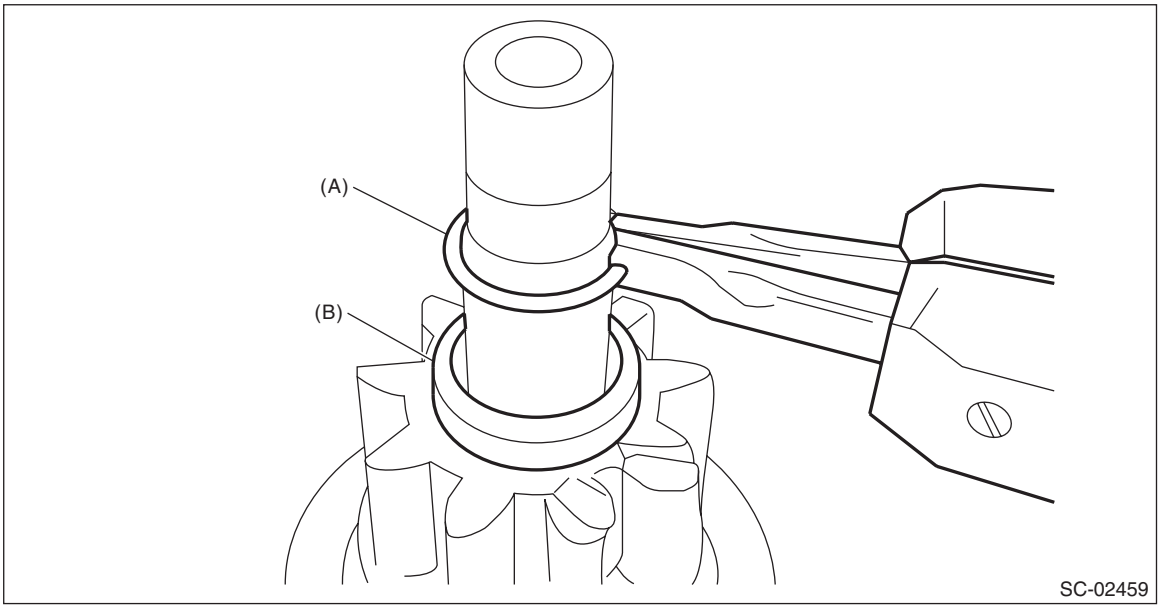
Grease:
Multemp #6129 or equivalent

(2) Install the overrunning clutch to shaft.

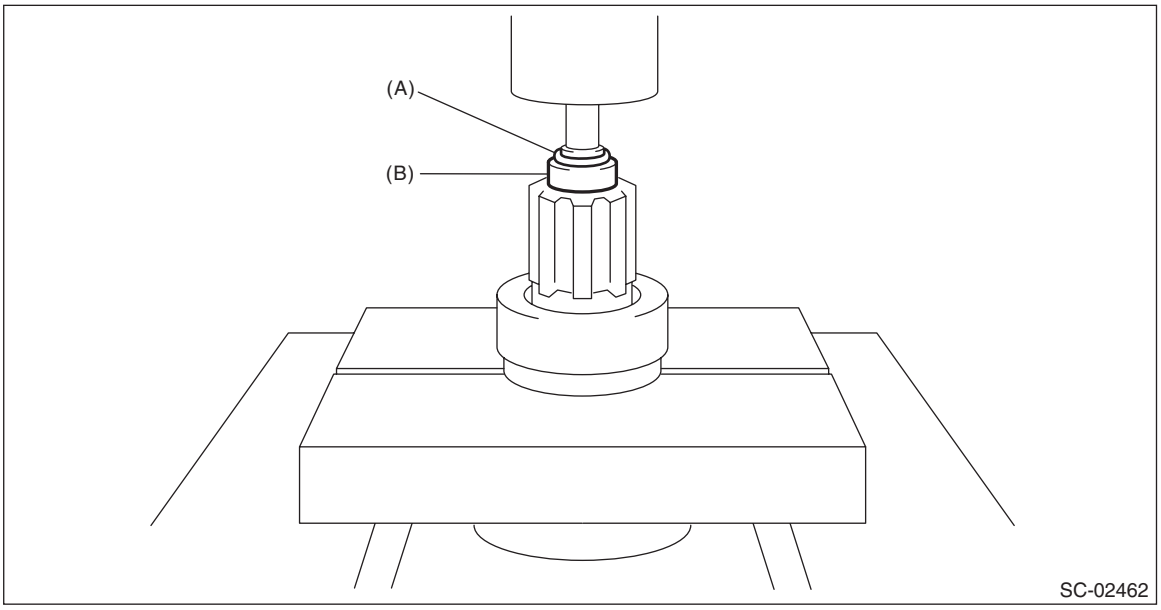


(3) Pass stopper (B) through the shaft assembly, and attach snap ring (A).

NOTE:
Use new stoppers and snap rings.



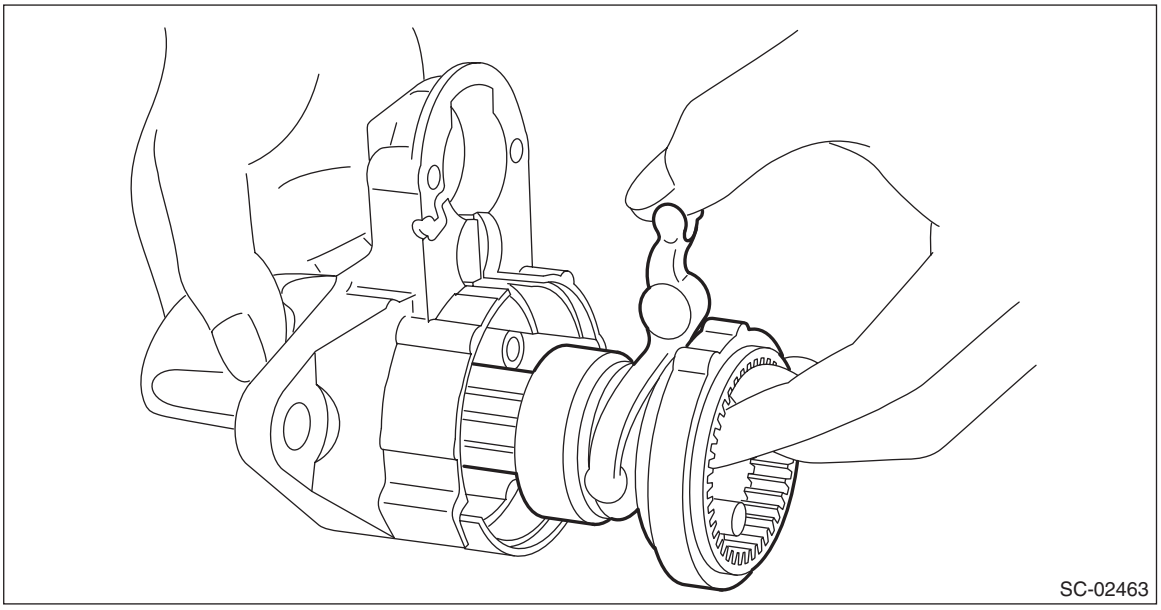
(4) Using a press, pressure fit stopper (B) into snap ring (A).



4) Assemble the overrunning clutch, internal gear assembly, shaft and shift lever as a single unit into the starter housing assembly.

NOTE:
Apply grease to the moving parts of the shift lever.

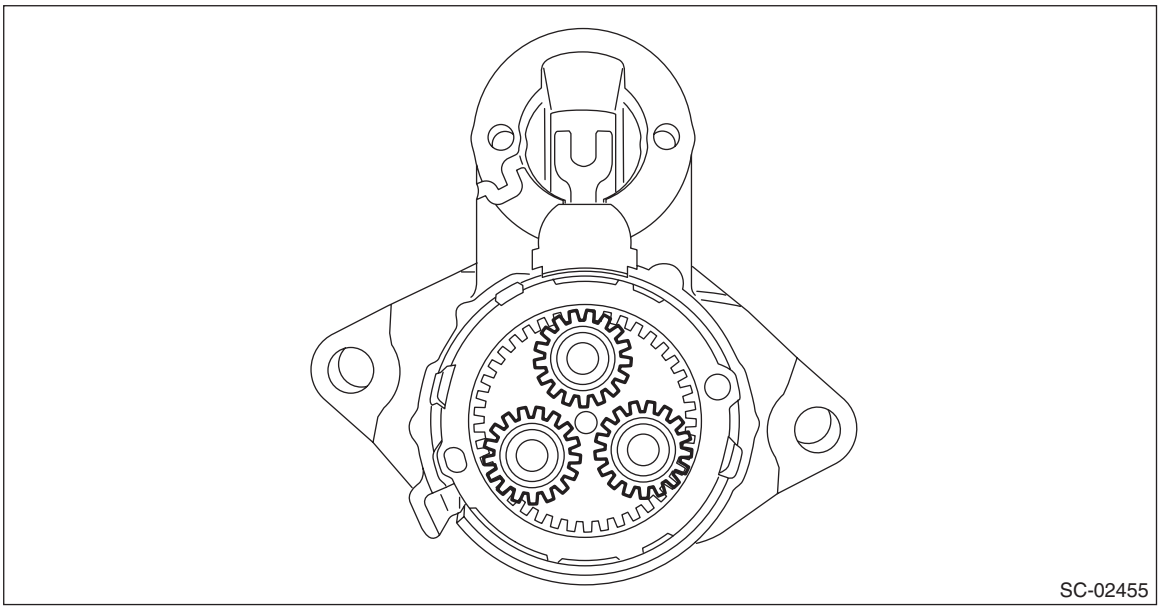
Grease:
Multemp #6129 or equivalent



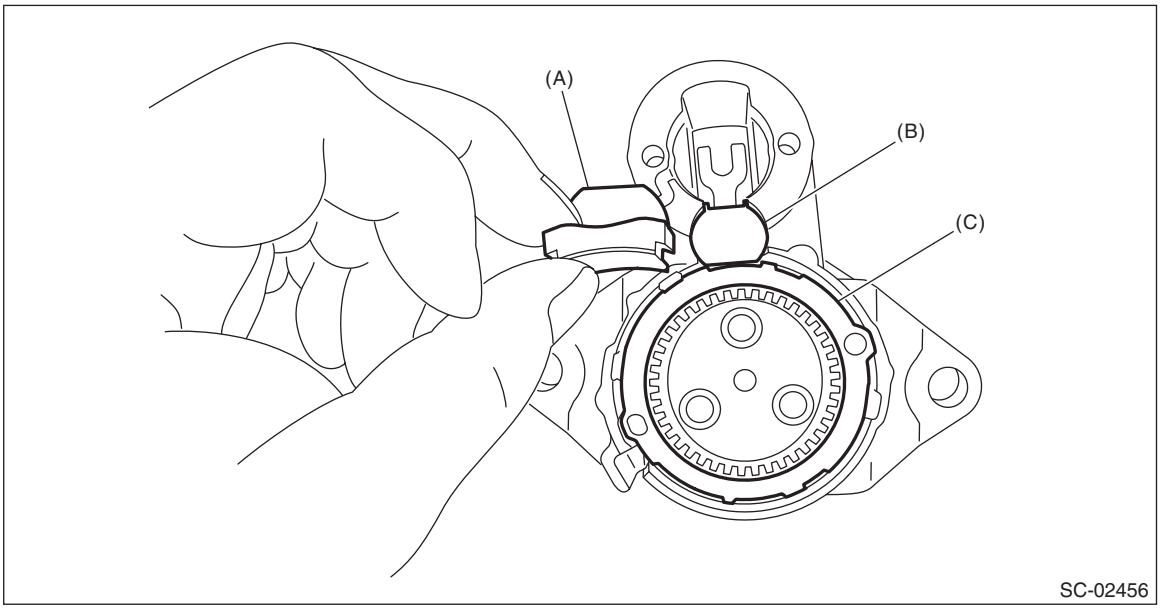
5) Apply grease to the inside of the internal gear assembly and pinion gear, and attach the pinion gear to the internal gear assembly.

NOTE:
- Apply grease evenly to the contact surfaces of each gear.
- Be careful that no debris becomes attached.

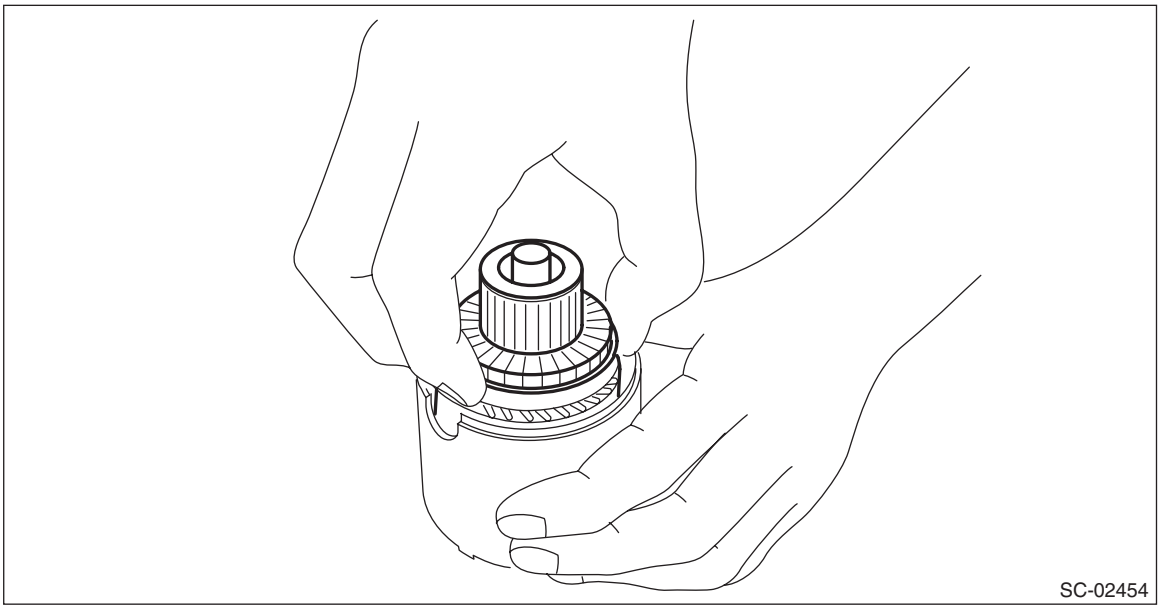
Grease:
Molykote® AG650 or equivalent



6) Install seal rubber (A), plate (B), and seal rubber (C).

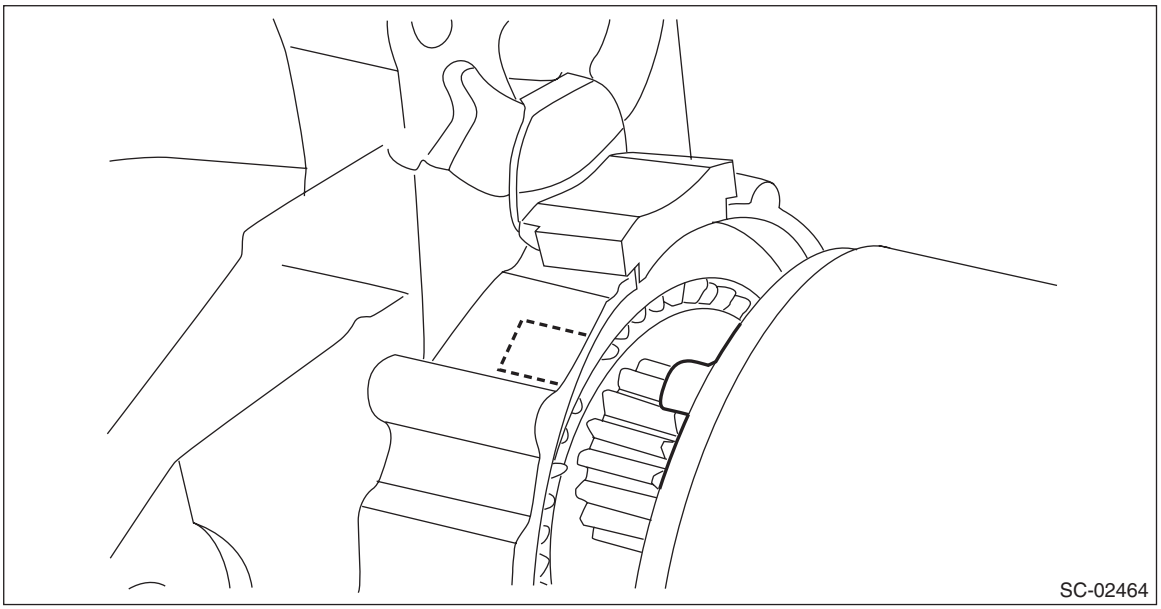


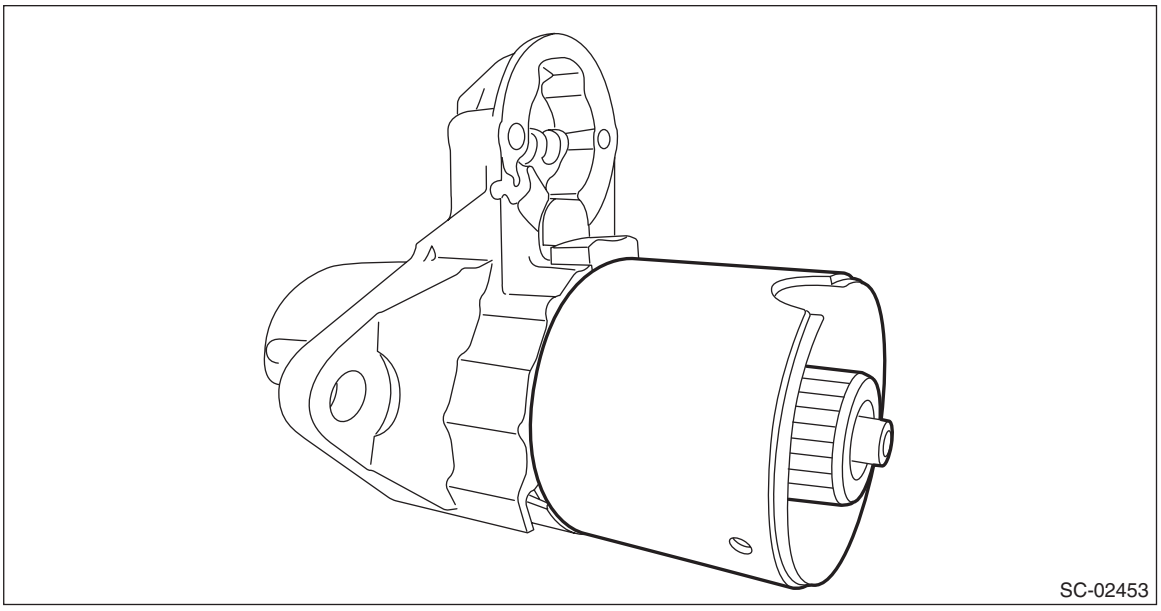
7) Assemble the armature assembly to the yoke assembly.



8) Attach the armature assembly and yoke assembly to the starter housing assembly together as a single unit.

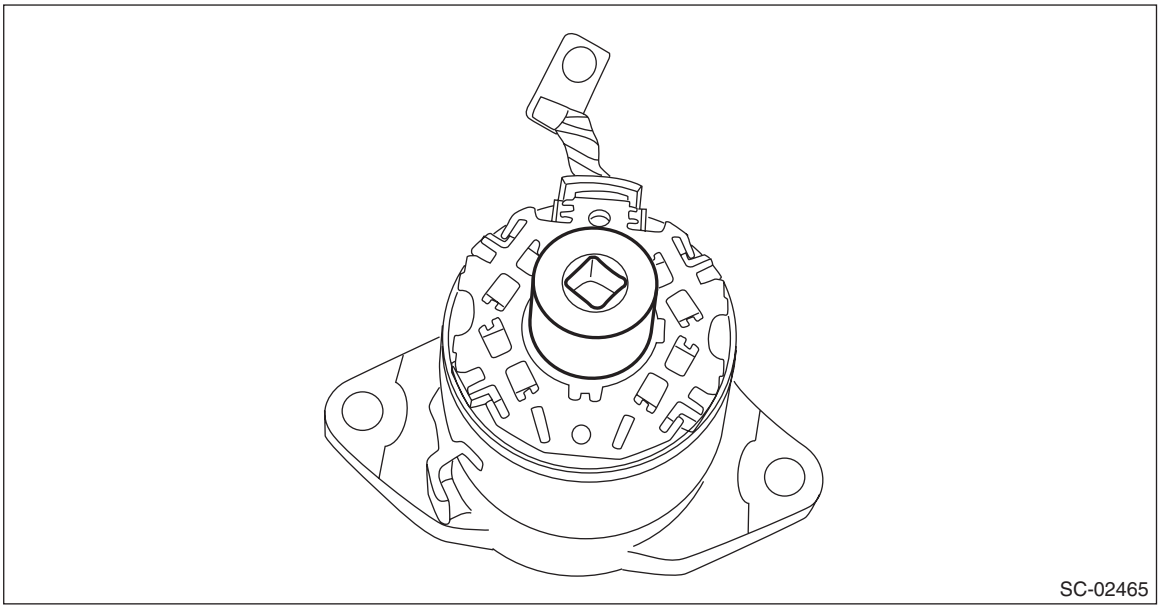
NOTE:
As shown in the figure, match the protrusion of the yoke assembly to the cut out of the starter housing assembly.




SC-02453

9) Use an appropriate tool (such as correctly sized socket wrenches) and attach the brush holder assembly to the armature assembly.

NOTE:
Be careful not to damage the brushes.

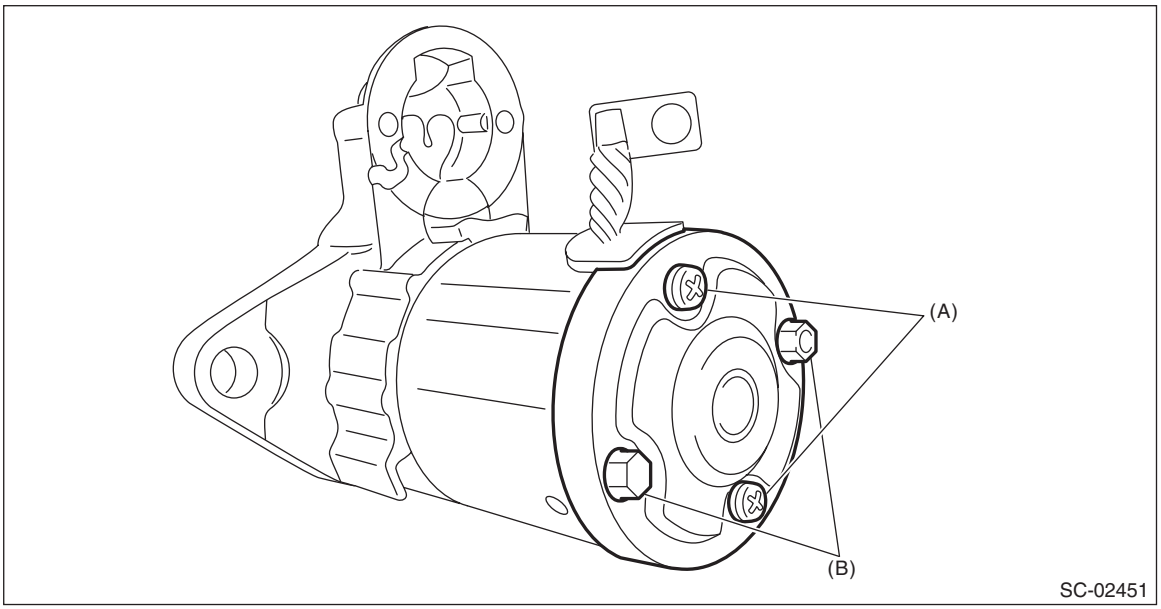

SC-02465

10) Secure starter cover assembly to the brush holder assembly with screws (A).

Tightening torque:
1.4 N·m (0.1 kgf-m, 1.0 ft-lb)

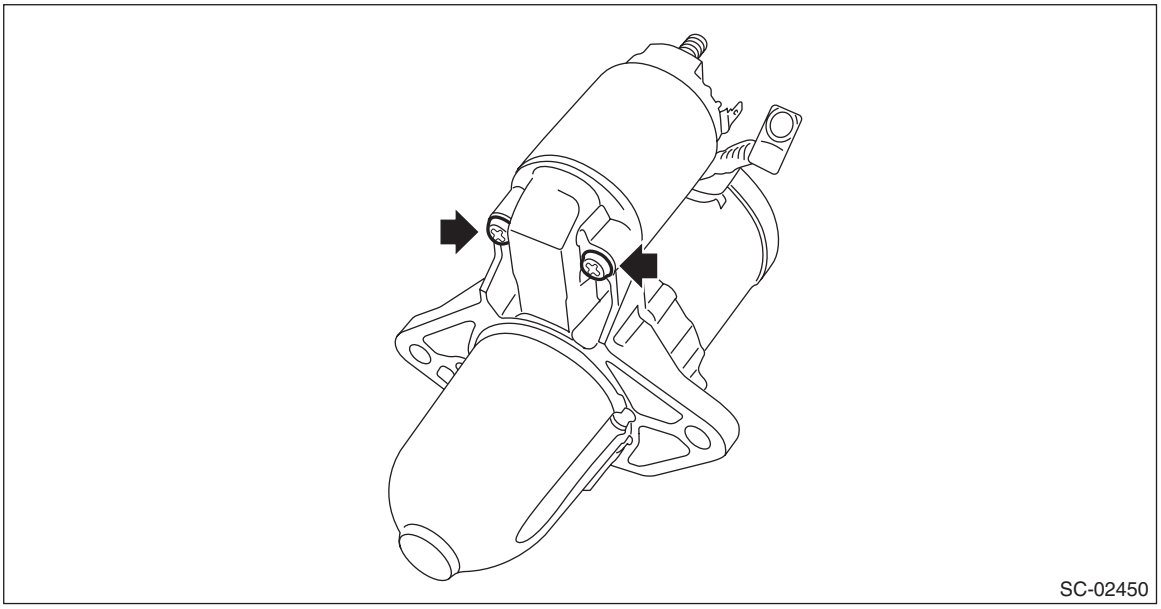
11) Tighten through bolts (B) on both sides.

Tightening torque:
6 N·m (0.6 kgf-m, 4.4 ft-lb)



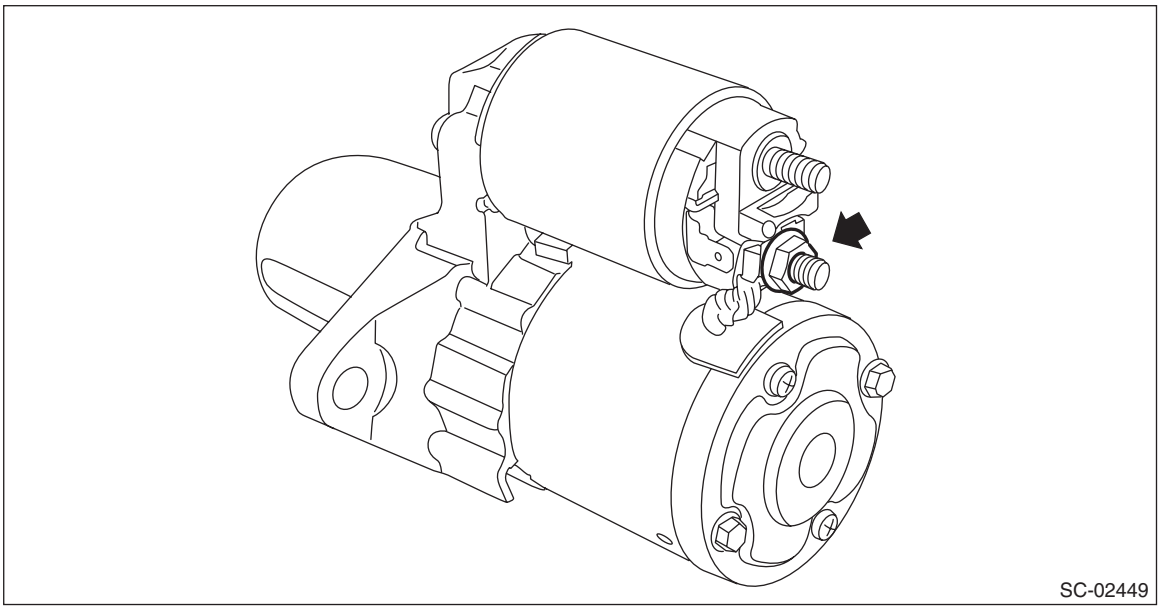
12) Attach the magnet switch assembly to the starter housing assembly.

Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



13) Attach the cable to the terminal M of the magnet switch assembly, and secure with nuts.

Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)

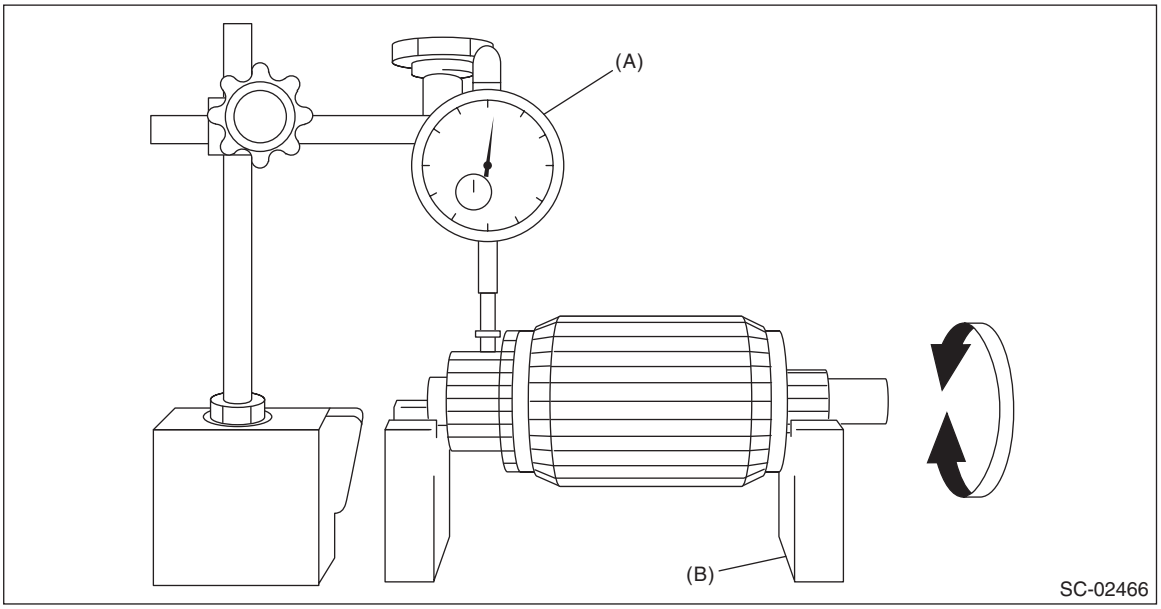


E: INSPECTION

1. ARMATURE

1) Check the commutator for signs of seizure or stepped wear caused by roughness of the surface. If there is light wear, use sandpaper to repair.
2) Check for runout on the commutator. If excessive, replace the armature.

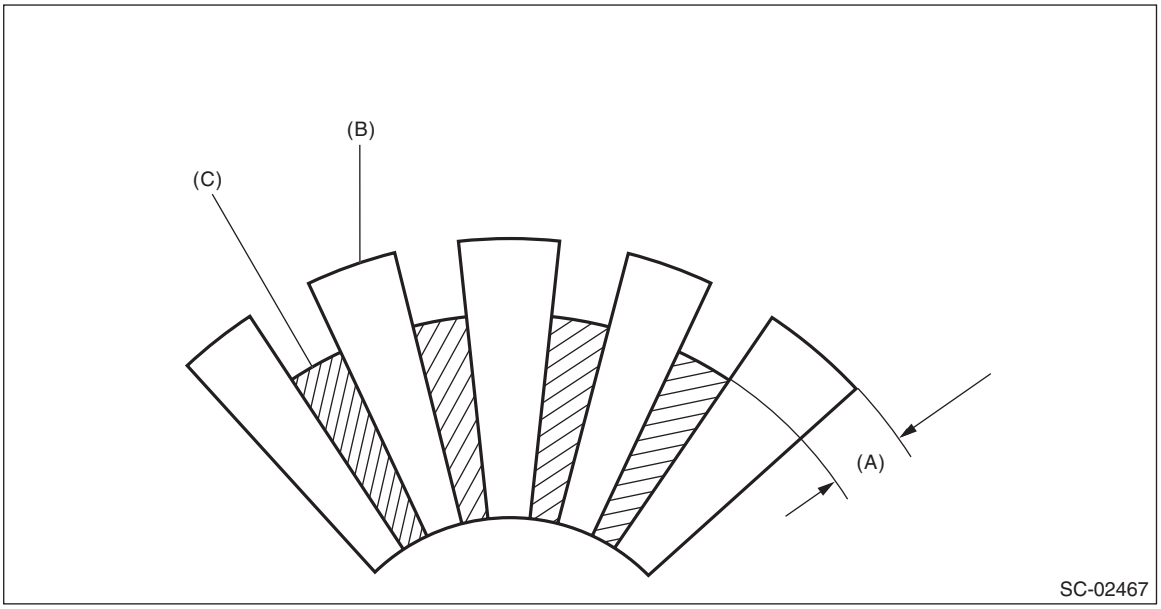
Commutator runout:
Standard
0.05 mm (0.0020 in)
Limit
0.10 mm (0.0039 in)



(A) Dial gauge (B) V-block

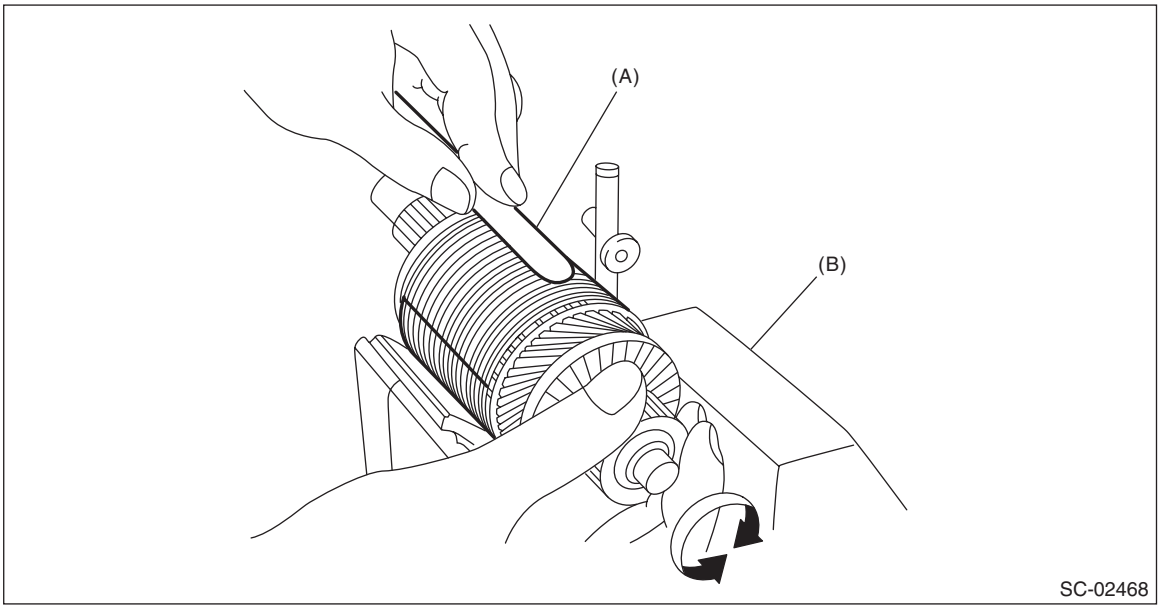
3) Check the depth of the segment mold. If it is not within the standard, replace the armature.

Depth of segment mold:
Standard
0.50 mm (0.020 in)



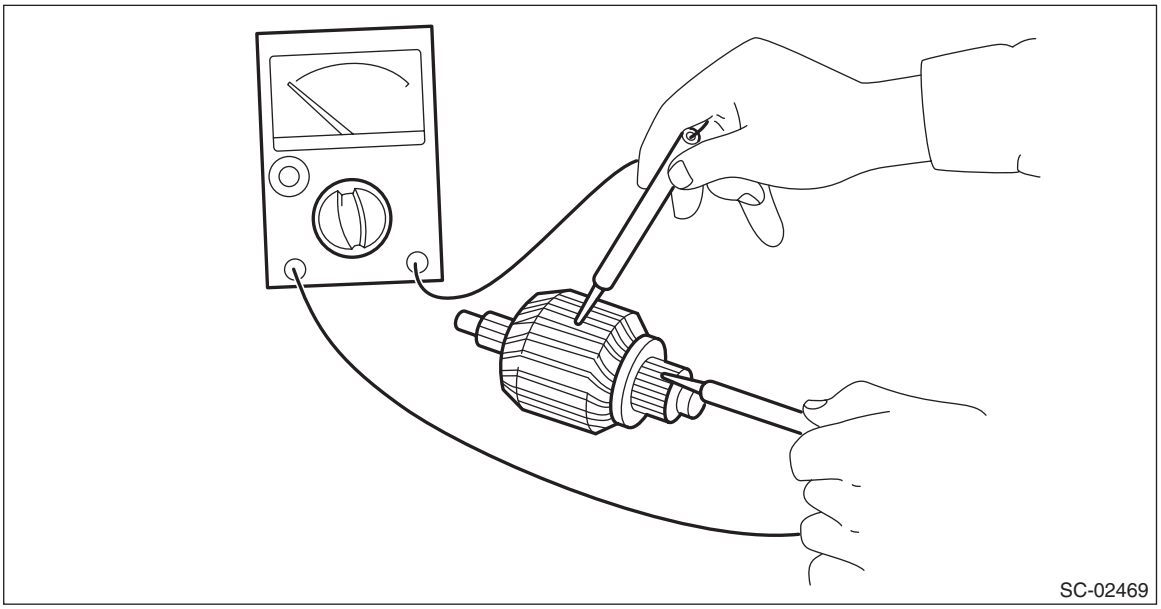
(A) Depth of mold (B) Segment (C) Mold

4) Place the armature on the growler tester to check for short circuits. While slowly turning the armature, support the steel sheet for the armature core. If the circuit of the armature is shorted, the steel sheet will vibrate, causing it to move towards the core. When the steel sheet has moved or vibrated, replace the armature.



(A) Steel sheet (B) Growler tester

5) Use a circuit tester to touch the probe of one side to the commutator segment, and the other probe to the shaft. If there is continuity, replace the armature.



2. YOKE

Make sure that the pole is set at the predetermined position.

3. OVERRUNNING CLUTCH

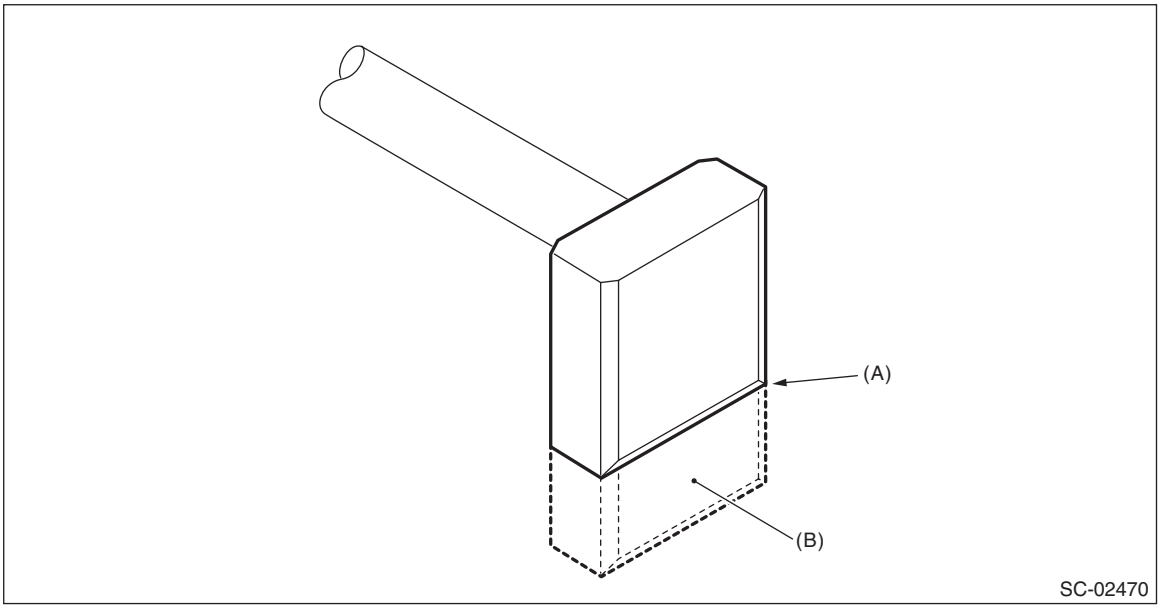
Inspect the pinion, and if there is any wear or damage, replace the overrunning clutch. Also, check that the pinion rotates counterclockwise smoothly and does not rotate clockwise. If there is any fault, replace the overrunning clutch.

CAUTION:
To prevent spilling of grease, do not clean the overrunning clutch with oil.

4. BRUSH AND BRUSH HOLDER

1) Visually check the brush. If there is any abnormal wear or cracks, replace the brush.
2) Measure the length of the brush. If it exceeds service limits, replace the brush.

Brush length:
Standard
12.3 mm (0.484 in)
Limit
7.0 mm (0.276 in)



(A) Service limit line (B) Brush

3) Check that the brush moves smoothly in the brush holder.
4) Measure the brush spring force with a spring scale. Replace the brush holder if below the service limit.

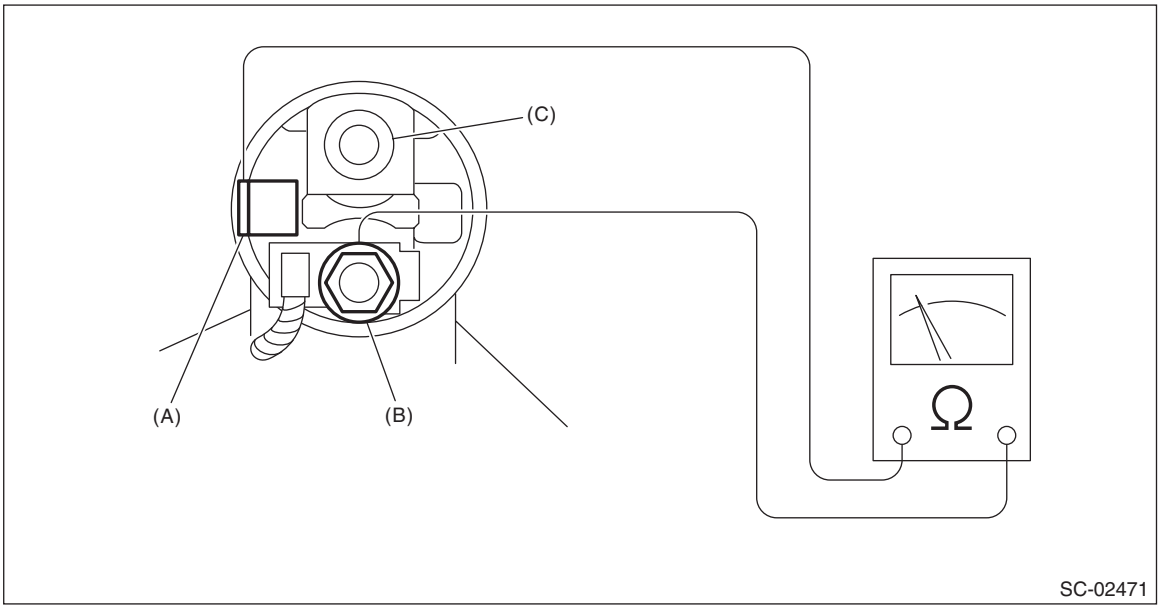
Brush spring force:
Standard
15.9 — 19.5 N (1.62 — 1.99 kgf, 3.57 — 4.38 lbf) (when new)
Limit
2.5 N (0.25 kgf, 0.56 lbf)

5. SWITCH ASSEMBLY

Using a circuit tester (set to “ohm”), check that there is continuity between terminals S and M, and between terminal S and ground. Also check to be sure there is no continuity between terminal M and B.

Resistance between switch assembly terminals:

Terminals	Standard
S — M	1 Ω or less
S — Ground	1 Ω or less
M — B	1 MΩ or more



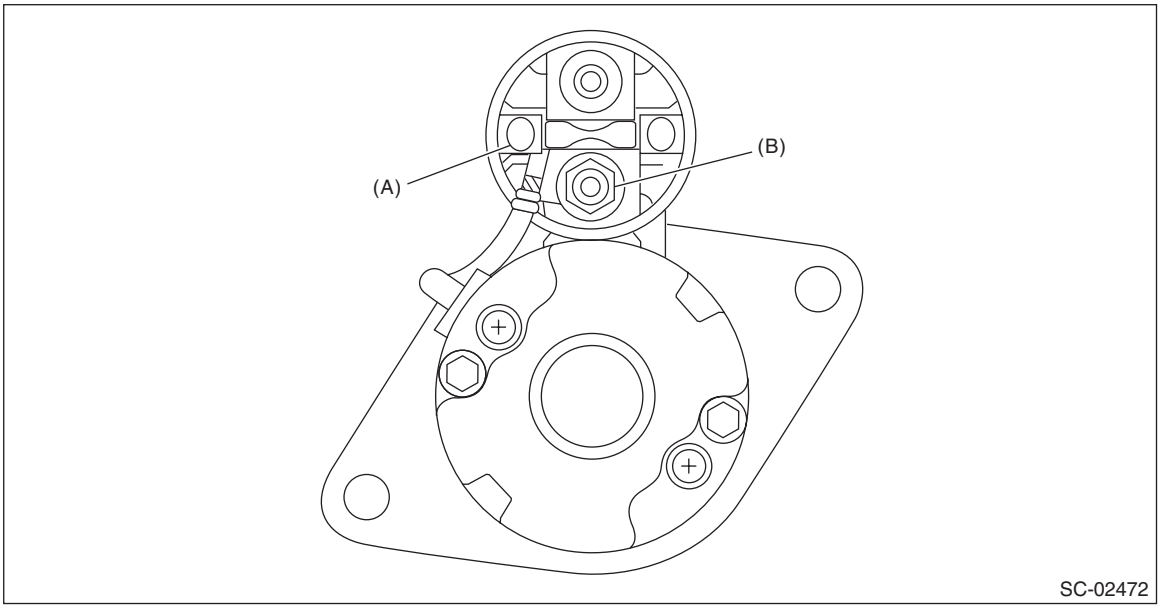
(A) Terminal S (B) Terminal M (C) Terminal B

6. SWITCH ASSEMBLY OPERATION

1) Using a lead wire, connect the switch assembly terminal S to the positive terminal of battery, and the starter body to the ground terminal of battery. The pinion should be forced endwise on shaft.

NOTE:
With the pinion forced endwise on shaft, starter motor can sometimes rotate because current flows, through pull-in coil, to motor. This is not a problem.

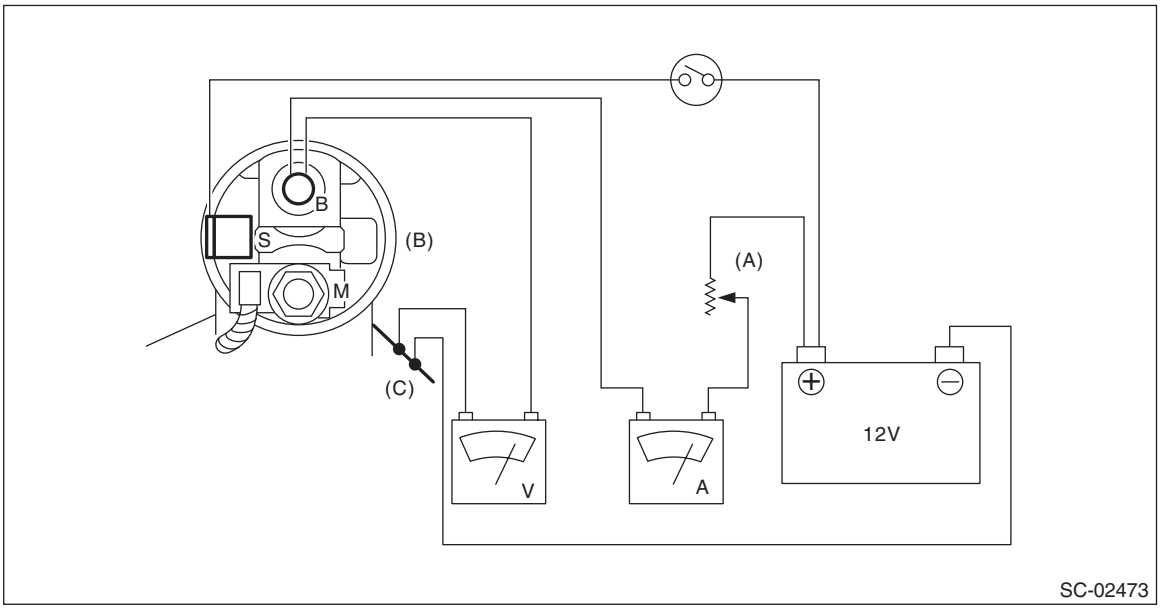
2) Disconnect the connector from terminal M. Then using a lead wire, connect the positive terminal of battery and terminal M, and ground terminal to starter body.
In this test set up, the pinion should return to its original position even when it is pulled out with a screwdriver.



(A) Terminal S (B) Terminal M

7. PERFORMANCE TEST

The starter should be submitted to performance tests whenever it has been overhauled, to assure its satisfactory performance when installed on the engine.
Three performance tests, no-load test, load test, and lock test, are presented here; however, if the load test and lock test cannot be performed, carry out at least the no-load test.
For these performance tests, use the circuit shown in figure.



(A) Variable resistance (B) Magnet switch (C) Starter body

1) Adjust the variable resistance with the switch on until the voltage is 11 V, and read the value displayed by the ammeter to measure starter speed. Compare these values with the standard.

No-load test (standard):

Voltage/Current
CVT model
Max. 11 V/90 A or less
MT model
Max. 11 V/95 A or less

Rotating speed
CVT model
2,370 r/min or more
MT model
2,500 r/min or more

2) Apply the specified braking torque to starter. The condition is normal if the current draw and starter speed are within standard.

Load test (standard):

Voltage/Load
CVT model
7.5 V/10.65 N·m (1.1 kgf-m, 7.8 ft-lb)
MT model
7.5 V/8.84 N·m (0.9 kgf-m, 6.5 ft-lb)

Current/Speed
CVT model
300 A / 840 r/min or more
MT model
300 A / 870 r/min or more

3) With the starter stalled, or not rotating, measure the torque developed and current draw when the voltage is adjusted to standard voltage.

Lock test (standard):

Voltage/Current
CVT model
4 V/780 A or less
MT model
4 V/680 A or less

Torque
CVT model
20 N·m (2.0 kgf-m, 14.8 ft-lb) or more
MT model
17 N·m (1.7 kgf-m, 12.5 ft-lb) or more

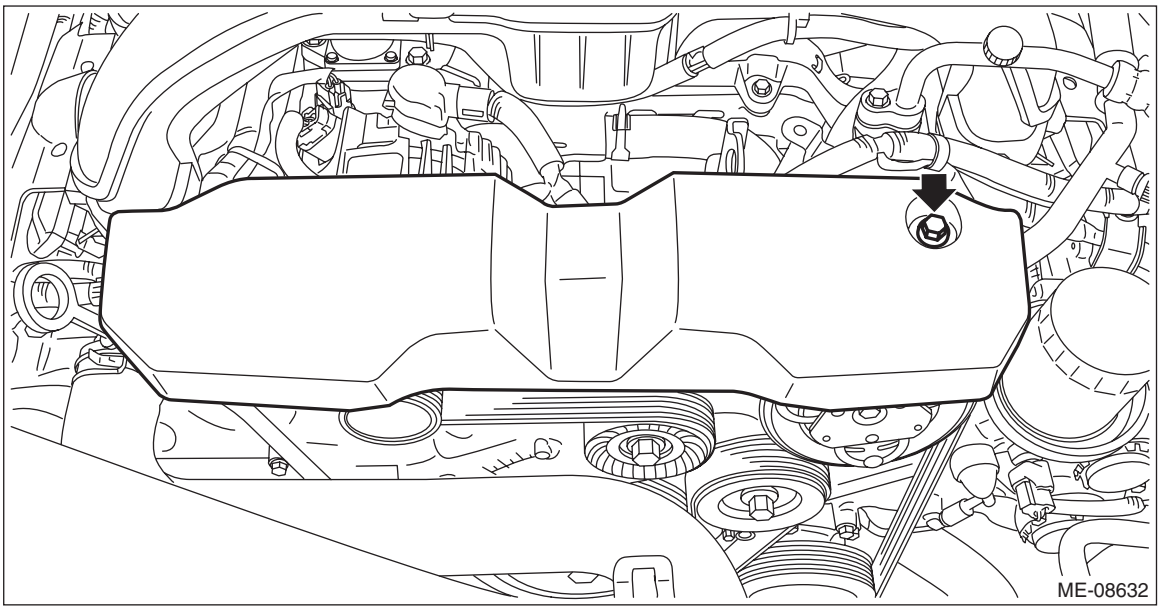
8. OTHER INSPECTIONS

Check that the starter does not have deformation, cracks and any other damage.

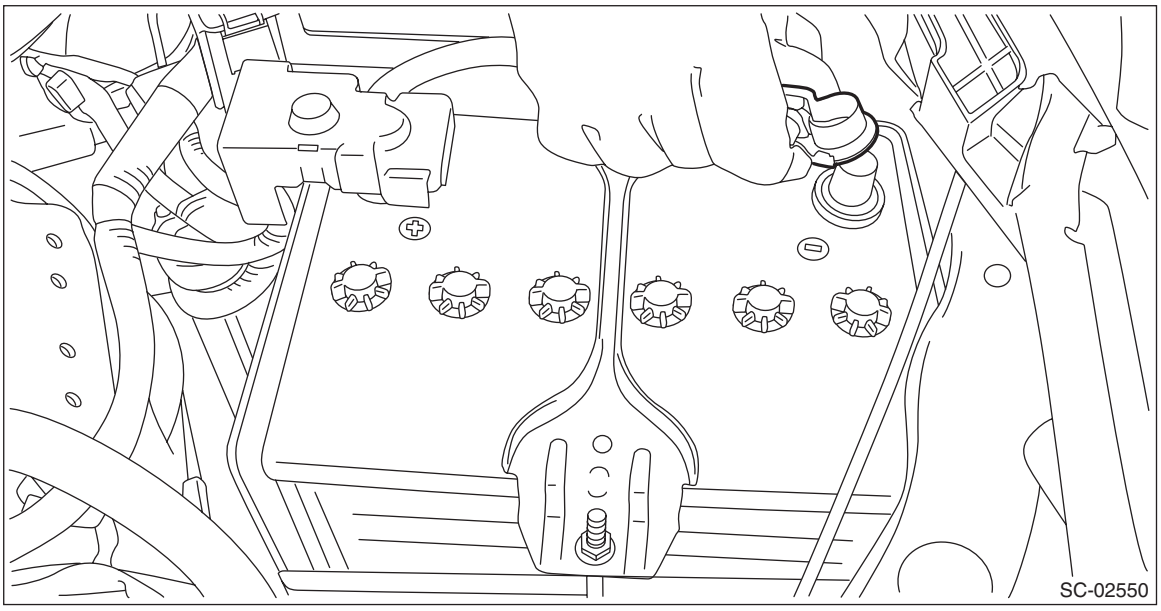
3. Generator

A: REMOVAL

1) Remove the V-belt covers.

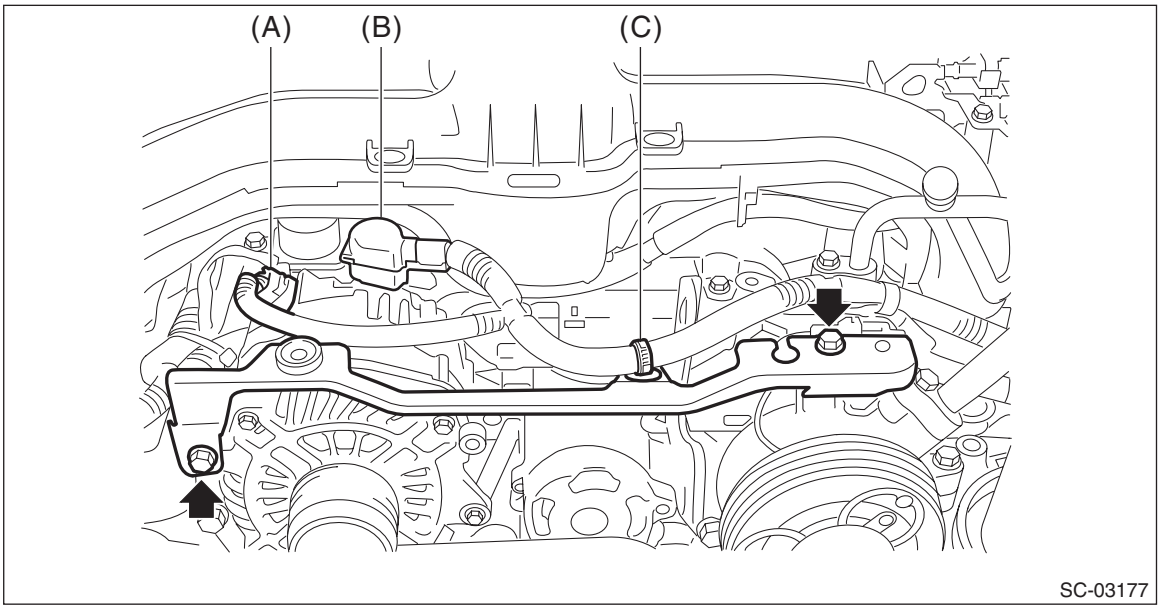


2) Disconnect the ground cable from battery.

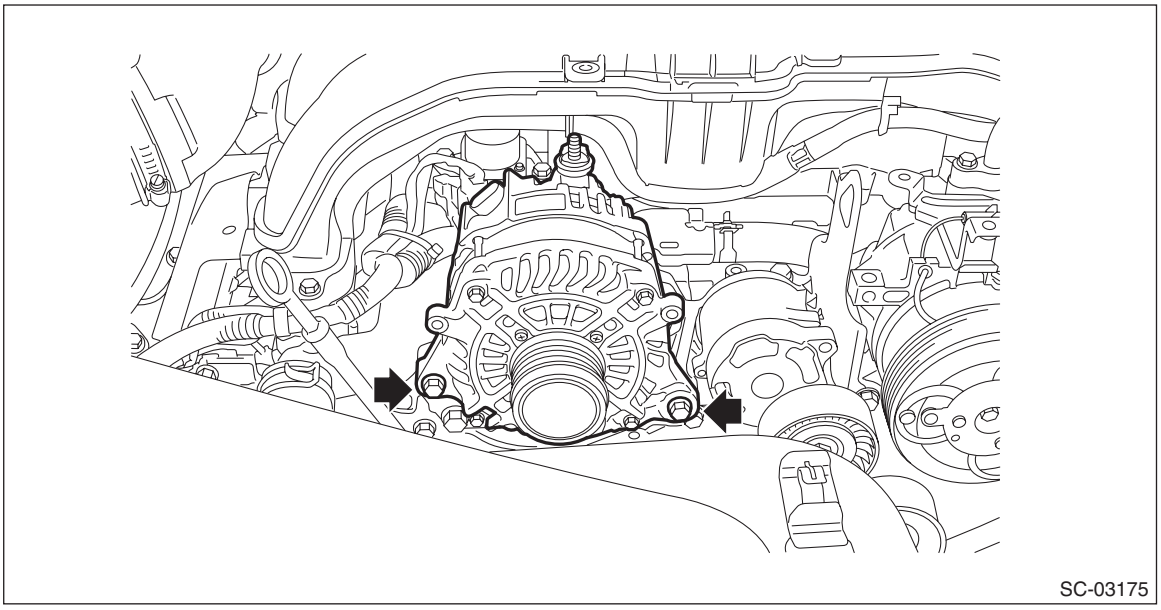


3) Remove the V-belts. <Ref. to ME(H4DO(w/o HEV))-122, REMOVAL, V-belt.>
4) Disconnect the connector (A) and terminal (B) from the generator, and remove the clip (C).

5) Remove the V-belt cover bracket.

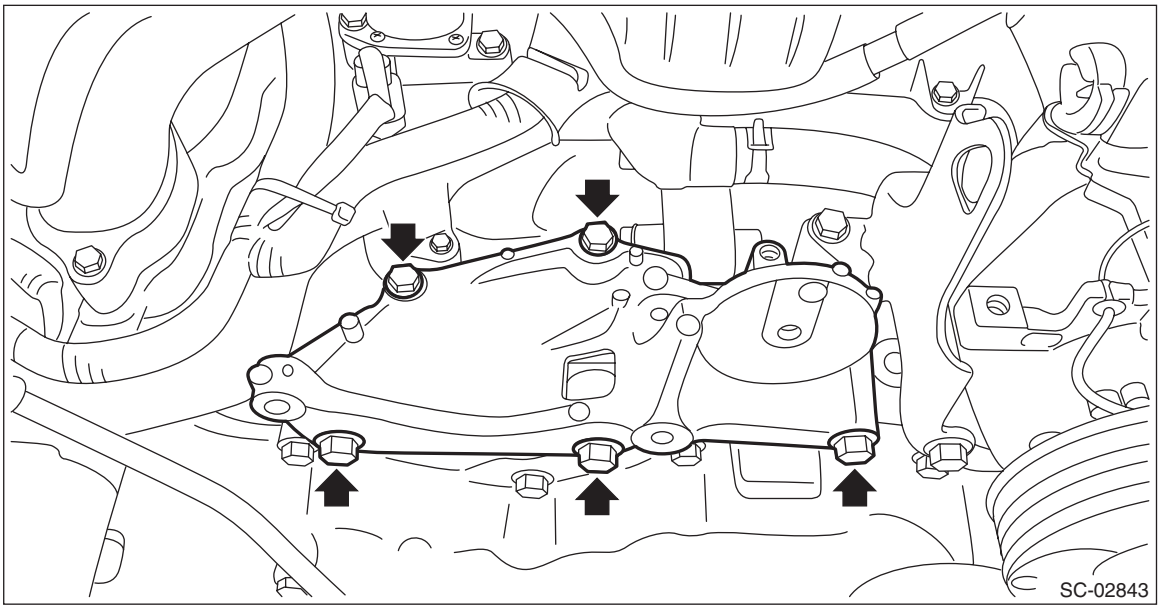


6) Remove the generator from the generator bracket.



7) Remove the V-belt tensioner. <Ref. to ME(H4DO(w/o HEV))-124, HEV MODEL, REMOVAL, V-belt.>

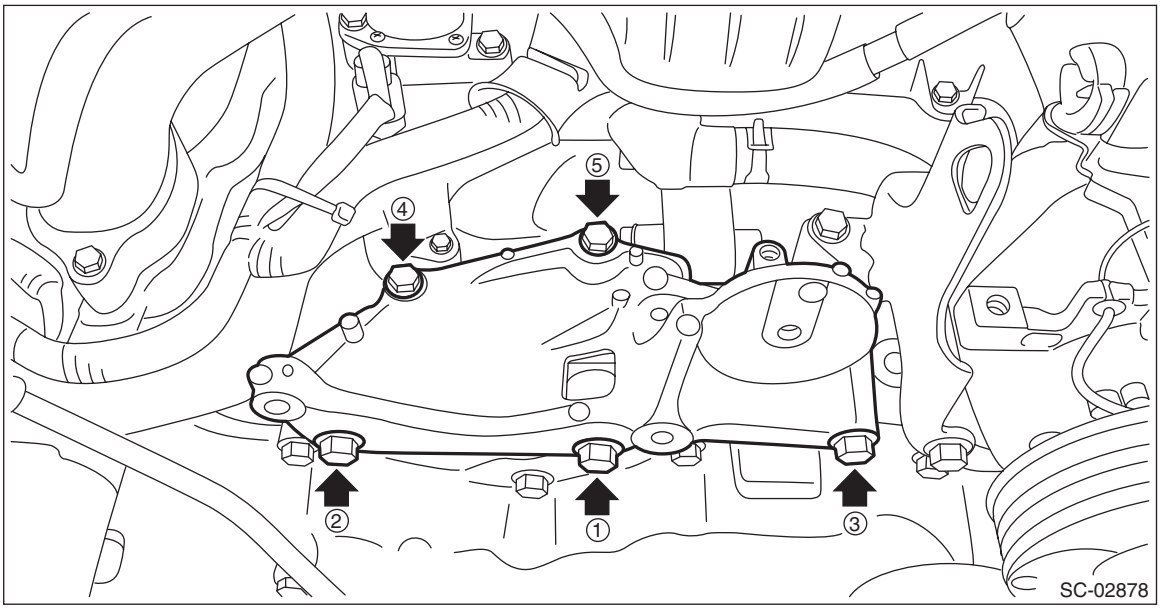
8) Remove the generator bracket from the engine.



B: INSTALLATION

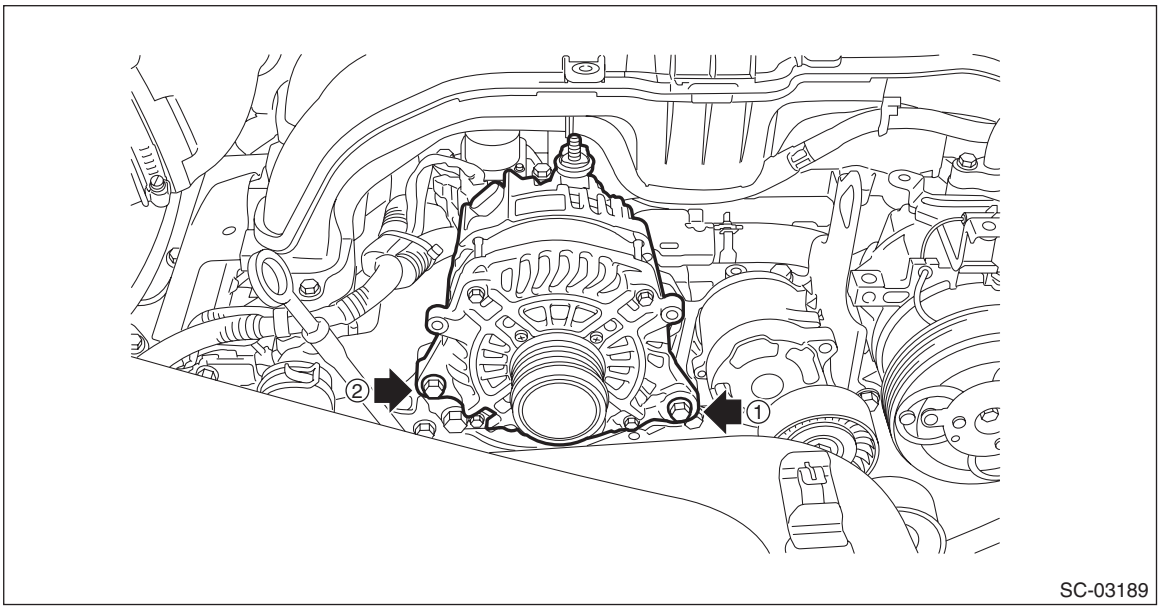
1) Temporarily install the generator bracket to the engine main body and tighten the bolts in the numerical order.

Tightening torque:
36 N·m (3.7 kgf-m, 26.6 ft-lb)



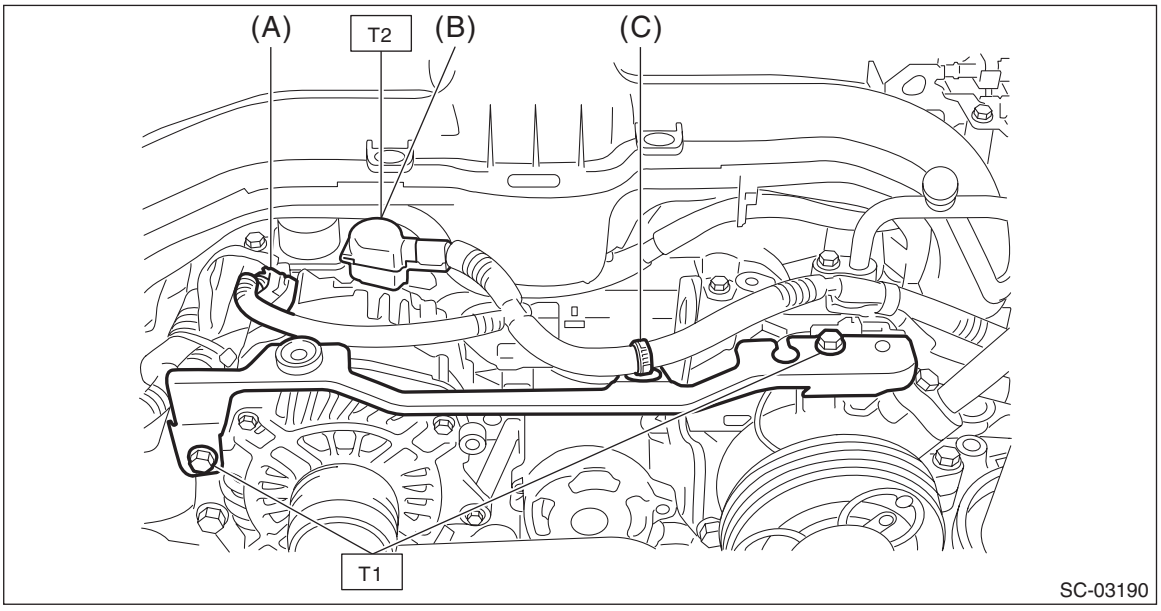
2) Temporarily install the generator bracket to the generator and tighten the bolts in the numerical order.

Tightening torque:
36 N·m (3.7 kgf-m, 26.6 ft-lb)



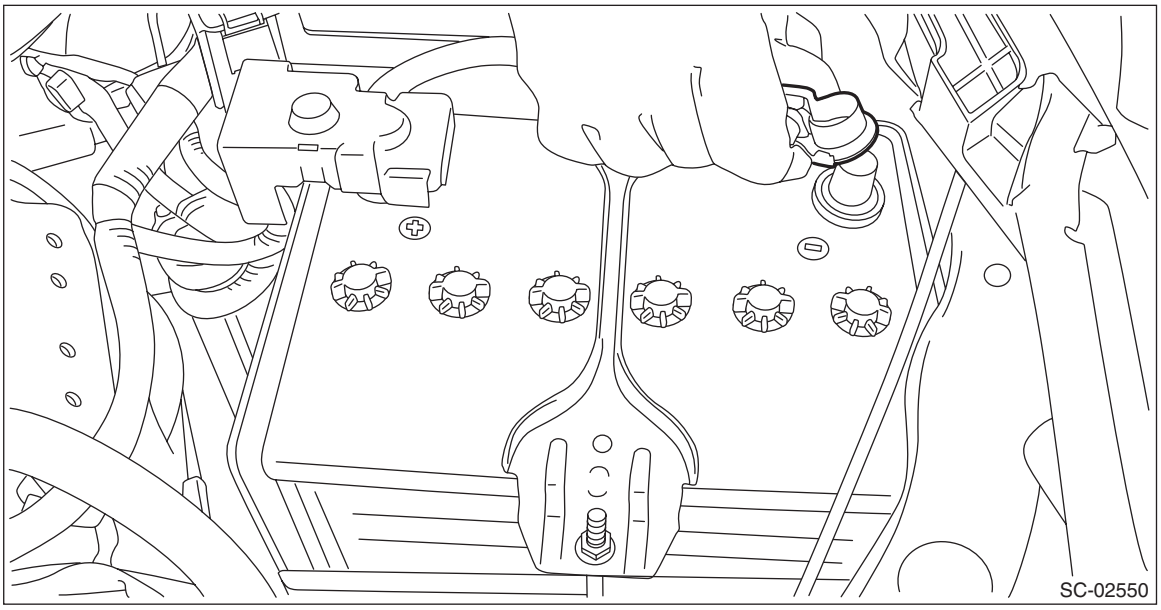
3) Install the V-belt cover bracket.
4) Connect the connector (A) and terminal (B) to the generator, and attach the clip (C).

Tightening torque:
T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
T2: 15 N·m (1.5 kgf-m, 11.1 ft-lb)



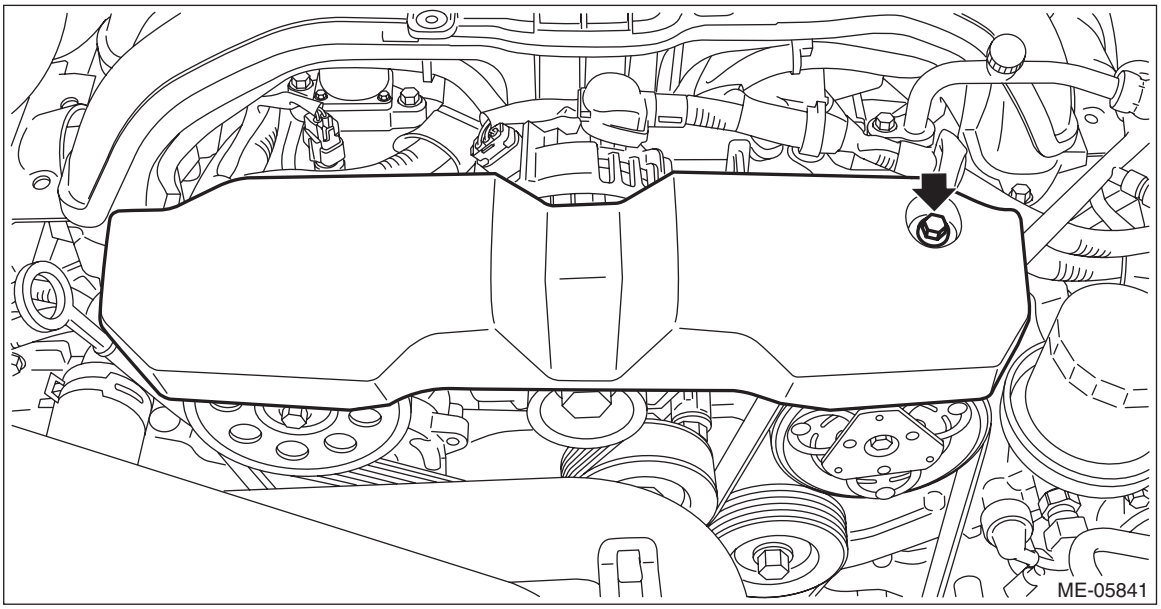
5) Install the V-belts. <Ref. to ME(H4DO(w/o HEV))-130, INSTALLATION, V-belt.>

6) Connect the battery ground terminal.



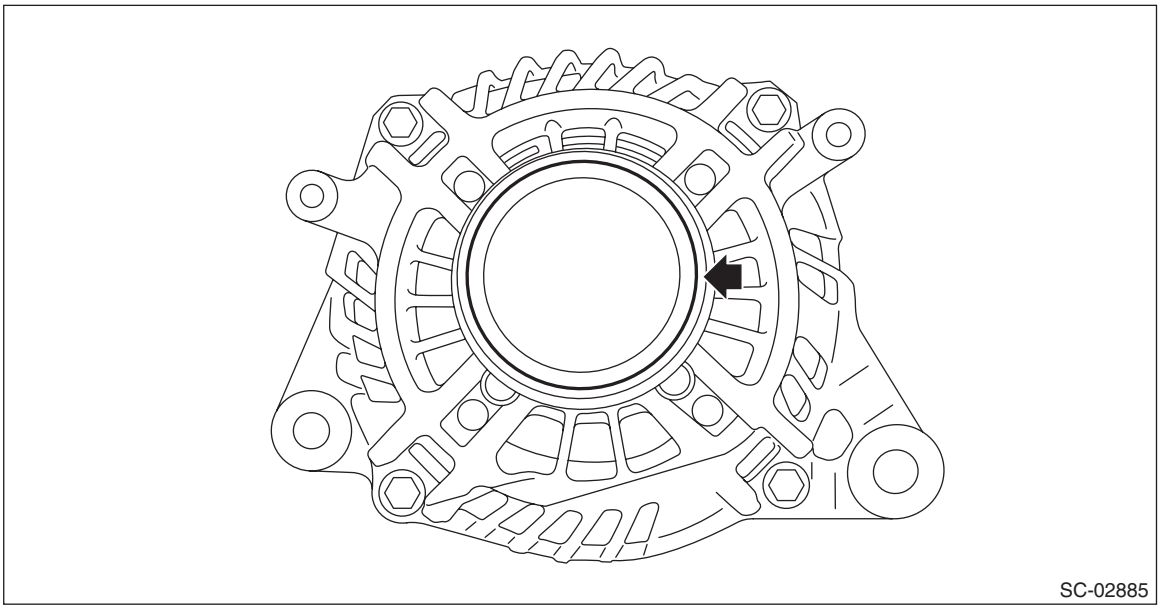
7) Install the V-belt cover.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

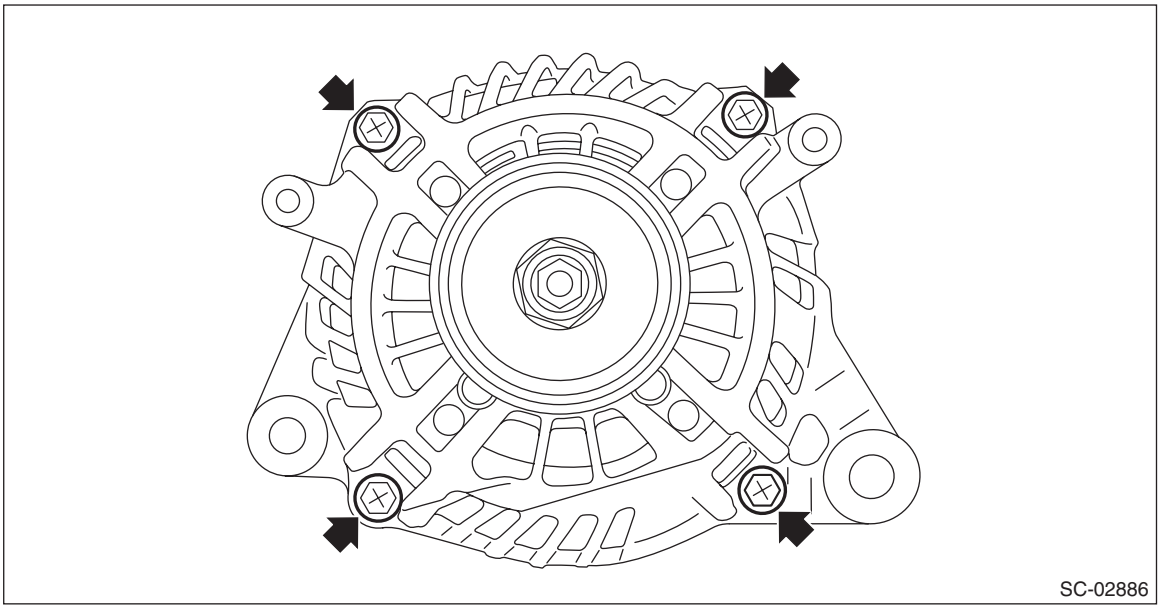


C: DISASSEMBLY

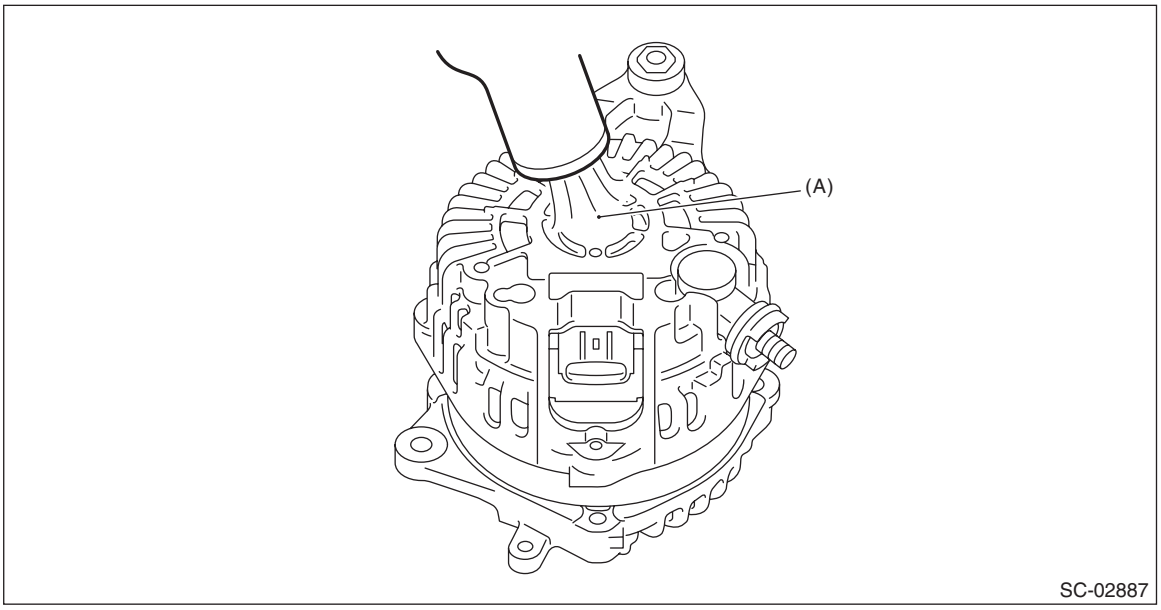
1) Remove the cap from the generator.



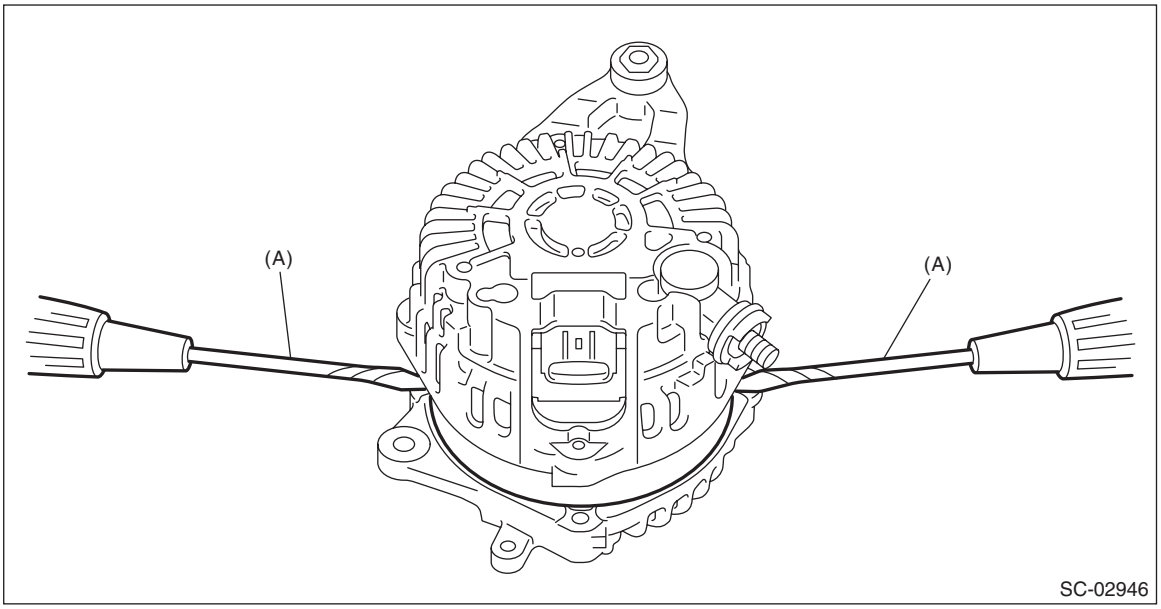
2) Remove four bolts.



3) Use a drier to heat the rear cover (A) portion to 50 — 60°C (122 — 140°F).



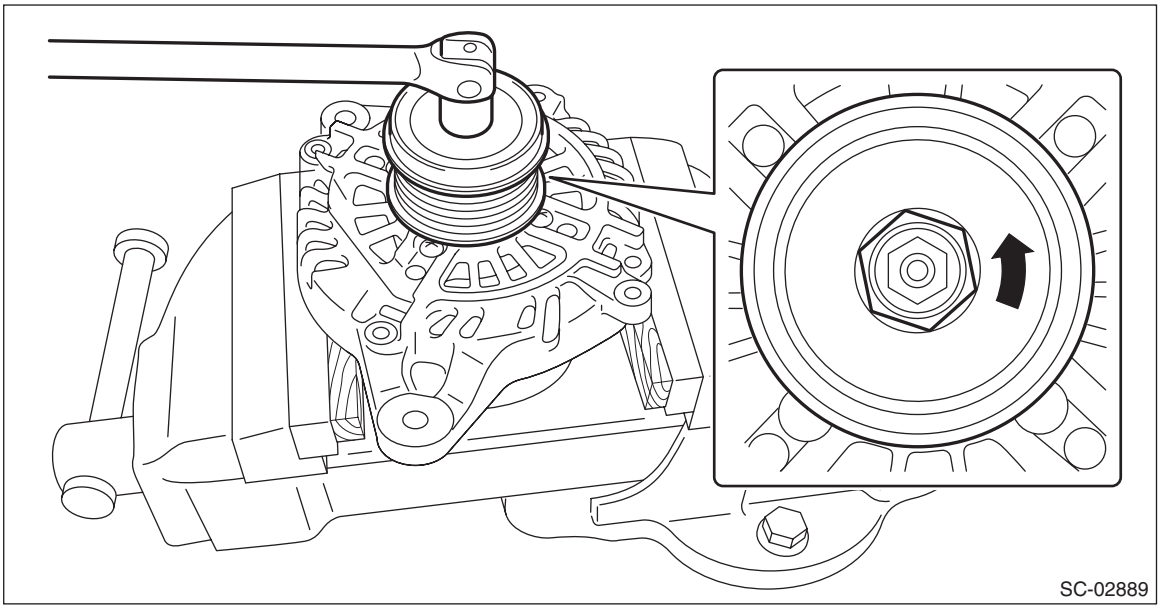
4) Insert a flat tip screwdriver or similar tool wrapped with protective tape into the gap between stator core and the front cover to disassemble.



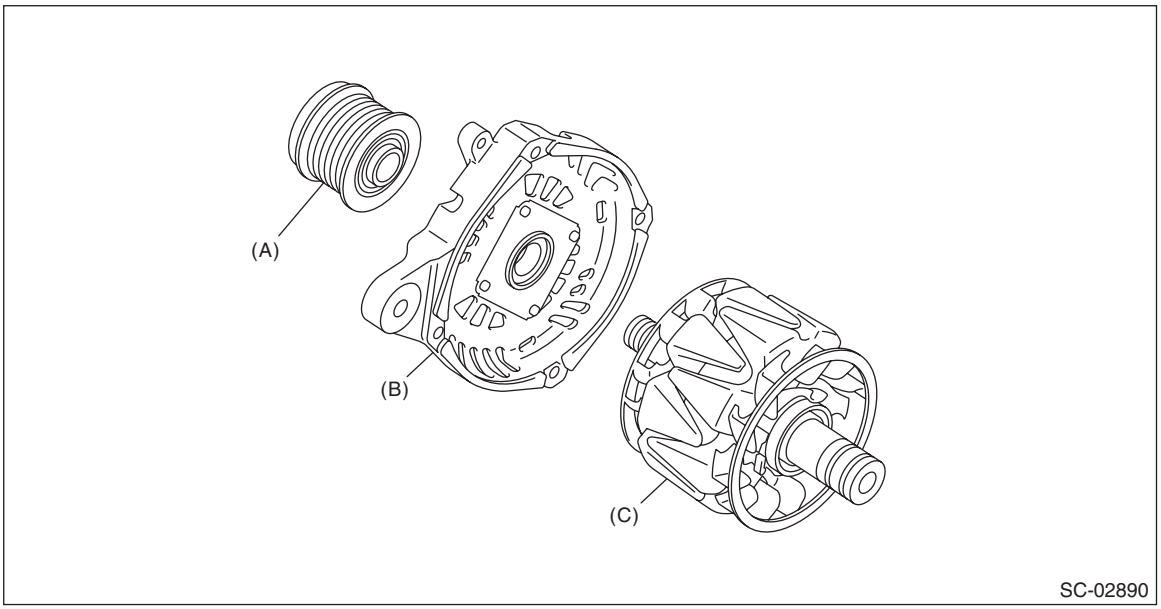
(A) Flat tip screwdriver

5) Hold the rotor on a vise and remove the pulley.

CAUTION:
When holding the rotor with a vise, place aluminum plates or wooden pieces on the vise jaws to prevent rotor from damage.

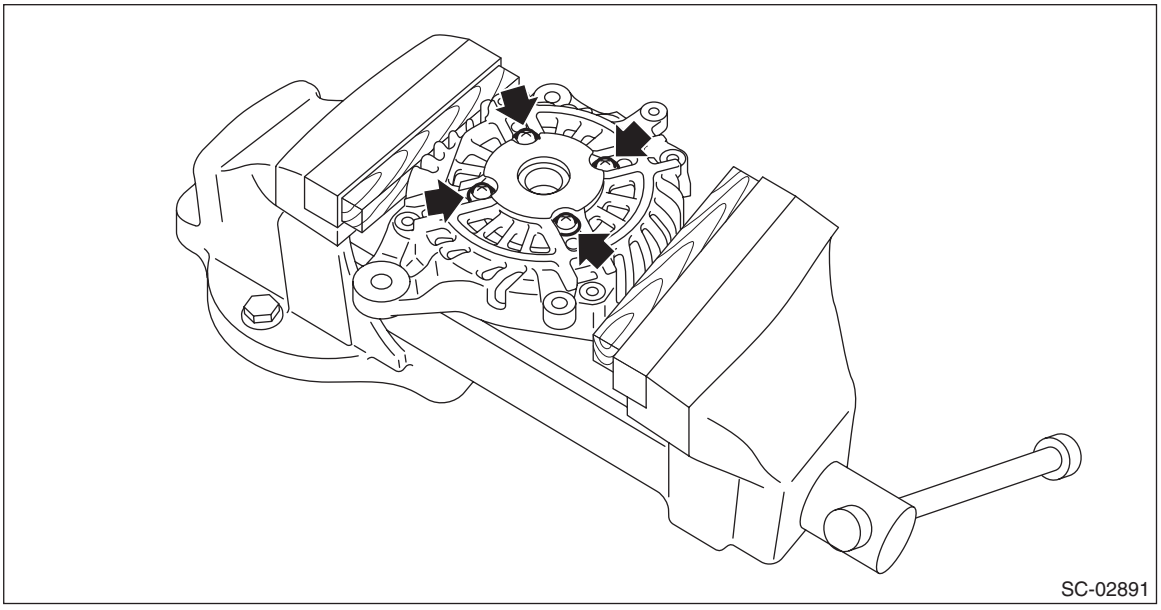


6) Remove the rotor from the front cover.

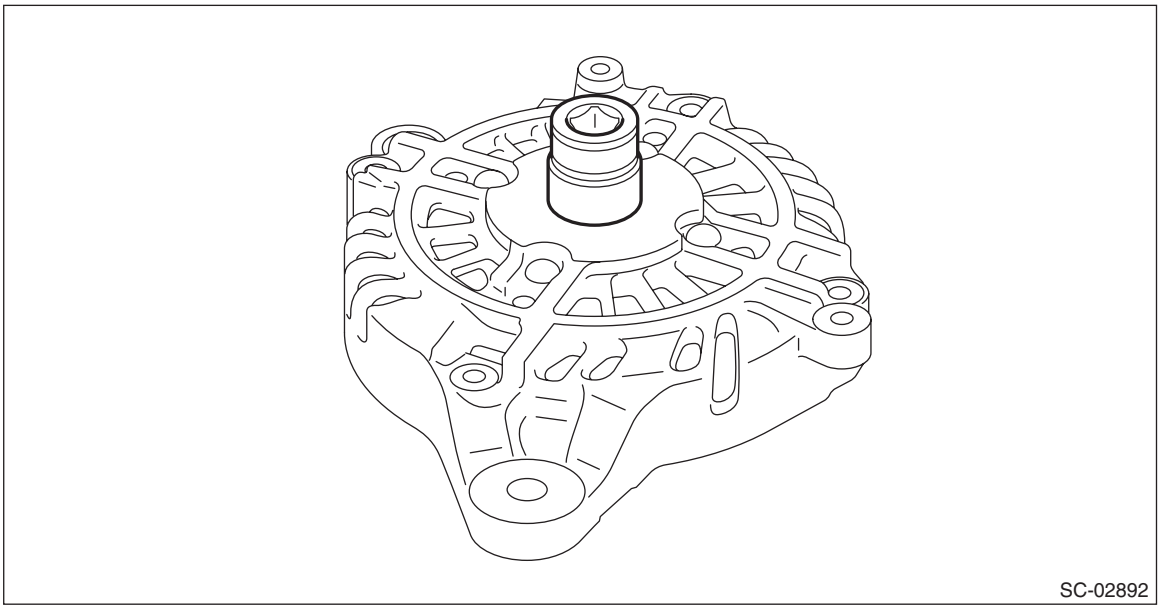


(A) Pulley (B) Front cover (C) Rotor

7) Use the following procedures to remove the ball bearings.
(1) Remove the bolt, and then detach the bearing retainer.

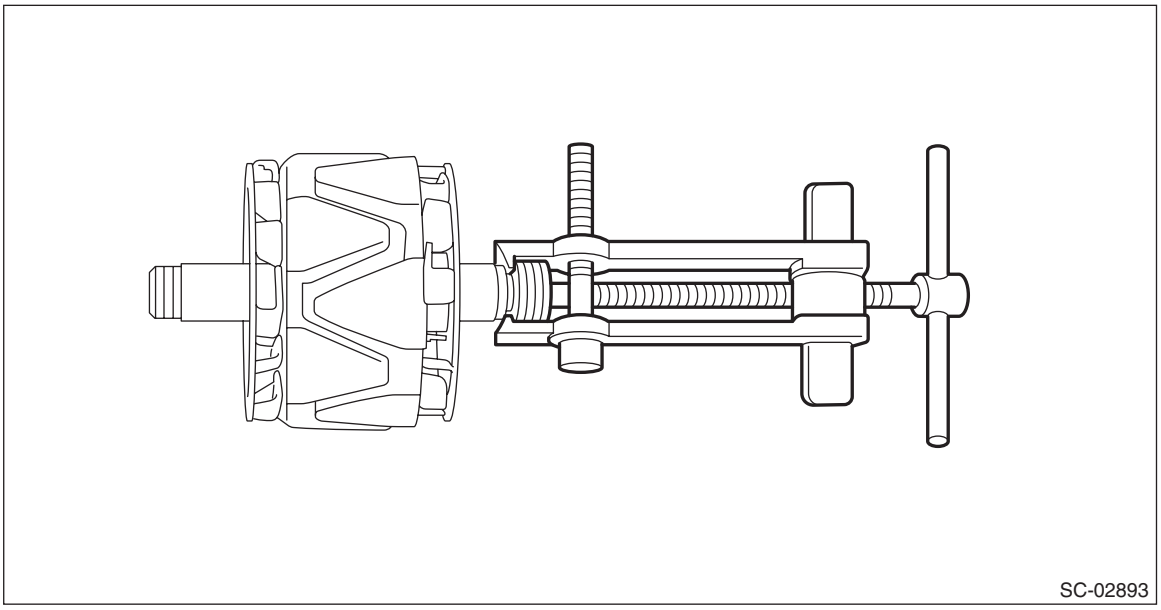

SC-02891

(2) Firmly attach an appropriate tool (such as a correct size socket wrench) to the bearing inner race.

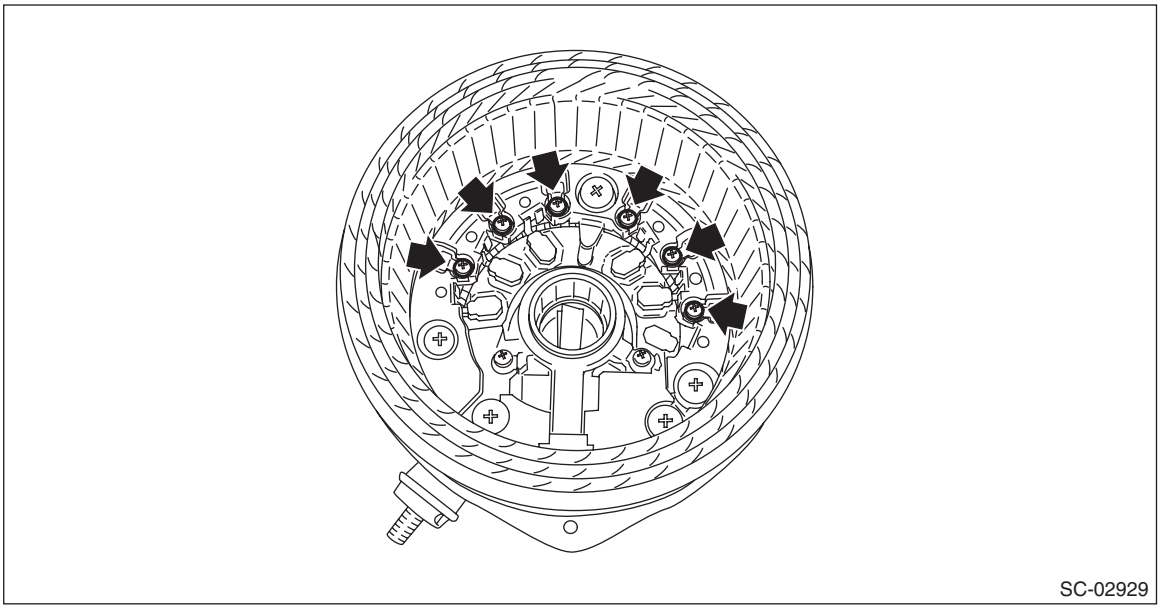

SC-02892

(3) Use the press to push the ball bearings out from the front cover.

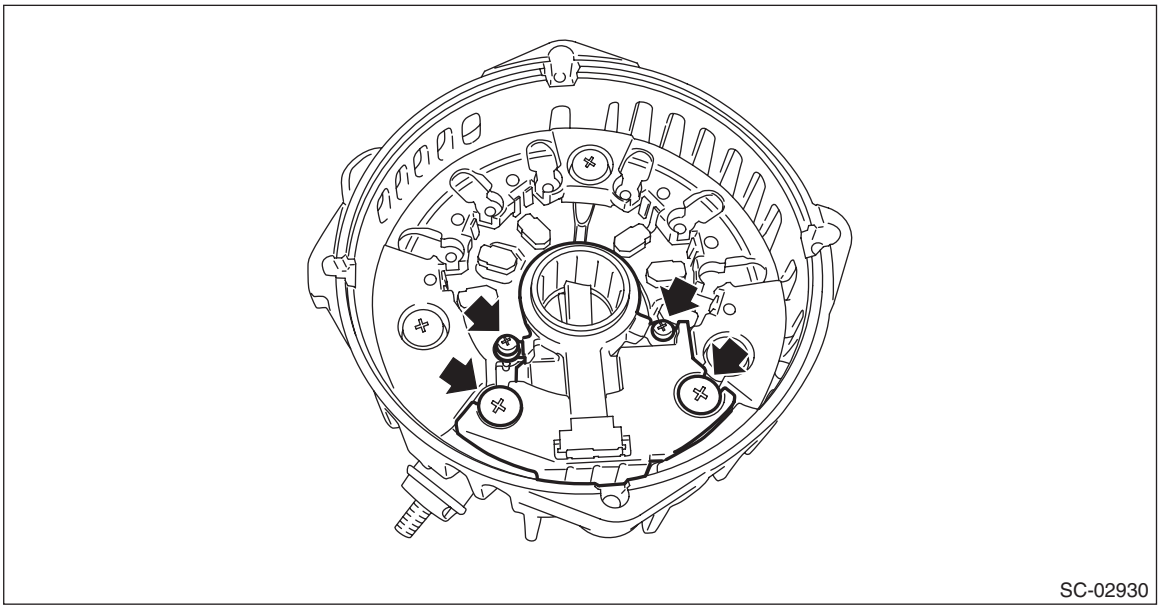
8) Using the bearing puller, remove the bearings from the rotor.


SC-02893

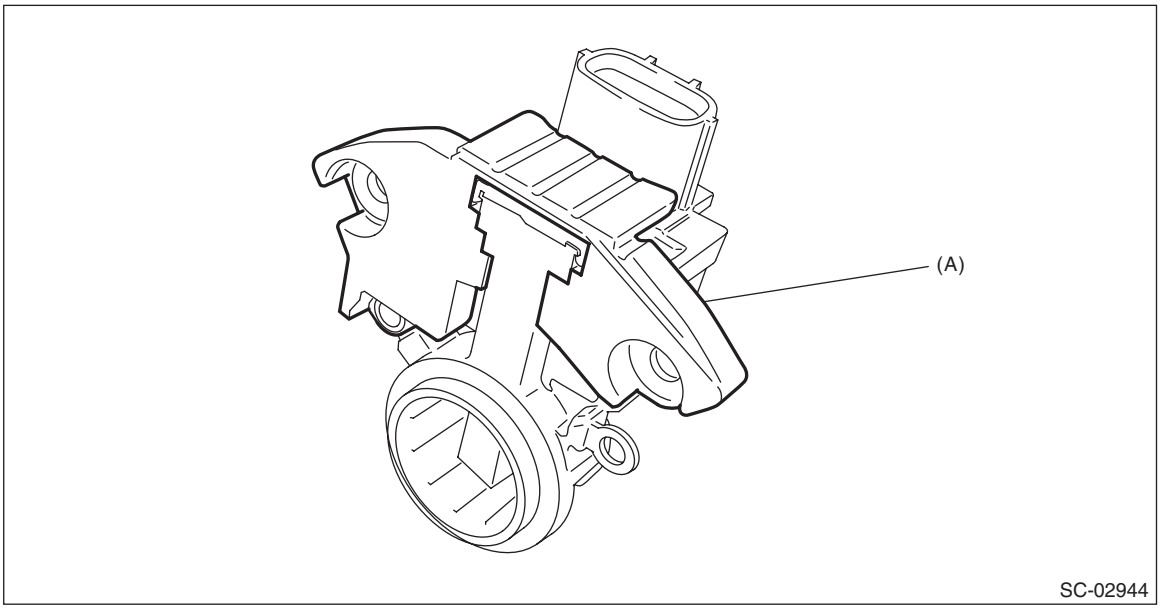
9) Remove six bolts which connect the rectifier and stator coil, then remove the stator coil.


SC-02929

10) Remove four screws which secure the IC regulator to the rear cover, then remove the IC regulator.


SC-02930

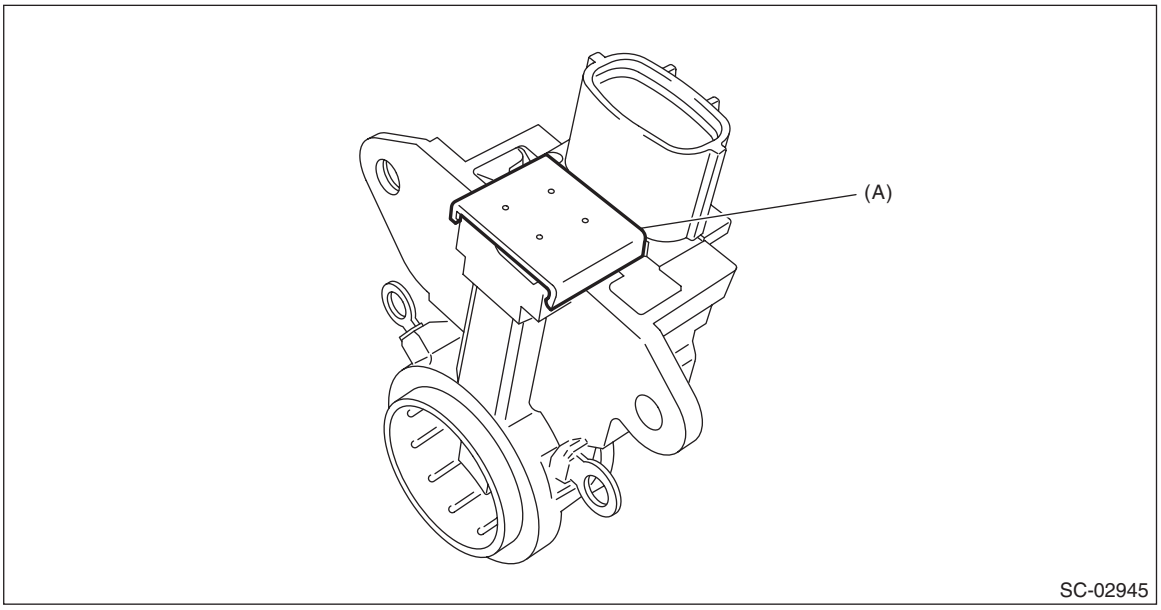
11) Use the following procedures to remove the brush.
(1) Remove the cover A.



SC-02944

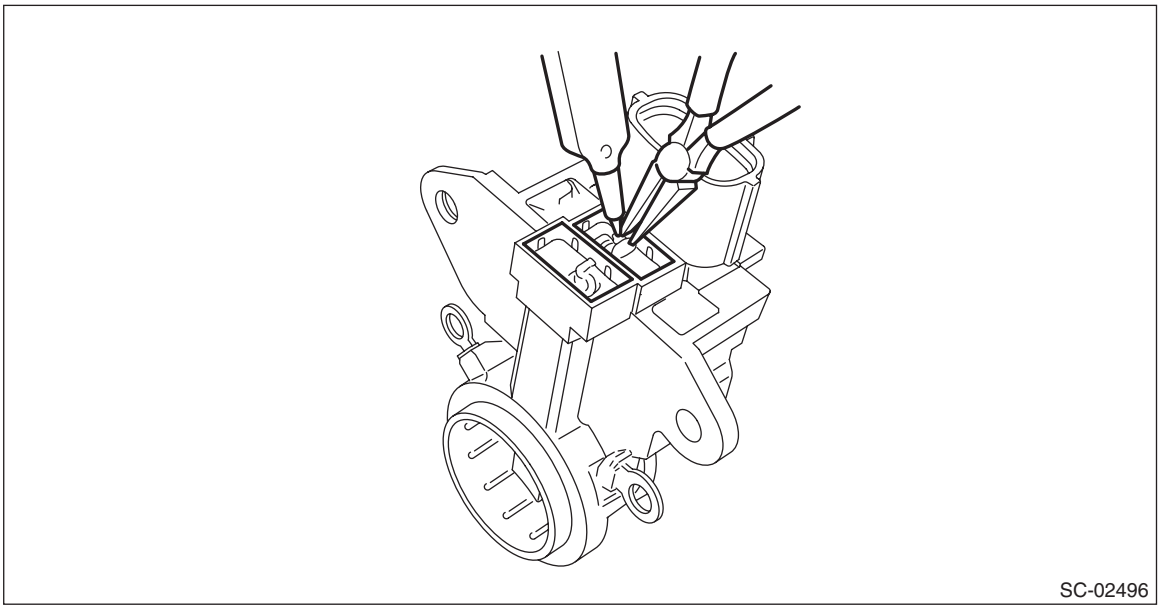
(A) Cover A

(2) Remove the cover B.

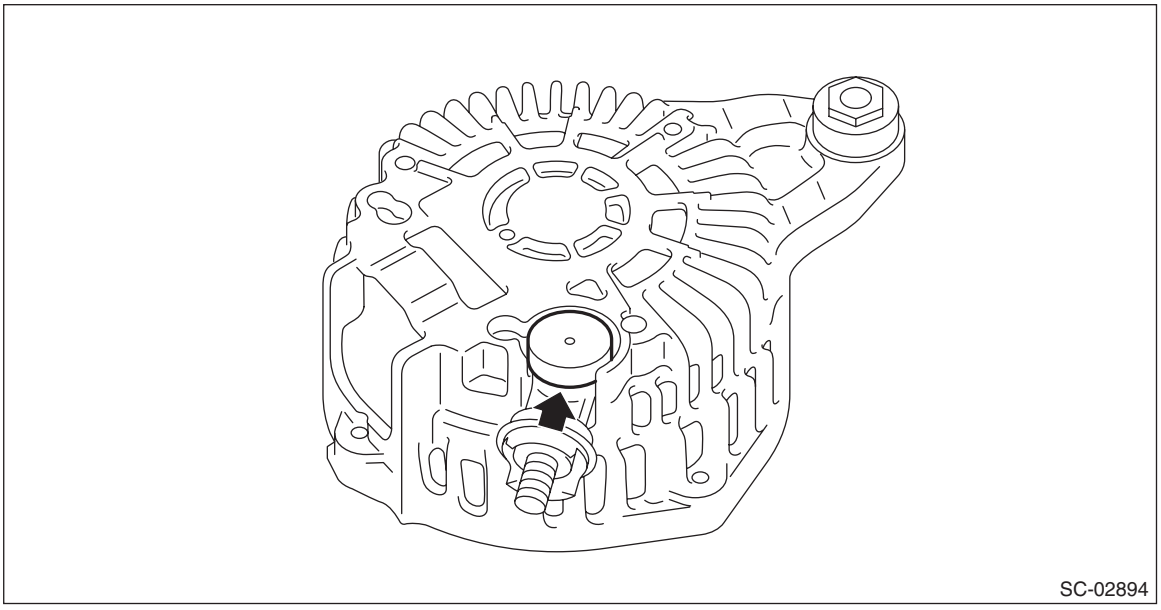


(A) Cover B

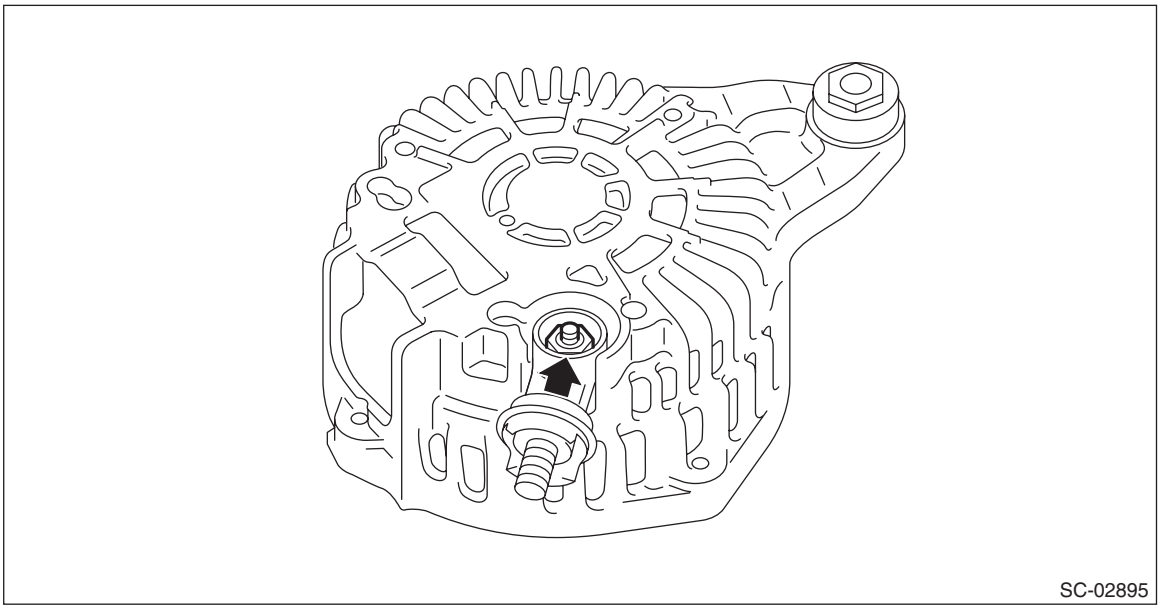
(3) Disconnect the connection and remove the brush.



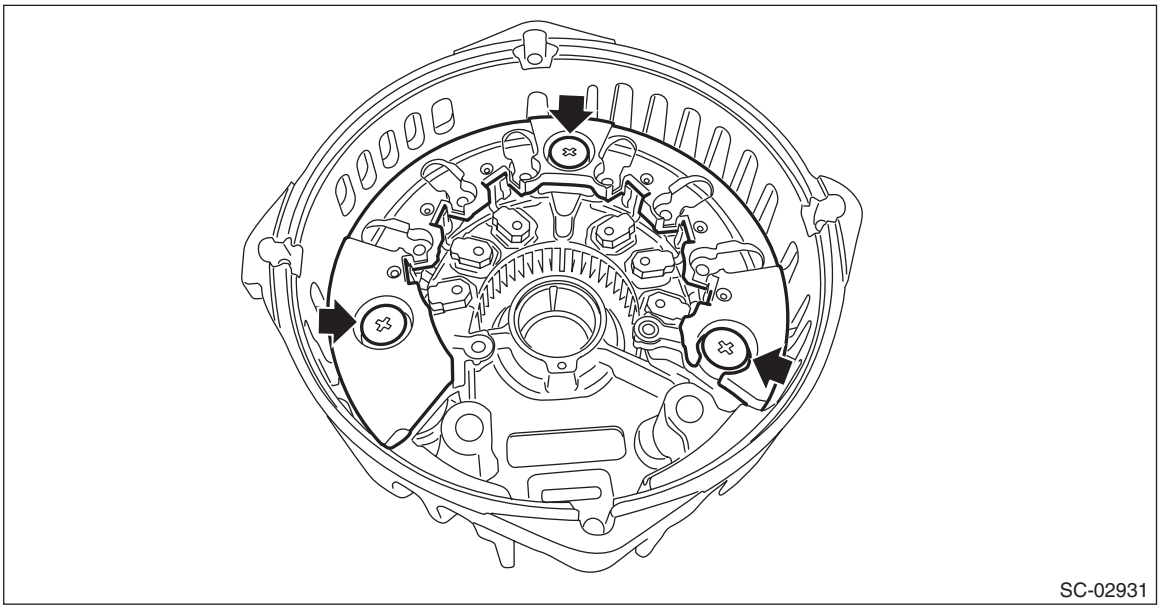
12) Remove the rectifier as follows.
(1) Remove the cover on terminal B.


SC-02894

(2) Remove the nut on terminal B.


SC-02895

(3) Remove the bolts which secure the rectifier, and remove the rectifier.



D: ASSEMBLY

Assemble in the reverse order of disassembly.

NOTE:

- Refer to component for tightening torque of each part. <Ref. to SC(H4DO(w/o HEV))-4, GENERATOR, COMPONENT, General Description.>
- After assembling, manually turn the pulley to check that the rotor rotates smoothly.

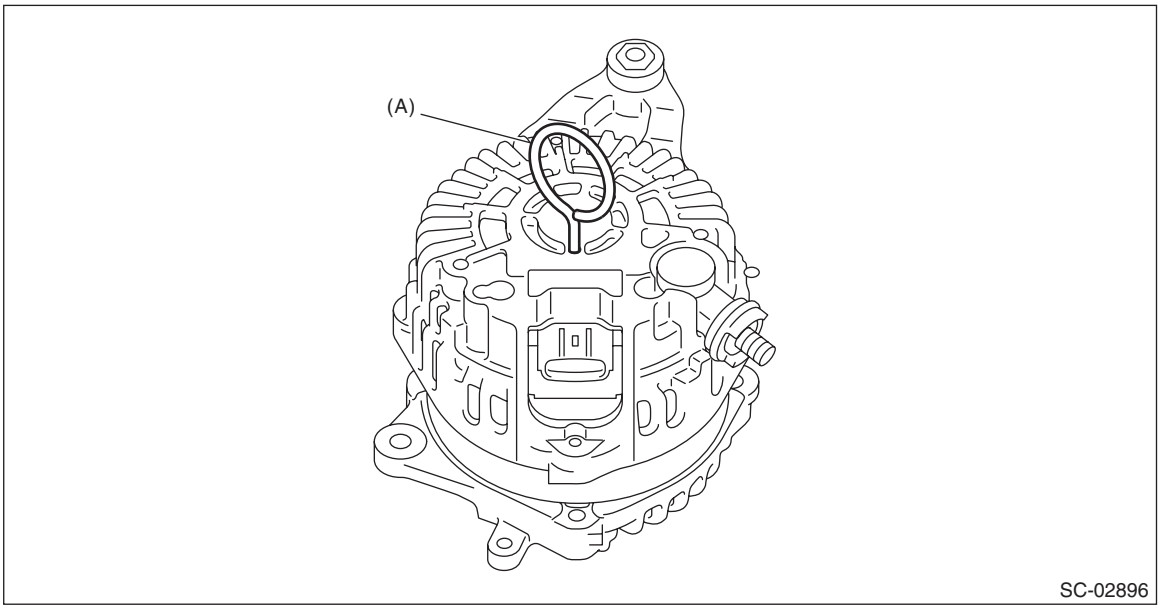
1) Assembling the rear cover and rectifier

Remove old silicone grease on the mating surface of rear cover and rectifier and apply new silicone grease.

CAUTION:
Do not apply silicone grease to the attachment threads of rectifier.

2) Push of the brush
Before assembling the front and rear parts, press the brush down into the brush holder, then fix the brush in that position by inserting a [1 mm (0.0394 in) dia., 40 — 50 mm (1.5748 — 1.9685 in) long] wire through the hole as shown in the figure.

CAUTION:
After assembling, remove the wire.



(A) Wire

3) Install the ball bearings.
   (1) Set the ball bearings in the front cover, then securely install an appropriate tool (such as a socket wrench of proper size) to the bearing outer race.
   (2) Using a press to press the ball bearings into the specified location.
   (3) Install the bearing retainer.
4) Install the bearings.

CAUTION:
Do not apply grease to the bearings. If there is any oil on the bearing box, remove it completely.
   (1) Use a press to install the bearings to the rotor shaft.
   (2) Heat the bearing box in rear cover at 50 to 60°C (122 to 140°F), and then press the bearing into rear cover.

E: INSPECTION

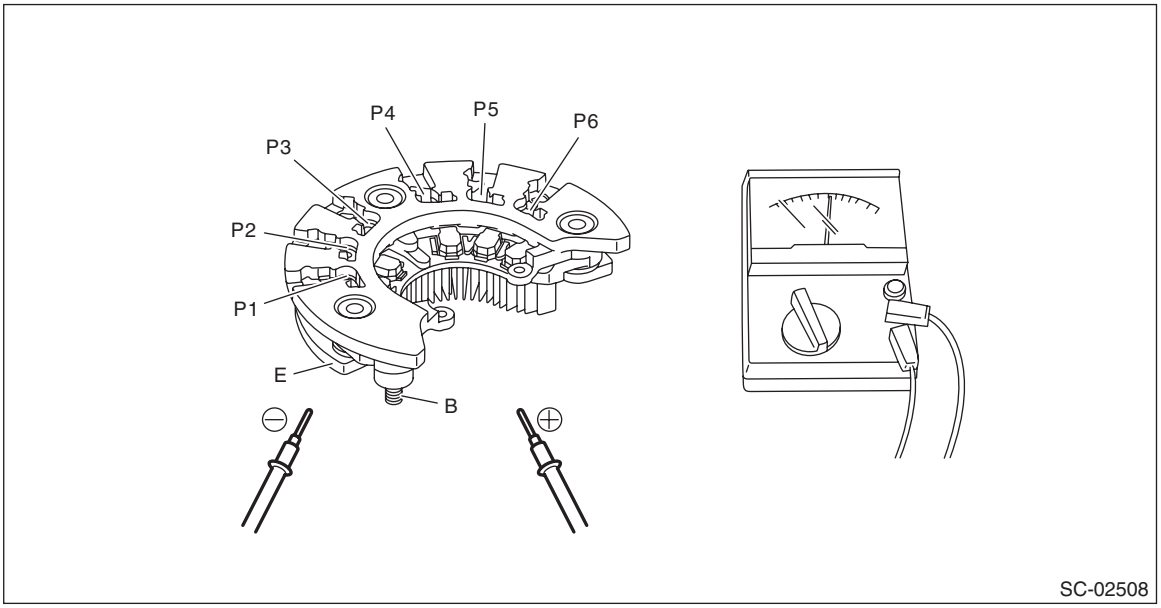
1. DIODE

CAUTION:
There is the possibility of damaging the diodes if a mega-tester (used to measure high voltages) or a similar measuring instrument is used. Never use a mega tester or equivalent for this test.
1) Check for continuity between the diode lead and terminal E or B. If continuity is not as shown in the table, replace the rectifier.
- At analog type tester

Tester lead		Continuity
–lead	+lead	
E	P1, P2, P3, P4, P5, P6	Yes
B		No
P1, P2, P3, P4, P5, P6	E	No
	B	Yes

- At digital type tester

Tester lead		Continuity
–lead	+lead	
E	P1, P2, P3, P4, P5, P6	No
B		Yes
P1, P2, P3, P4, P5, P6	E	Yes
	B	No



2. ROTOR

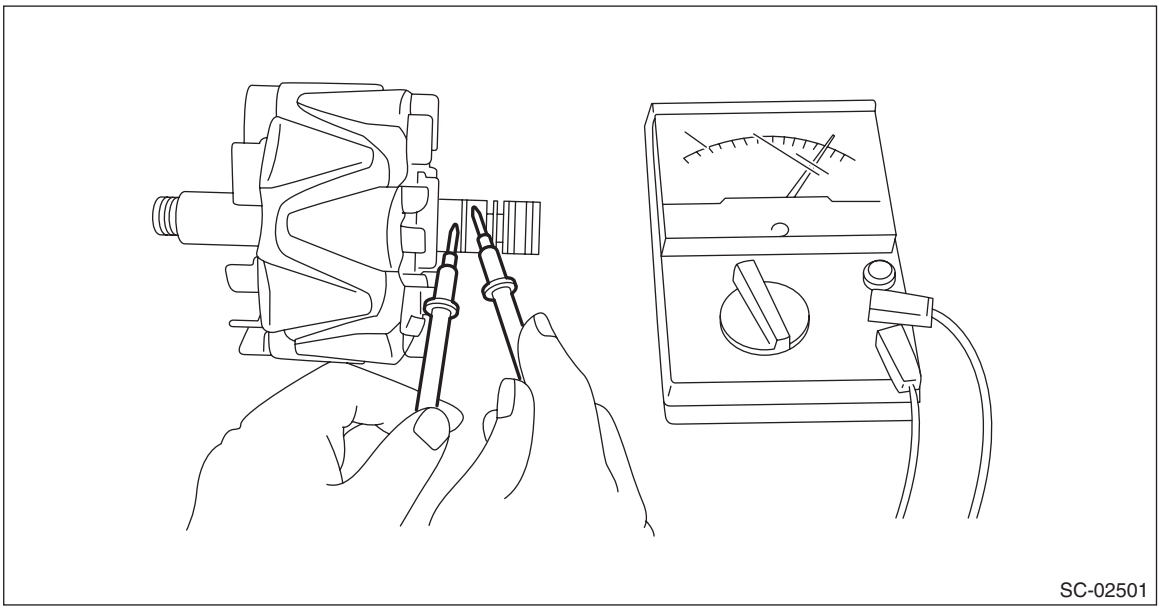
1) Slip ring surface
Inspect the slip rings for contamination or any roughness on the sliding surface. Repair the slip ring surface using a lathe or sand paper.

2) Slip ring outer diameter
Measure the slip ring outer diameter. Replace the rotor if the slip ring is worn.

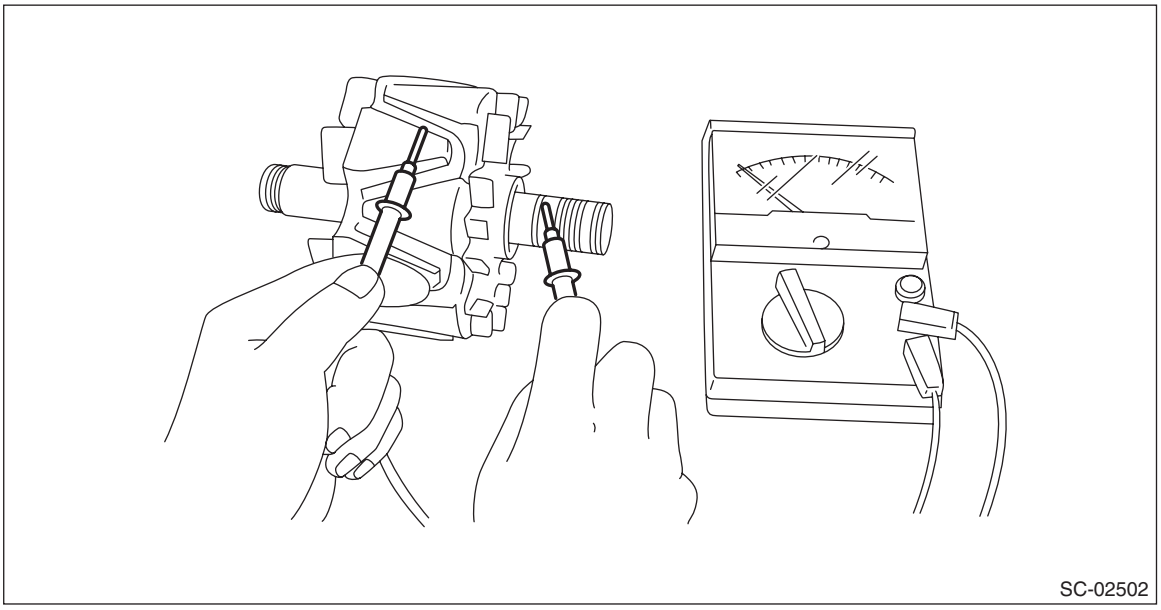
Slip ring outer diameter:
Standard
22.7 mm (0.894 in)
Limit
22.1 mm (0.870 in)

3) Continuity test
Using a circuit tester, check the resistance between slip rings. If the resistance is not within the standard, replace the rotor.

Standard:
Approx. 2.0 — 2.4 Ω


SC-02501

4) Insulation test
Check the continuity between slip ring and rotor core or shaft. If there is continuity, replace the rotor because the rotor coil is grounded.

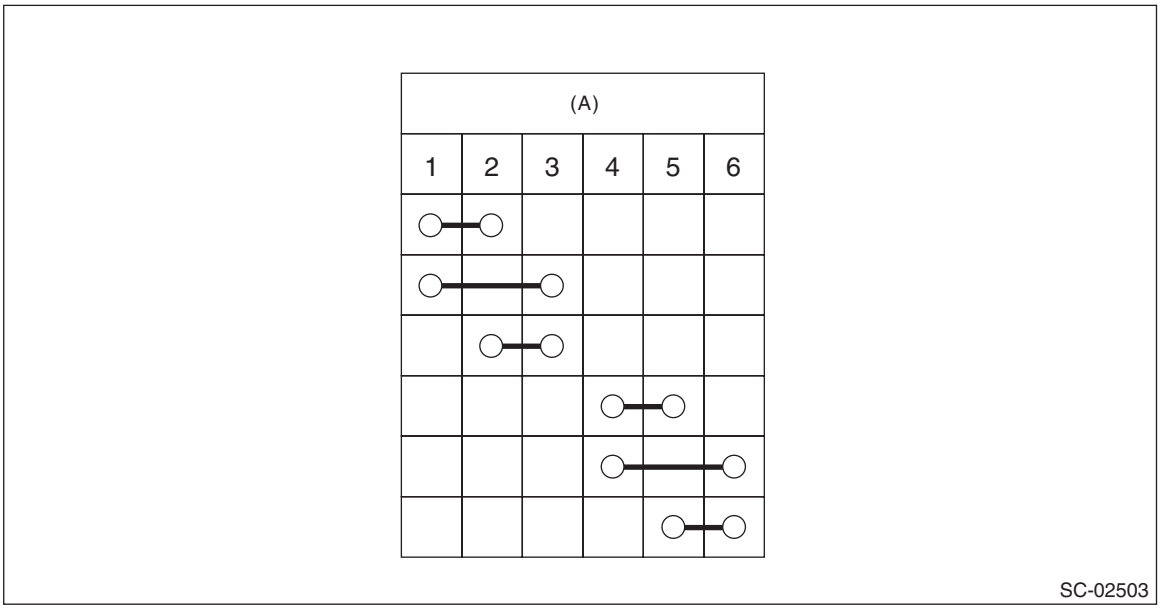

SC-02502

5) Bearing
Check the bearings. If there is any noise, or the rotor does not rotate smoothly, replace the bearings.

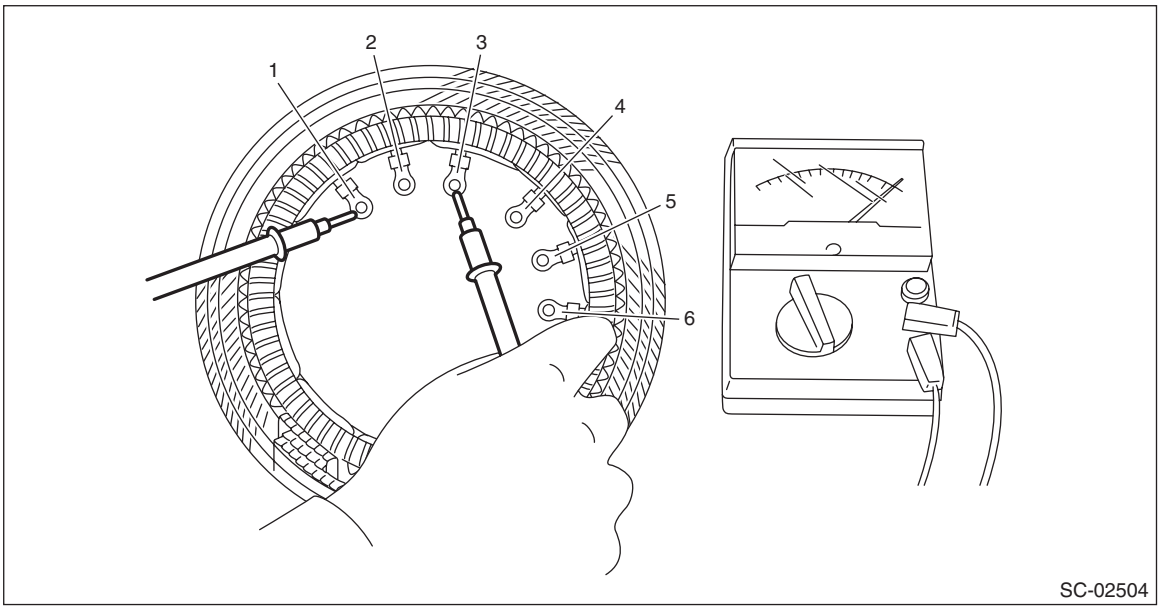
3. STATOR COIL

1) Continuity test

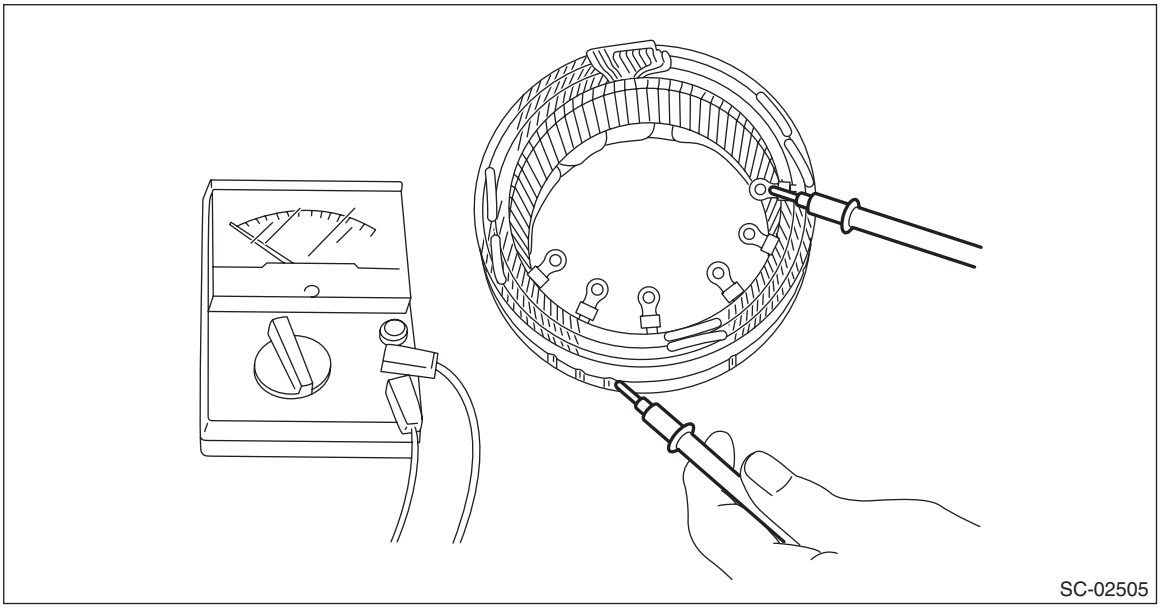
Inspect the continuity between the stator coil terminals. If continuity is not as shown in the table, replace the stator coil.



(A) Terminals



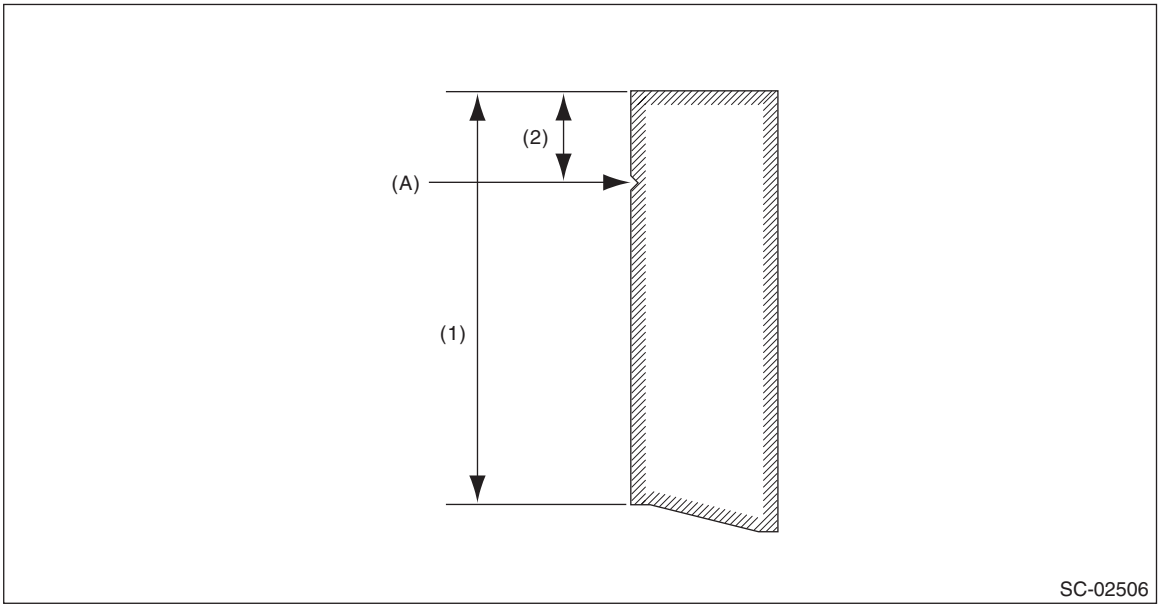
2) Insulation test
Inspect the continuity between the stator coil stator core and lead wire terminals. If there is continuity, replace the stator coil because the stator coil is grounded.


SC-02505

4. BRUSH

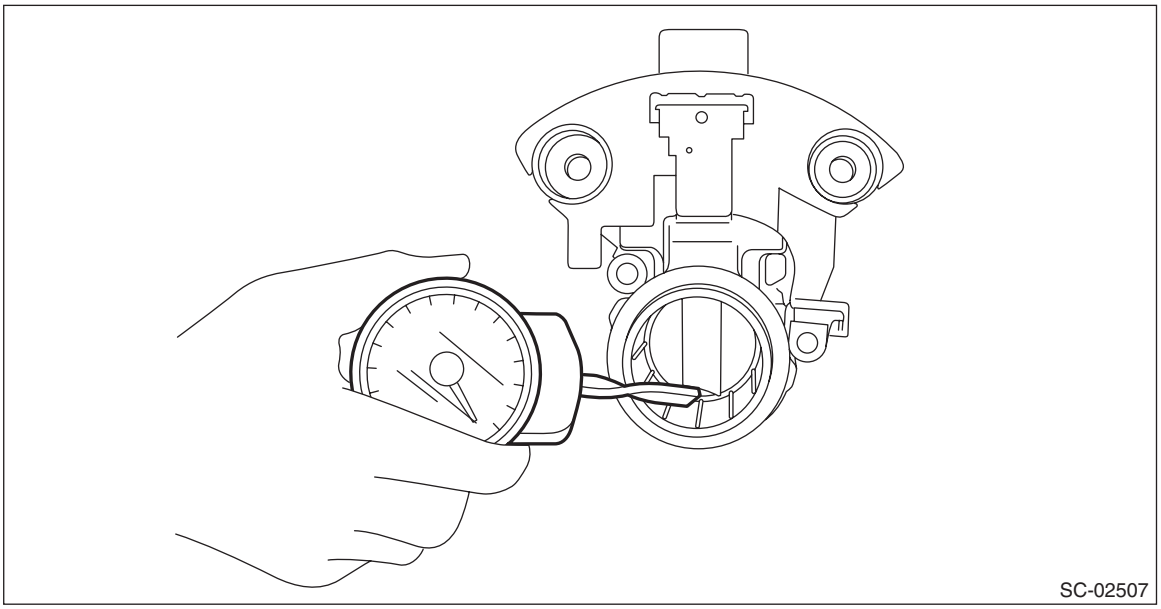
1) Measure the length of each brush. Replace the brush if wear exceeds service limits. There is a service limit mark (A) on each brush.

Brush length:
Standard (1)
22.5 mm (0.886 in)
Limit (2)
5.0 mm (0.197 in)



SC-02506

2) Check that there is appropriate pressure on the brush spring. Using a spring pressure indicator, push the brush into the brush holder until its tip protrudes 2 mm (0.0787 in). Then measure the pressure of brush spring. If the pressure is 1.7 N (173 gf, 6.11 ozf) or less, replace the brush spring. 4.1 — 5.3 N (418 — 540 gf, 14.75 — 19.06 ozf) pressure is required on the new spring.



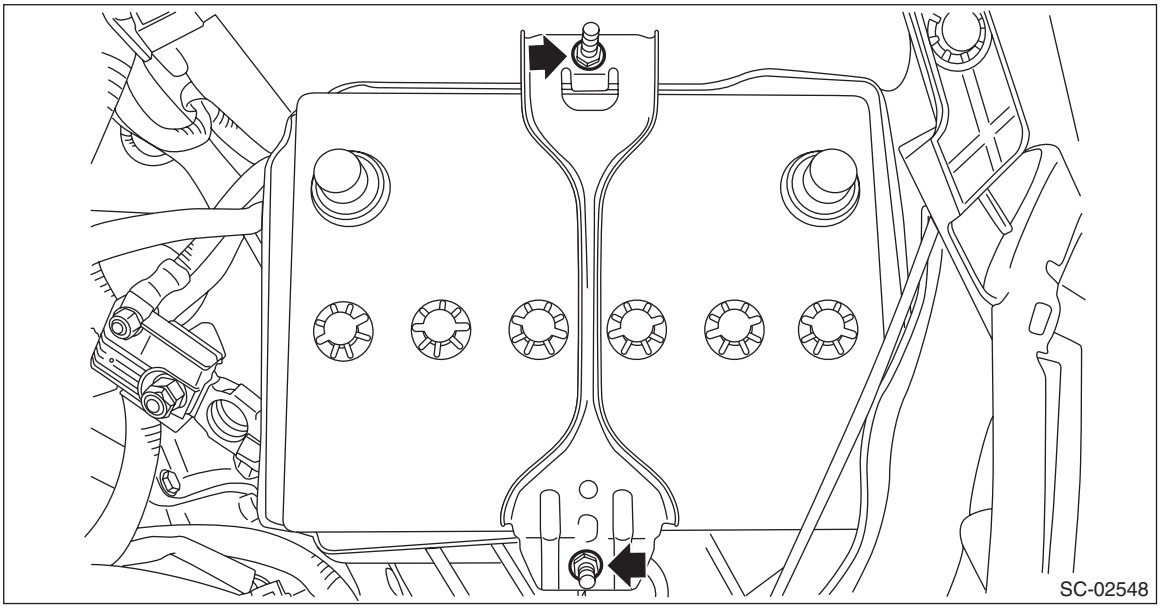
5. BALL BEARING

Check the ball bearings. Replace the ball bearings if there is resistance in the rotation, or if there is any abnormal noise.

4. Battery

A: REMOVAL

1) Disconnect the positive (+) terminal after disconnecting the negative (–) terminal of battery.
2) Remove the battery cable holder from the battery rod.
3) Remove the flange nut from battery rod and remove battery holder.



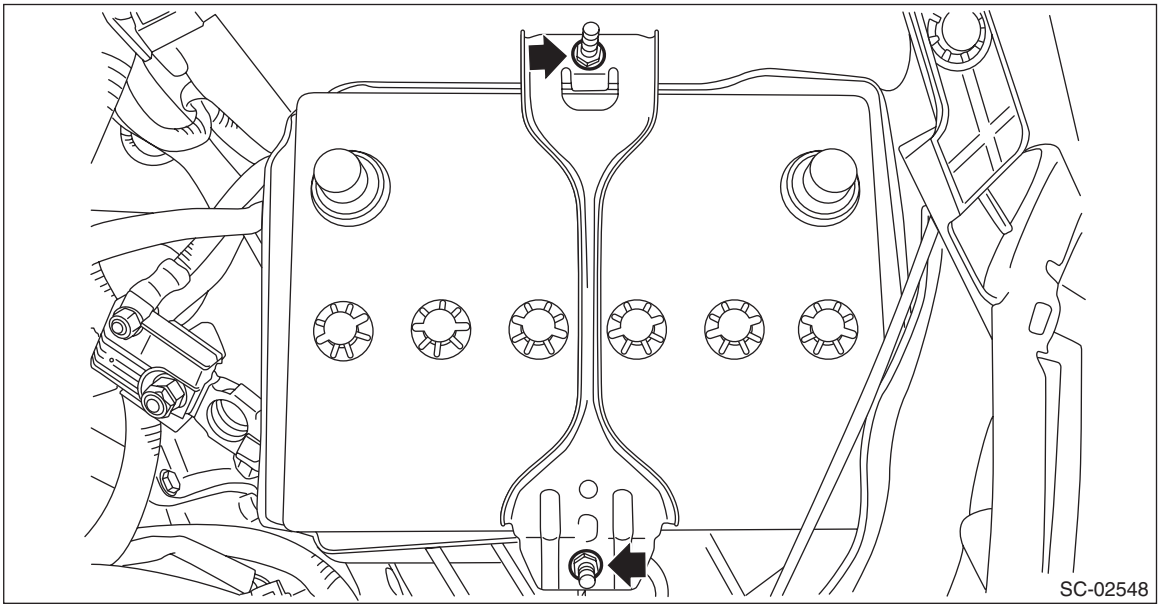
4) Remove the battery.

B: INSTALLATION

CAUTION:
After the battery is installed, initial diagnosis of the electronic throttle control is performed. Wait for 10 seconds or more after turning the ignition switch to ON, and then start the engine.

1) Install the battery.
2) Set the battery holder and install the flange nut to the battery rod.

Tightening torque:
3.5 N·m (0.4 kgf-m, 2.6 ft-lb)



3) Install the battery cable holder to the battery rod.

4) Connect the positive terminal and then connect the negative terminal to the battery.

NOTE:
Clean the battery cable terminals and apply grease to prevent corrosion as necessary.

C: INSPECTION

WARNING:
- **As batteries produce flammable gases, be careful not to bring an open flame close to the batteries.**
- **Ventilate sufficiently when using or charging battery in enclosed space.**
- **Electrolyte is corrosive acid, and has toxicity; be careful of handling the fluid.**
- **For safety, in case an explosion does occur, wear eye protection or shield your eyes when working near any battery. In addition, never lean over the battery.**
- **Be careful that the electrode does not come into contact with skin, eyes or clothing. Especially at contact with eyes, flush with water for 15 minutes and get prompt medical attention.**
- **Be careful not to let the electrode contact with the coated parts.**
- **Before starting work, remove rings, metal watch-bands, and other metal jewelry.**
- **Be careful not to let the metal tools contact the positive battery terminal and anything connected to it. When the operation using a metal tool to the positive terminal or anything connected to it is required, disconnect the battery ground terminal before starting the operation.**

1. APPEARANCE

Check the battery case, top cover and terminal post for contamination or cracks and perform the following procedures as necessary.
- Clean the battery with water and wipe with a dry cloth.
- Apply a light coat of grease to the terminal post to prevent corrosion.

Check

- ***Normal → Go to the check item 2.***
- ***Abnormal → Replace the battery.***

2. ELECTROLYTE LEVEL

Check the electrolyte level in each cell.

CAUTION:
Do not fill beyond MAX level.

NOTE:
If the level is below the middle point between MIN level and MAX level, pour distilled water into the battery cell to bring the level to MAX.

Check

- ***MAX level → Go to the check item 3.***
- ***Below the middle point between MIN level and MAX level → Fill → Go to the check item 3.***

3. SPECIFIC GRAVITY OF ELECTROLYTE

Check the specific gravity of the electrolyte using a hydrometer and a thermometer.

NOTE:

- Specific gravity varies with temperature of electrolyte so that it must be corrected at 20°C (68°F) using the following calculation:

S_{20} = St + 0.0007 × (t – 20)

S_{20}: Specific gravity corrected at electrolyte temperature of 20°C

St: Measured specific gravity

t: Measured temperature (°C)

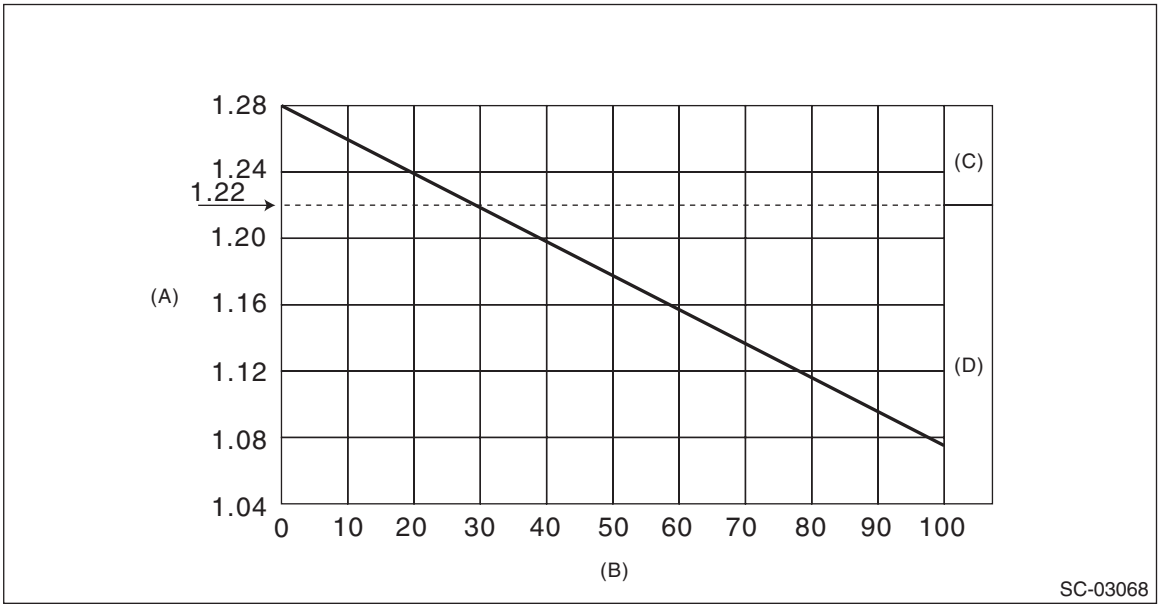
- When measuring in a simplified manner using the battery terminal voltage, calculate the specific gravity by the following formula.

Specific gravity = [0.187 × battery terminal voltage (V)] – 1.1

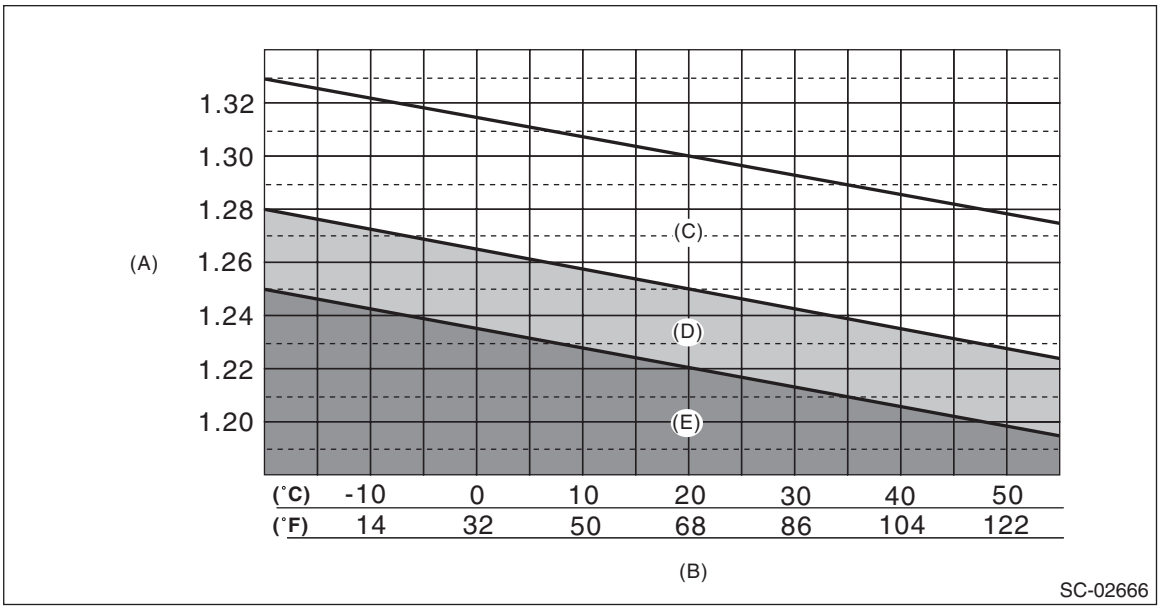
Perform the steps 1) and 2) before measuring the voltage in order to stabilize the voltage.

1) Turn the ignition switch to OFF and illuminate the headlight for 30 seconds.
2) After turning off the headlight, leave the vehicle for one minute.

- Measuring the specific gravity of the electrolyte in the battery will disclose the state of charge of the battery. The relation between specific gravity and state of charge is as shown in the figure.



(A) Specific gravity [20°C (68°F)] (B) Amount of discharge (%) (C) Good
(D) Need to charge or replace



(A) Specific gravity [20°C (68°F)] (B) Electrolyte temperature (C) Good
(D) Caution (E) Need charging

Check

- ***Specific gravity: 1.250 — 1.290, and difference between cells is 0.04 or less → Battery is normal***
- ***Specific gravity: Less than 1.250, or difference between cells is 0.04 or more → Battery needs to be charged or replaced***

4. STANDBY CURRENT

1) Prepare the circuit tester which can measure down to 1 mA.

NOTE:
For models with keyless access function, the standby current changes regularly. Therefore, prepare an analog type circuit tester.

2) Using the circuit tester, check the standby current.
   (1) Check the battery. <Ref. to SC(H4DO(w/o HEV))-53, APPEARANCE, INSPECTION, Battery.> <Ref. to SC(H4DO(w/o HEV))-53, ELECTROLYTE LEVEL, INSPECTION, Battery.> <Ref. to SC(H4DO(w/o HEV))-54, SPECIFIC GRAVITY OF ELECTROLYTE, INSPECTION, Battery.>

NOTE:
The standby current may be displayed lower than the actual value if the battery is weak, so be sure to check the battery. Charge or replace if necessary.

   (2) Check that the fuse is not blown out and is properly inserted.
   (3) When non-genuine electrical parts (including parts sold in authorized workshops) are installed, remove all parts except for genuine electrical parts.
   (4) Check that back-up fuse is inserted. <Ref. to PI-4, FUSE INSTALLATION, PRE-DELIVERY INSPECTION (PDI) PROCEDURE, Pre-delivery Inspection.>
   (5) Start the engine, and set the switch positions for each system as shown in the following table.

NOTE:
Some of the listed systems are not equipped depending on the vehicle. Set only the systems equipped on the vehicle to the positions as shown.

System	Position
Headlight	ON or Auto
Fog light	ON
Wiper (front and rear)	ON or Low speed
Audio and navigation system	ON
Rear defogger	ON
Room light	DOOR
Luggage light	DOOR
Map light	OFF
Auto A/C	ON (AUTO)
Manual A/C	ON (Speed 1)
Electronic parking brake	ON
Electrical parts other than listed above (electrical parts that users can confirm the operation with the key removed)	OFF

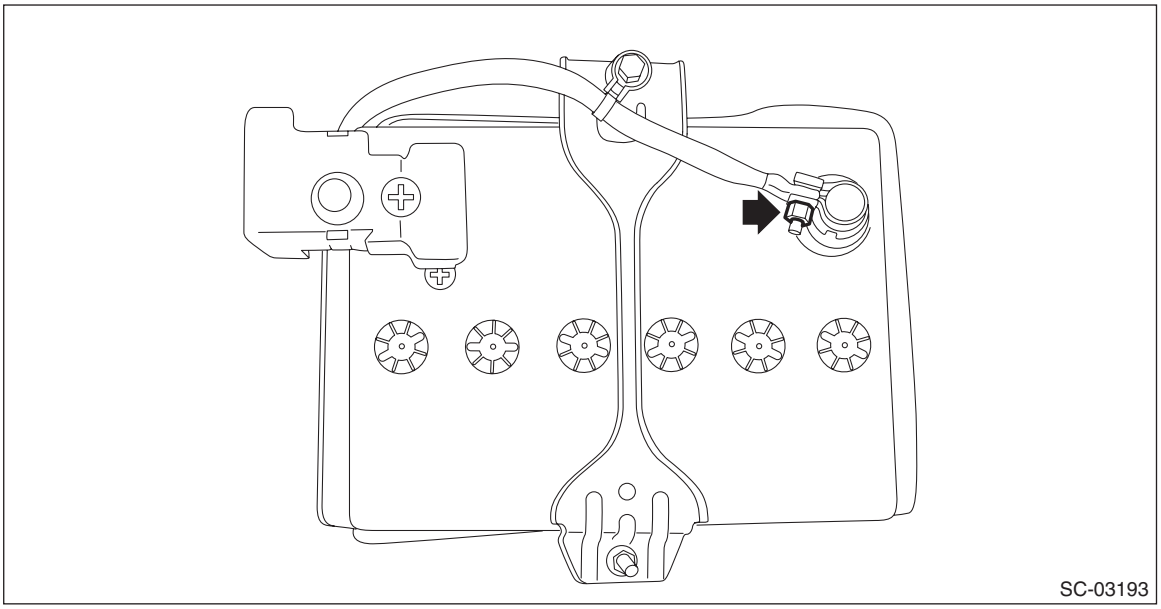
   (6) Turn the ignition switch to OFF.
   (7) Operate the front hood lock release lever to unlock the front hood.
   (8) Close all the doors (including rear gate and trunk lid) and then lock the doors. (Security alarm is in set condition)

NOTE:
For models with keyless access function, take the access key 1.5 m or more away from the vehicle after the door lock. And do not put the access key close to the vehicle while measuring the standby current.

   (9) Wait for 5 minutes after door lock until the standby current stabilizes.

(10) Loosen the nut which holds the ground terminal to the battery.

NOTE:
Do not remove the ground terminal.

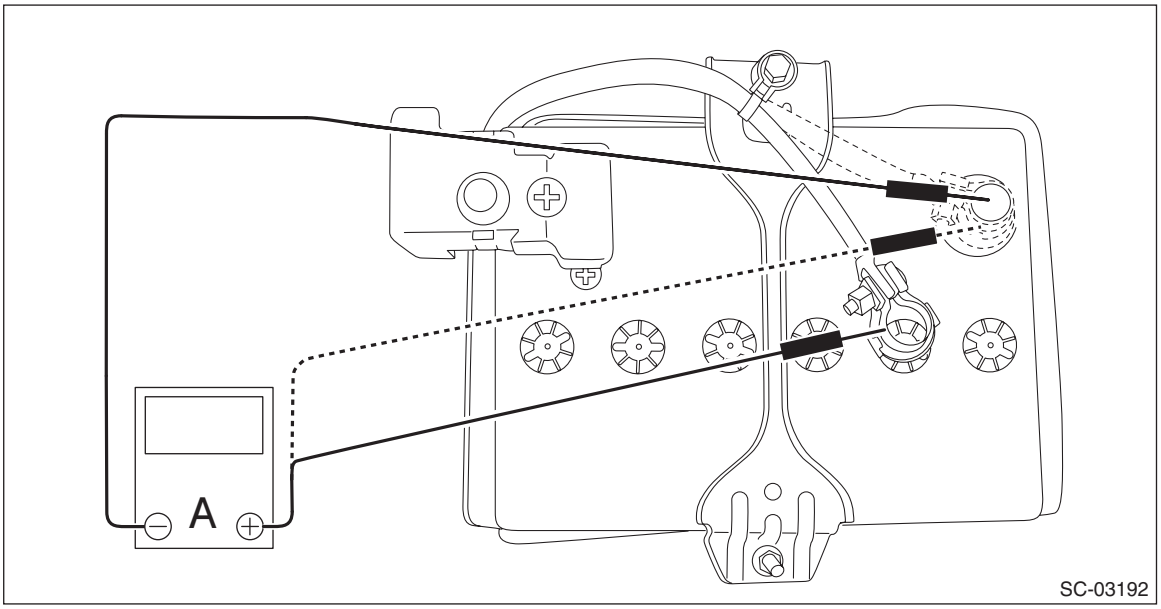


(11) Connect the circuit tester positive terminal to the ground terminal.

NOTE:
To prevent the damage to the circuit tester, set the circuit tester range to a large value first, then gradually change it to smaller values.

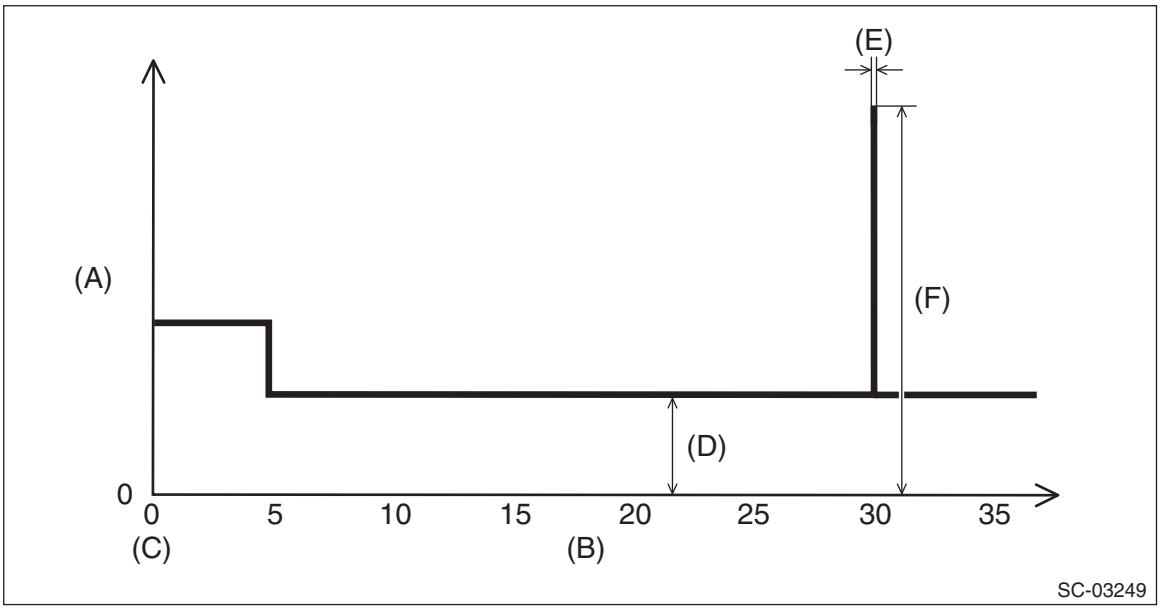
(12) Connect the circuit tester negative terminal to the ground terminal installation part of the battery.

(13) While connecting the circuit tester positive terminal with the ground terminal as shown in the figure below, remove the ground terminal from the battery.



(14) Check the standby current.

NOTE:
• For models with keyless access function, the standby current changes periodically because the keyless access system continuously searches the access key (polling).
• When measuring the standby current, the reading of the circuit tester oscillates. Therefore, read the average value (median value).
• The standby current may become large when the vehicle system is activated 5 times at 30-minute intervals or 5 hours after turning the ignition switch to OFF. Therefore, the measurement should be completed in 20 minutes. If it takes more than 20 minutes, start the engine once, stop the engine, then perform the inspection.



(A)	Current/mA	(B)	Time/minute	(C)	Ignition OFF
(D)	Less than 70 mA	(E)	5 seconds (system operation)	(F)	300 mA or more

Check

- ***When the maximum measurement value is less than 70 mA → Standby current is normal.***
- ***When the maximum measurement value is 70 mA or more → Go to step (15).***

(15) Remove all fuses one by one to identify which system changes the standby current value significantly. <Ref. to WI(HEV)-21, Power Supply Circuit.>
(16) Check the harness and connector of the system whose standby current has changed significantly.

D: CHARGE

WARNING:
• Do not bring an open flame close to the battery when working.

CAUTION:
• Prior to charging, corroded terminals should be cleaned with a brush and common caustic soda solution.
• Be careful while charging the battery because it produces flammable gasses.
• Observe instructions when handling the battery charger.
• Before charging the battery on the vehicle, disconnect the battery ground terminal to prevent damage of generator diodes or other electrical units.

1. NORMAL CHARGE (CONSTANT CURRENT CHARGE)

Charge the battery with the current value specified by manufacturer or with approximately 1/10 of battery's rating capacity. (See the table below.)

Battery size	Charging current (A)	CCA (A)
55D23L	4.0 — 5.0	390

CAUTION:
• The charge control feature and specifications for judgment of charge completion depend on the device. Follow the instruction manual of the charger used.
• Keep the electrolyte temperature at 45°C (113°F) or less while charging. Stop charging when the temperature exceeds this value.

NOTE:
The characteristics of typical charging methods are as follows.
• Constant current charging
This method makes it easy to charge to 100%, since the electrolyte is agitated by the gassing occurred at the end of charging. However, the time for charging is comparatively long because the current value is kept constant.
• Constant voltage charging
This method completes charging in a short period of time due to the large current. However, it is difficult to charge to 100% because no gassing occurred at the end of charging and the electrolyte is not agitated. Therefore, the combined use with the constant current charging is preferable.
• Quasi-constant voltage charging
This method is widely used for commercially available chargers.
Compared to the constant voltage charging whose charging current at the beginning of charging becomes large, it reduces the charging current by lowering the voltage at the initial stage, resulting in battery load reduction. The time for charging is comparatively long. However, this type of chargers can be manufactured comparatively inexpensive due to the simple control circuit (or manual settings). After the initial stage of charging is completed, it gradually raises the charging voltage so that the charging current is within the specification, until the battery is fully charged.
• Constant voltage/current charging
In addition to the constant voltage charging, this method controls the upper limit of the current.
The constant current charging is applied at the beginning of charging, and the constant voltage charging is applied at the end. This makes battery charge comparatively efficient in a short period of time. Charging by generators is similar to this method.
Judgment of charge completion
1) Specific gravity of electrolyte should be held within the specific range of 1.250 — 1.290 for one hour or more.
2) Voltage while charging should be held within the specified range of 15.0 — 16.8 V for one hour or more.
3) Gas is actively generated in all cells.
4) The amount of charge reaches 1.2 — 1.5 times of the amount of discharge.

NOTE:
The amount of discharge/charge can be calculated by the following formula.
Amount of discharge (Ah) = Remaining capacity (%) calculated by specific gravity × 5 hour rate capacity (Ah)
Amount of charge (Ah) = Charging current value (A) × Time for charging

2. QUICK CHARGING

Charge the battery in a short period of time with a relatively large current by using a quick charger.
Charge the battery with the current value at approximately 1/2 of battery's rating capacity. (See the table below.)

CAUTION:
• Quick charging is accompanied by a large amount of heat generation. Charging should be completed in up to 30 minutes regardless of battery size.
• Quick charging is used to recover the battery until it can start the vehicle. For full charging, use the normal charging method.
• Keep the electrolyte temperature at 55°C (131°F) or less while quick charging. Stop charging when the temperature exceeds this value.

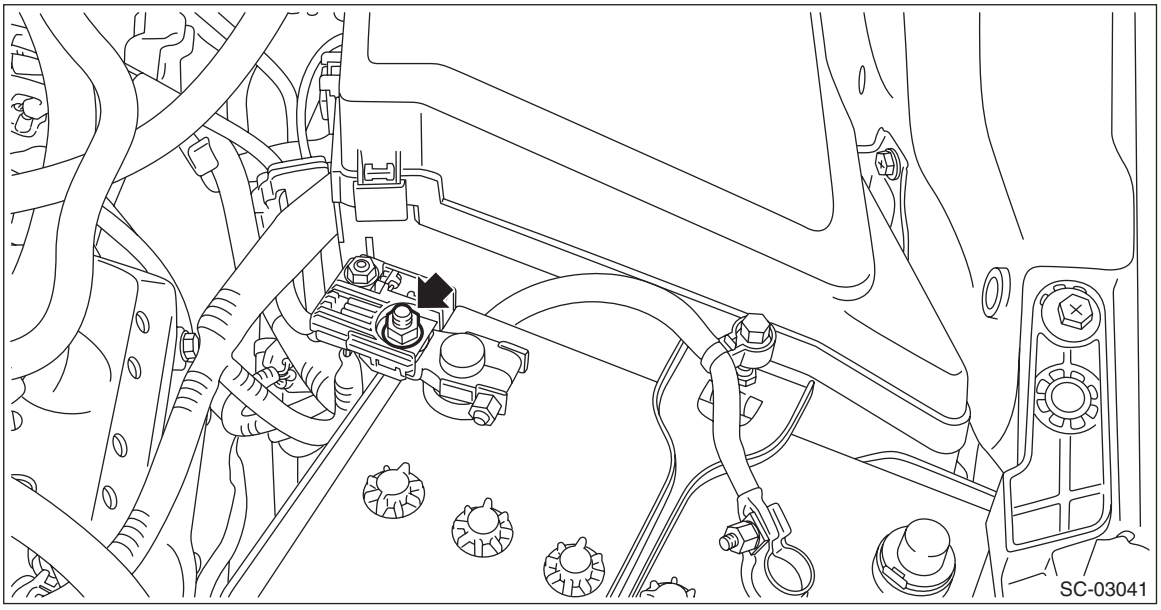
Battery size	Charging current (A)	CCA (A)
55D23L	20.0 — 25.0	390

5. Battery Current & Temperature Sensor

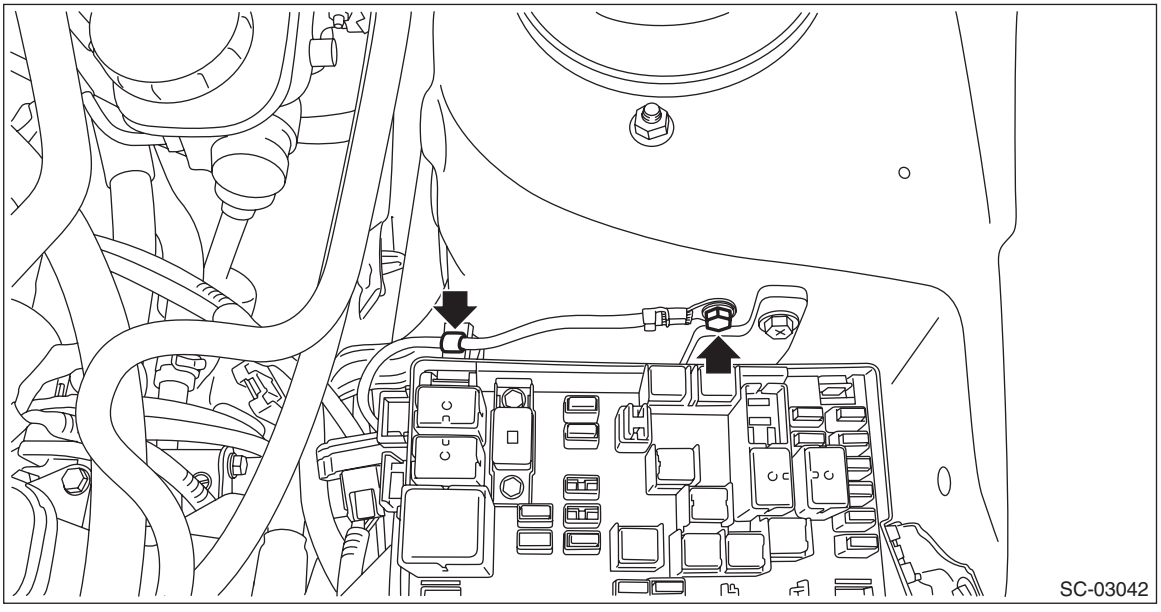
A: REMOVAL

1. BATTERY CURRENT SENSOR

NOTE:
Remove the battery current sensor and battery cable as a unit.
1) Disconnect the battery ground cable and remove the clip from the battery rod.
2) Remove the battery terminal boot.
3) Remove the nuts, and then remove the terminal fuse assembly.

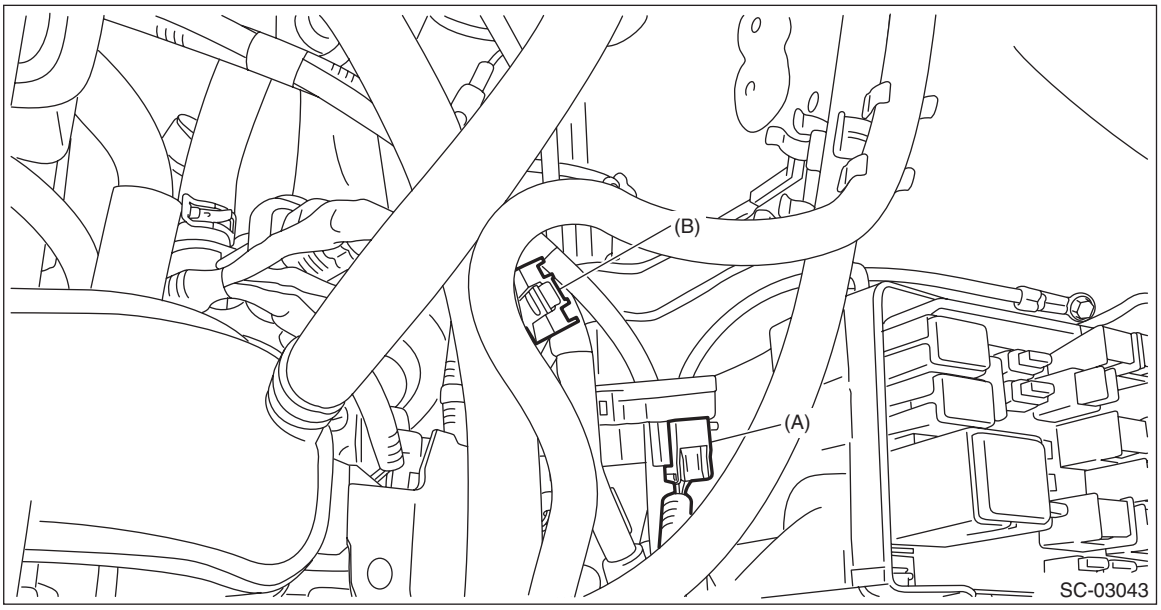


4) Remove the ground terminal from the vehicle and remove the harness clip.

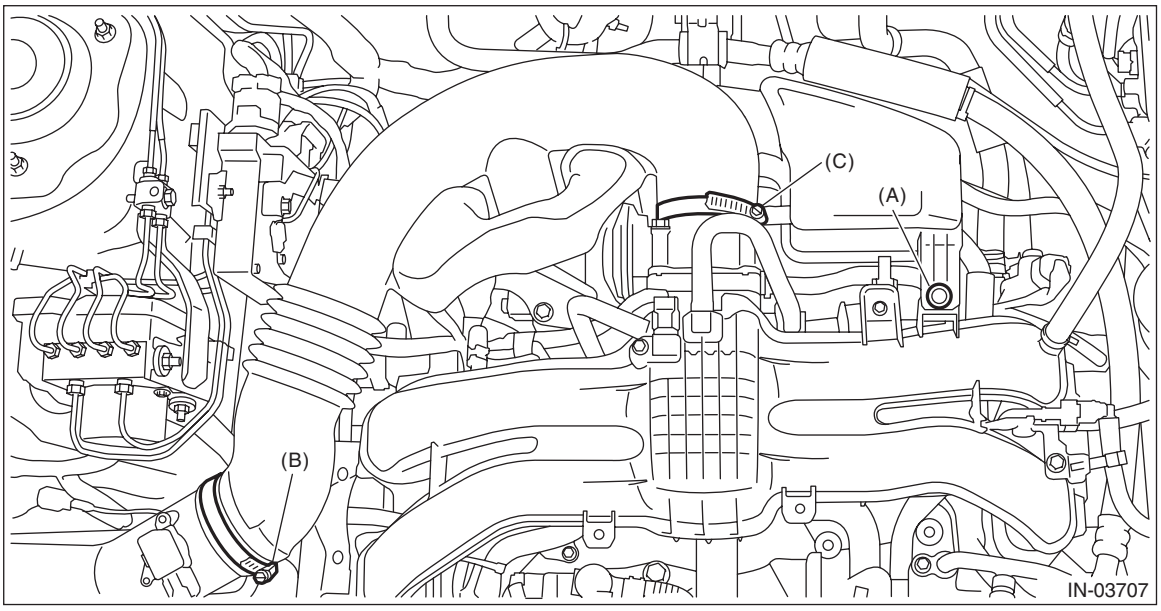


5) Disconnect the harness connector (A) from the battery cable.

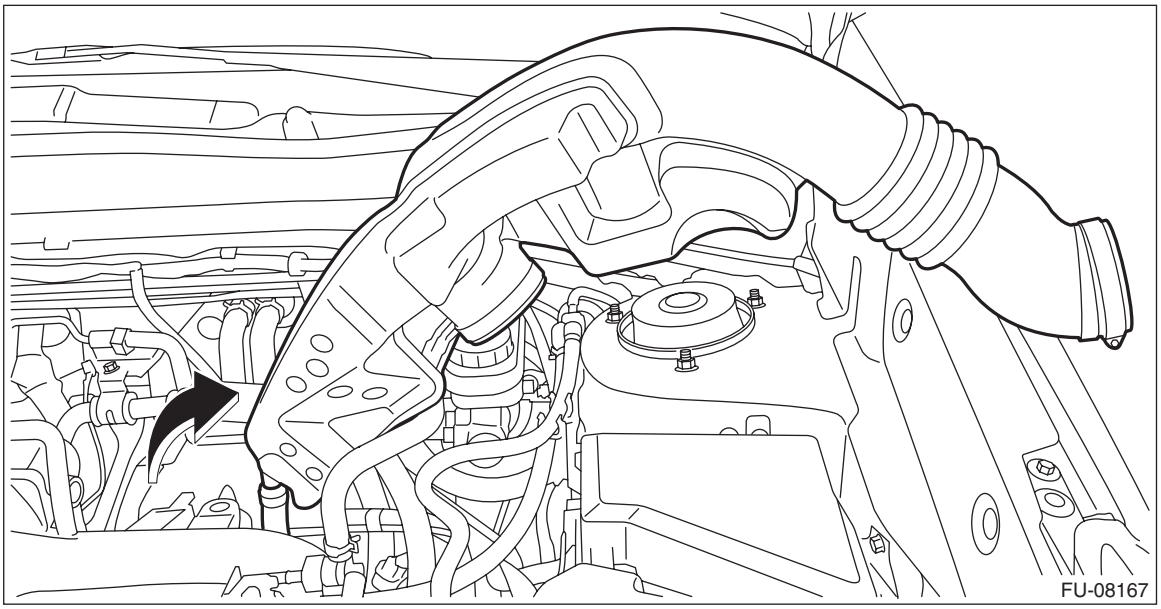
6) Remove the battery cable clip (B) from the battery cable bracket.



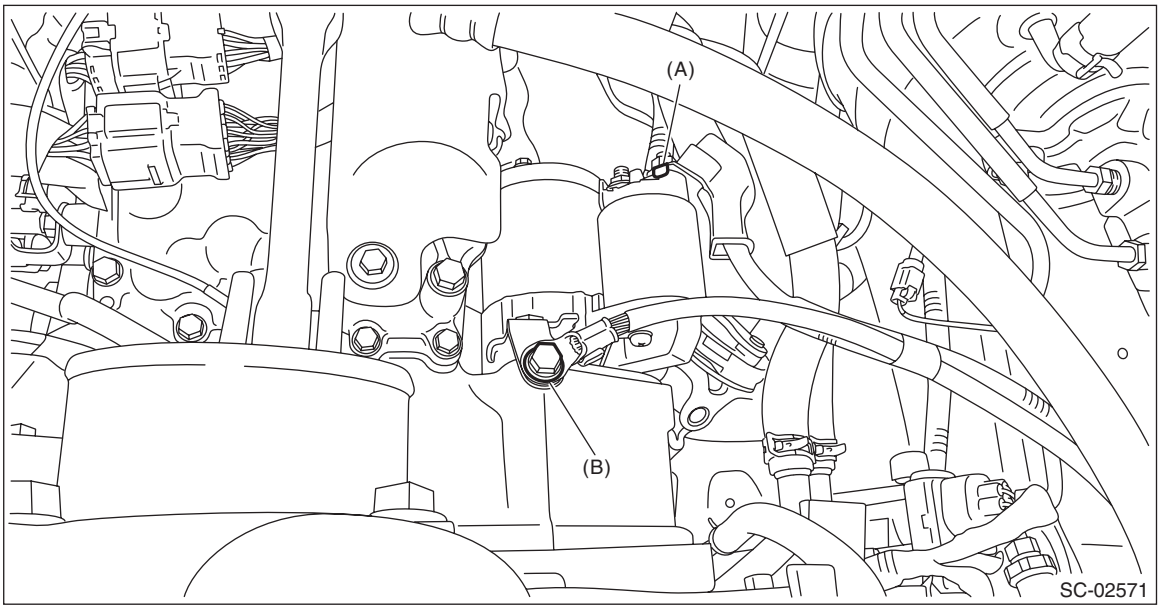
7) Remove the clip (A) from the air intake boot.
8) Loosen the clamp (B) securing the air cleaner case (rear) to the air intake boot.
9) Loosen the clamp (C) which secures the throttle body to the air intake boot.



10) Remove the air intake boot from the throttle body, and move the air intake boot to the left side wheel apron.

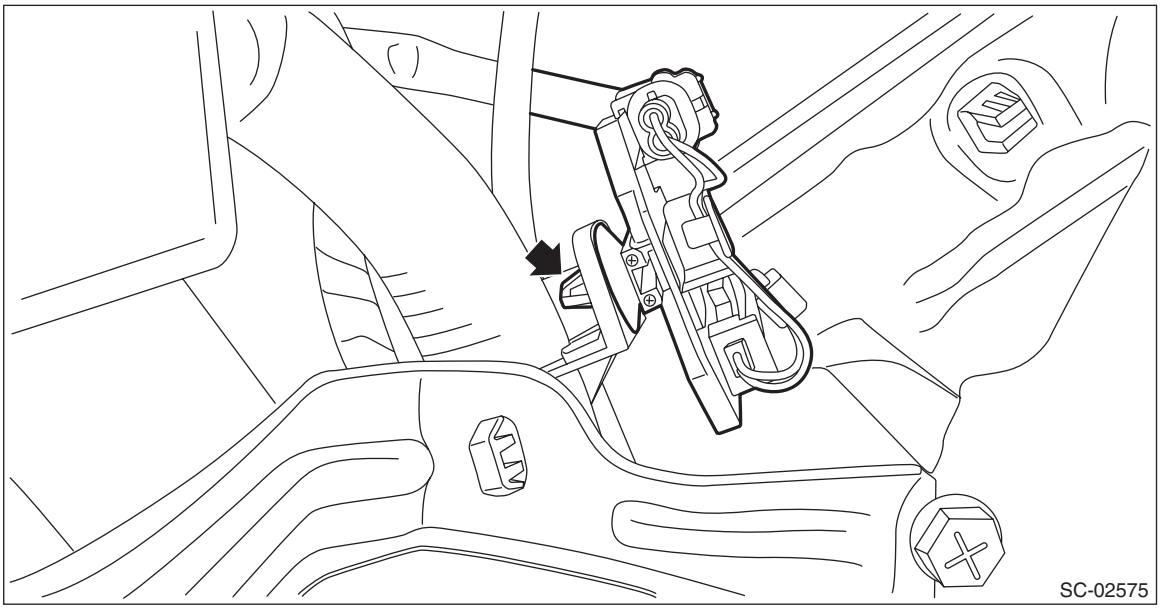


11) Remove the terminal B (A) from the starter.
12) Remove the starter ground cable (B) and remove the battery cable.

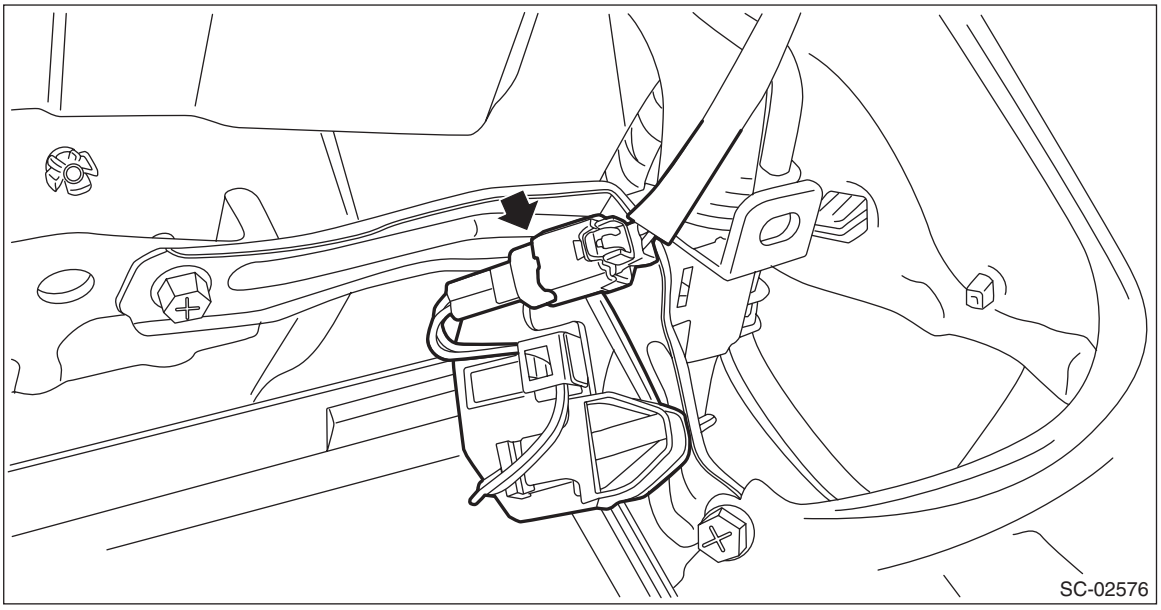


2. BATTERY TEMPERATURE SENSOR

1) Remove the battery. <Ref. to SC(H4DO(w/o HEV))-52, REMOVAL, Battery.>
2) Remove the clip, and remove the battery temperature sensor from the bracket.



3) Disconnect the connector and remove the battery temperature sensor.

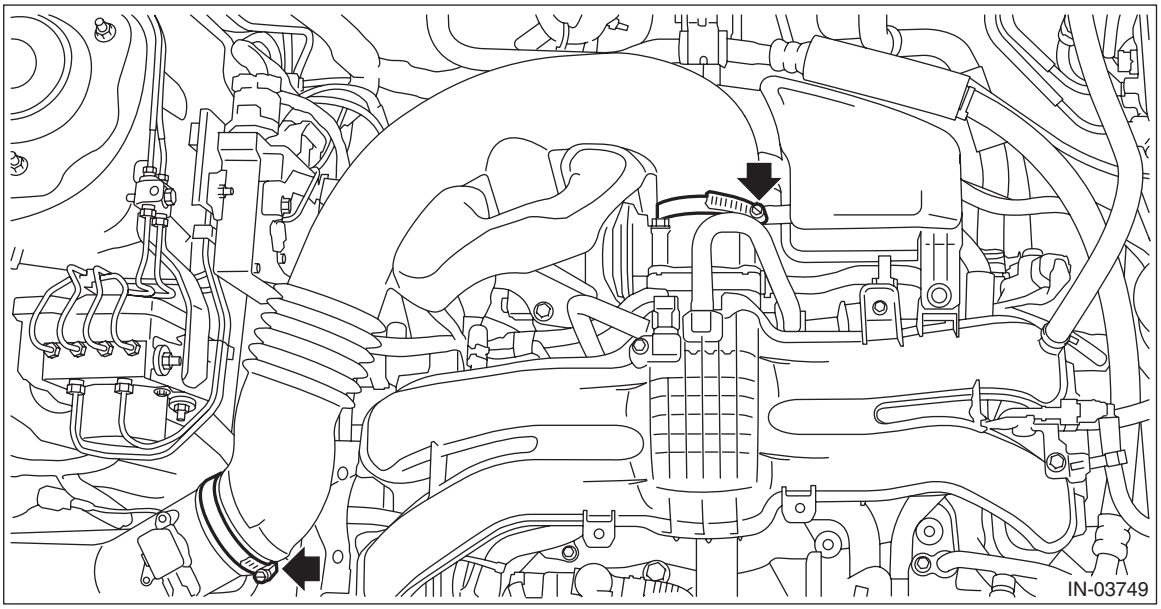


B: INSTALLATION

1. BATTERY CURRENT SENSOR

Install in the reverse order of removal.

Tightening torque:
<Ref. to SC(H4DO(w/o HEV))-6, BATTERY CURRENT & TEMPERATURE SENSOR, COMPONENT, General Description.>
3 N·m (0.3 kgf-m, 2.2 ft-lb)



2. BATTERY TEMPERATURE SENSOR

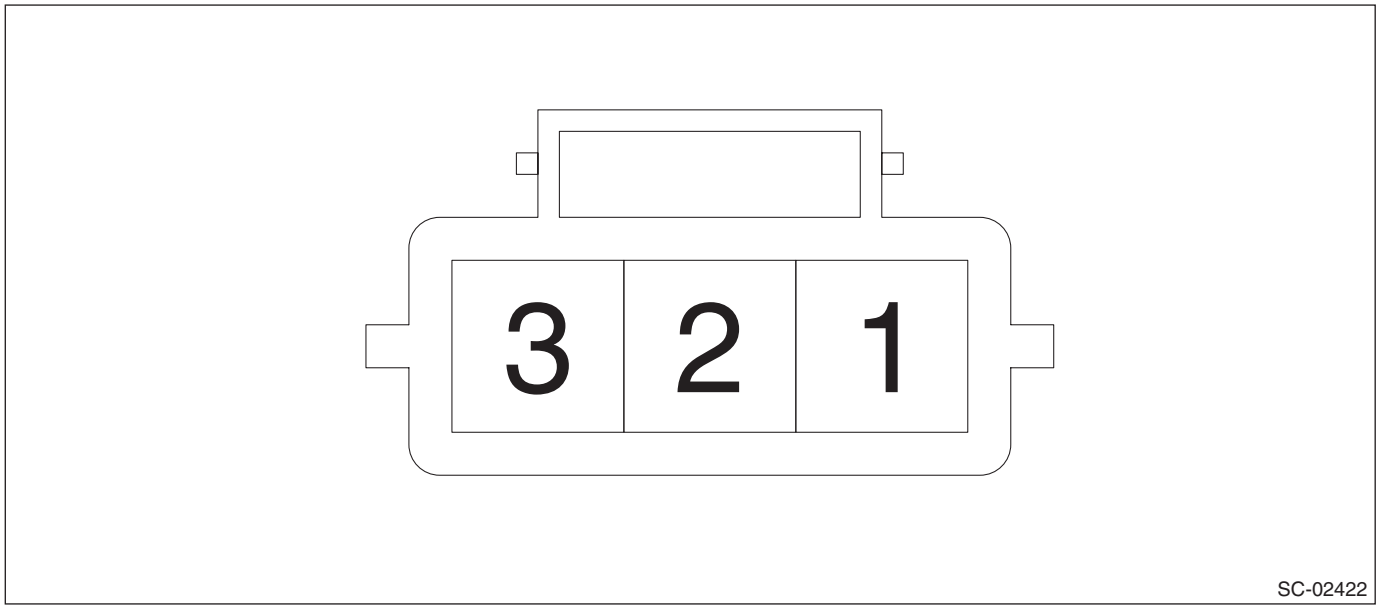
Install in the reverse order of removal.

C: INSPECTION

1. BATTERY CURRENT SENSOR

CAUTION:
Pay attention to polarity when checking the resistance in the battery current sensor.
Check the resistance between the battery current sensor terminals.

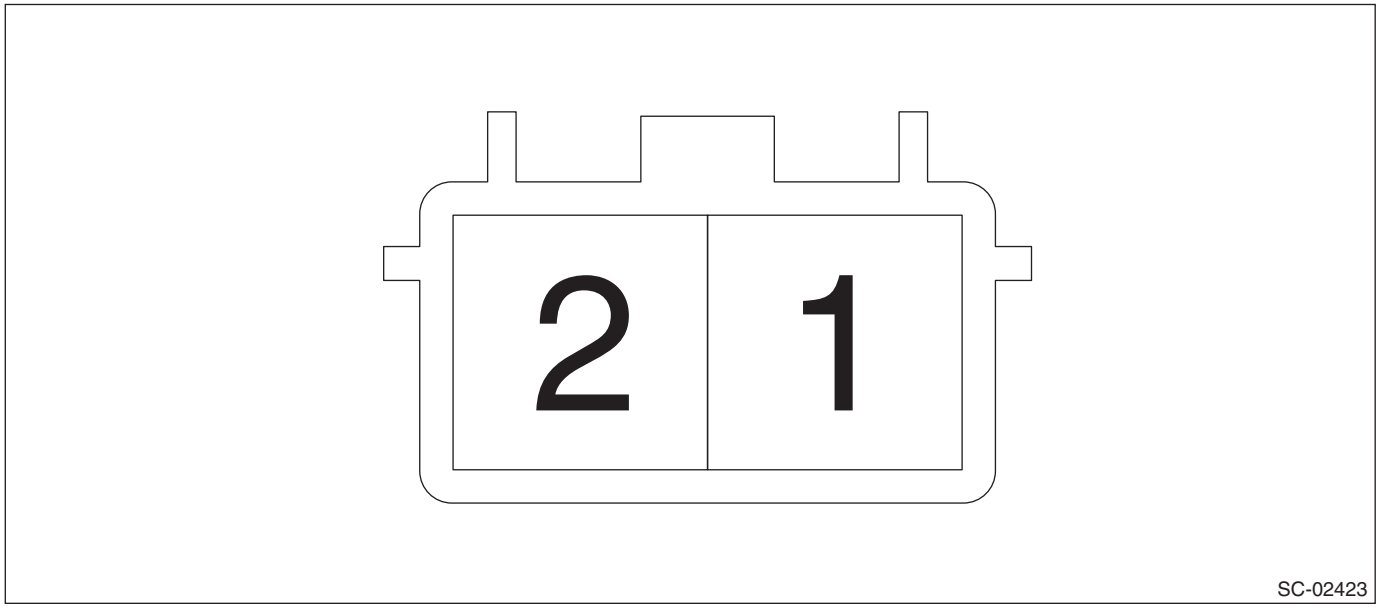
Terminal No.	Standard
1 (+) and 2 (–)	3 — 10 kΩ
1 (+) and 3 (–)	0.5 kΩ or less
2 (+) and 3 (–)	3 — 10 kΩ



2. BATTERY TEMPERATURE SENSOR

Check the resistance between the battery temperature sensor terminals.

Temperature	Terminal No.	Standard
20 — 30°C (68 — 86°F)	1 and 2	1.5 — 2.8 kΩ



3. OTHER INSPECTIONS

Check that the battery current & temperature sensor has no deformation, cracks or other damages.

ENGINE (DIAGNOSTICS)

EN(H4DO w/o HEV) (diag)

		Page
1.	Basic Diagnostic Procedure	2
2.	Check List for Interview	4
3.	General Description	6
4.	Electrical Component Location	9
5.	Engine Control Module (ECM) I/O Signal	19
6.	Engine Condition Data	30
7.	Data Link Connector	31
8.	General Scan Tool	32
9.	Subaru Select Monitor	37
10.	Read Diagnostic Trouble Code (DTC)	49
11.	Inspection Mode	50
12.	Drive Cycle	55
13.	Clear Memory Mode	65
14.	System Operation Check Mode	66
15.	Malfunction Indicator Light	67
16.	Diagnostics for Engine Starting Failure	73
17.	Diagnostic Procedure for Subaru Select Monitor Communication	94
18.	List of Diagnostic Trouble Code (DTC)	96
19.	Diagnostic Procedure with Diagnostic Trouble Code (DTC)	105
20.	General Diagnostic Table	379